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A Strongly Secure Identity-based and Pairing-free Key Agreement Protocol

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Abstract: To reduce the computing costs, an identity-based authenticated key agreement protocol is proposed. The new protocol, based on the elliptic curve discrete logarithm problem, the new protocol minimizes message exchange times with only one exchange by using an implicit authentication, and does not adopt computationally intensive bilinear paring operation. Based on the ID-AKA security model proposed by Chen et al. and the eCK model proposed by LaMacchia et al., a stronger model with adding Ephemeral-Secret query for ID-AKA protocols is proposed. Meanwhile, the paper points out that the security model proposed by Shu Jian was ineffective to analyze the key-compromise impersonation in ID-AKA protocols, because the model constraints are too strong. Under the new model, the new protocol is provably secure. Comparative analysis shows that the new protocol with not only strong security but also lower computational overhead is suitable for establishing a secure end-to-end connection in mobile communication environment.
Keywords: identity-based cryptography; elliptic curve; discrete logarithm problem; authenticated key agreement

1. INTRODUCTION

Shamir firstly proposed identity-based cryptography (IBC) [1], which is used to solve the complex certificate management in the traditional public key system. In 2001, Boneh and Franklin [2] proposed the first IBC programs according to using bilinear pairing theory. Subsequently, multiple authenticated key agreement protocols have been proposed based on identities and the bilinear theory [3-6]. However, it is difficult to find a subgroup to meet the requirements of bilinear and computing cost of bilinear pairings is high. The computing cost of bilinear pairings is 20 times than that of elliptic curve point multiplication [3].

In order to reduce computational overhead, the ID-AKA program is proposed based on elliptic curve discrete logarithm problem. Elliptic Curve Cryptography has some adventure such as the short key length, low computational overhead and high security. Cao Xue Fei et al [7] proposed ID-AKA protocol based on elliptic curve discrete logarithm problem (denoted as: CXF-IDAK). But the protocol was not satisfied the temporary secret session leaked security [5]. CAO and HE proposed ID-AKA protocol for computing linear (denoted as: CAO-IDAK [8] and HE-IDAK [9]). CAO [8] used the random oracle model by CHEN [3], HE [9] used the security model by Canetti and Krawczyk [10] (CK model). The two security models did not consider temporary session protocol secret leaked security. SK Hafizul Islam [11] pointed that the CAO-IDAK protocol [8] existed a flaw of session temporary secret leaked security and KOA (Key Off-set Attack) attacks. It can be verified that HE-IDAK protocol [9] does not meet the temporary secret session leaked security same. Based on CAO-IDAK protocol, SK Hafizul Islam put forward an improved ID-AKA protocol [11] (denoted as: SHI-IDAK). This paper proposes that SHI-IDAK protocol does not meet the perfect forward security and PKG (Private Key Generator).

Formal analysis technology of security protocols is another hot issue in this field. Bellare and Rogaway [12] firstly proposed distinguish ability security model of authenticated key agreement protocol (BR model). Subsequently, the CK model is proposed based on the BR model [10]. However, the model assumes that the attacker cannot get any private secret of test session, which makes that the secure protocol proved by CK model may not resist leaking secret key or session temporary secret camouflage leak attacks. Krawczyk [13] proposed a improved CK model (iCK model) can be used to analyze the secret key leaks camouflage. Subsequently, LaMacchia [14] proposed eCK model which is considered the most security model. But eCK model is built on the traditional public key system, and cannot be used to analyze ID-AKA protocol directly. Ren Yongjun [4] analyzed ID-AKA protocol by eCK model, but they did not give a complete ID-AKA security model. SHU Jian [5] proposed the eCK model based on ID-AKA but the model contains many constraints. So it cannot really be used to analyze the key compromise impersonation.

This paper proposes a new ID-AKA protocol and the security model. The new protocol, based on the elliptic curve discrete logarithm problem, uses the implicit authentication. The new security model, based on the ID-AKA model by Chen [3] and the eCK model [14], analyzes all known security attributes of ID-AKA protocol by adding temporary session secret inquiries. And the paper gives the

entire process of analysis and demonstrates. According to the proposed security model in the paper, the new protocol is proven to meet the requirements as follows: Known Key Security (KKS), No Key Control (NKC), Perfect forward Security (PFS), PKG Forward Security (PKG-FS), Key Compromise Impersonation (KCI), Unknown Key-Share (UKS) and Known Session-Specific Temporary Information (KSTI).

2. THEORETICAL BASIS

2.1 CDH (Computational Differ-Hellman) hypothesis

We imagine P and Q are points of the elliptic curve EF (p), which satisfy the condition: Q = aP. When a∈Zq*.

CDH hypothesis: For any unknown a,b ∈ Zq*, given aP, bP, any probabilistic polynomial time algorithm A can successfully calculate the advantage of abP: AdvCDH(A)= Pr[A(aP,bP)=abP| a,b ∈ Zq*] is negligible.

2.2 Security model definition

Chen [3] proposed random oracle model called ID-AKA. But the model cannot be used to analyze the forward security and session temporary secret leaked security. On the basis of the eCK model by LaMacchia [14] and the research of Ren Yongjun [4] and Shu Jian [5], this paper proposes a standard security model for the analysis of ID-AKA protocol, which is described as below:

For Random oracle $\Pi_{i,j}^{s}$, i and j are defined as the s-th session instance. The key agreement protocol is modeled as a game between challenger C and rival Adv.

Definition 1 (matched oracle): If two oracles $\Pi_{i,j}^{s}$ and $\Pi_{j,i}^{t}$ have the same session ID (session ID format (IDi, IDj, Ri, Rj)), we call $\Pi_{i,j}^{s}$ and $\Pi_{j,i}^{t}$ matched oracle mutually.

Definition 2 (fresh oracle): If meeting the following conditions: (1) $\Pi_{i,j}^{s}$ has been successfully completed; (2) no execution for Corrupt (IDj) queries, Reveal ($\Pi_{i,j}^{s}$) queries and Ephemeral-Secret ($\Pi_{i,j}^{s}$) queries, and the matched oracle $\Pi_{j,i}^{t}$ is also not executed Reveal ($\Pi_{j,i}^{t}$) query, then $\Pi_{i,j}^{s}$ is called fresh oracle.

When simulating key compromise impersonation, allowing rival query have session with a party's key (Corrupt (IDi) query) and temporary secret value selected by another party (Ephemeral-Secret ($\Pi_{j,i}^{t}$) query). But it is not allowed to query the other two secret values (Corrupt (IDj) and Reveal ($\Pi_{i,j}^{s}$)). Shu Jian [5] proposed excessive constraints for the definition of fresh oracle. In addition to the above definition content, it is also not allowed to execute Corrupt (IDi) queries and Ephemeral-Secret ($\Pi_{j,i}^{t}$) query of the matched oracle for rival. Therefore, the model cannot be used to analyze the key compromise impersonation security.

ID-AKA-GAME：

The challenger C runs system parameter generation algorithm.Entering the security parameter k and we can get the master key (msk) and system parameters params according to the output system. Then the params is sent to adversary Adv.

Adversary can perform the following query adaptively, C responses correspondingly according to simulating algorithms of key agreement scheme.

-Create (ID) query: C is identity-based key pair created by the user ID.

-Public-Key (ID) query: C returns the ID's public key.

-Corrupt (ID) query: C returns the ID's private key.

-Ephemeral-Secret ($\Pi_{i,j}^{s}$): C returns temporary secret parameters of the corresponding oracle $\Pi_{i,j}^{s}$.

-Send ($\Pi_{i,j}^{s}$, M) query: If $\Pi_{i,j}^{s}$ do not exist and M =λ, C will create the initiator oracle $\Pi_{i,j}^{s}$. Otherwise it is a responder oracle.

-Reveal ($\Pi_{i,j}^{s}$) query: If the oracle $\Pi_{i,j}^{s}$ has been successfully completed and the session key is not null, it returns the session key, otherwise it returns⊥.

After the above query, adversary chooses fresh oracle $\Pi_{I,J}^{u}$ to request Test query.

-Test ($\Pi_{I,J}^{u}$) query: C selects b∈{0,1} randomly. If b = 0 then returning the session key of the $\Pi_{I,J}^{u}$ correspondingly. Otherwise, it chooses the key value from the list of session key randomly as its response.

After test inquiry, the adversary can still request other queries arbitrarily. But it cannot destroy the freshness of $\Pi_{I,J}^{u}$. Finally, the adversary outputs the estimate value b' of b in the Test query. If b'= b, then the adversary will win the game. Advantage of winning the game for adversary is defined as:

$$Advantage_{Adv}^{ID-AKA}(k) = |\Pr[b' = b] - \frac{1}{2}|$$

Definition 3: if: (1) There exists positive attacker between $\Pi_{I,J}^{u}$ and $\Pi_{J,I}^{v}$ [3], and it can negotiate the same session key SK, whose value is uniformly distributed on $\{0,1\}^{k}$; (2) $Advantage_{Adv}^{ID-AKA}(k)$ is negligible, then the authenticated key agreement protocol is security.

3. IDENTITY-BASED KEY AGREEMENT

System construction: system parameters params =

{EF (p), P, P0, H1, H2}. Where, P0 = sP as the public key of PKG, and s ∈ Zq* is the master key of PKG. H1 and H2 are security hash function.

User Registration: submitting the user identity as IDi, PKG randomly selects yi ∈ Zq*, computing Yi = yiP, qi = H1 (IDi, Yi) and di = yi + sqi. It returns (Yi, di) to the user through secret channels and yi is deleted permanently. Where, Yi is public key parameter of IDi, di is private key of IDi. User confirms private key by the equation: diP = Yi + qiP0. If the equation holds, the private key will be accepted, otherwise re-applying for the private key.

Key Negotiation: Suppose that user Alice and Bob need to negotiate session key user, follow the steps as below:

Alice selects rA∈Zq* randomly, calculates RA = rAP, and sends (IDA, YA, RA) to user B;

After Bob receives the message (IDA, YA, RA), selecting randomly rB ∈ Zq*, computing RB = rBP, and sending (IDB, YB, RB) to A. Then Bob calculates qA = H1 (IDA, YA), PA = YA + qAP0, KB1 = rBPA + dBRA, KB2 = dBPA, KB3 = rBRA, and the session key SKBA = H2 (IDA, IDB, RA, RB, KB1, KB2, KB3);

After Alice receives the message (IDB, YB, RB), calculating qB = H1 (IDB, YB), PB = YB + qBP0, KA1 = rAPB + dARB, KA2 = dAPB, KA3 = rARB, and the session key SKAB = H2 (IDA, IDB, RA, RB, KA1, KA2, KA3);

Key negotiation process can be described in Figure 1.

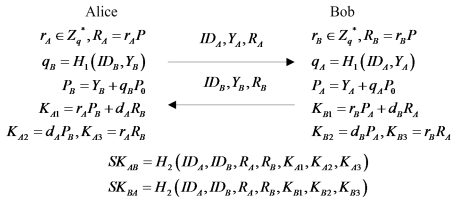

Figure 1 A Identity-Based and Pairing-Free Key Agreement Protocol

4. PROTOCOL ANALYSIS

4.1 Protocol correctness analysis

Correctness of the protocol is proved by the following equation:

KA1=rAPB+dARB
=rAdBP+dArBP=rBPA+dBRA=KB1 (1)

KA2=dAPB =dAdBP=dBPA=KB2 (2)

KA3=rARB =rArBP=rBRA=KB3 (3)

Through equation 1-3 it can be obtained SKAB = SKBA, then we obtain the same session key.

4.2 Protocol security analysis

Theorem 1: If the imagination CDH is correct, the proposed identity-based authenticated key agreement protocol is security.

Proof: By definition 3, the holding of Theorem 1 must satisfy two conditions. Here, Theorem 2 and 3will prove the two conditions respectively.

Theorem 2: Suppose there exists a positive attacker between the oracle $\Pi_{i,j}^{s}$ and $\Pi_{j,i}^{u}$, then $\Pi_{i,j}^{s}$ and $\Pi_{j,i}^{u}$ always can negotiate the same session key SK, and SK is uniformly distributed during $\{0,1\}^k$.

Proof: According to the definition of benign attacker [3], it can faithfully transmit the message sent by oracles. Therefore, $\Pi_{i,j}^{s}$ and $\Pi_{j,i}^{u}$ can correctly receive the messages sent by each other. According to the proof 3.1, $\Pi_{i,j}^{s}$ and $\Pi_{j,i}^{u}$ and can get the same session key. (ri, rj) is temporary secret parameter selected randomly by IDi and IDj, then the session key may be regard to the parameter generated randomly by the H2. According to the feature of key derivation function, the session key uniformly distributed on $\{0,1\}^k$. QED.

Theorem 3: If the assumption CDH holds, the adversary Adv cannot break the proposed key agreement protocol under the standard model. Specifically, if the hash function Hi (i = 1, 2) is modeled as random oracle, adversary executes mostly qi times queries, creates qo prophecy machine and wins the game in polynomial time t with non-negligible advantage ϵ (k). Then there must exist algorithm C to solve the CDH problem successfully with non-negligible advantage $\rho \geq \frac{1}{q_1 \cdot q_2 \cdot q_o} \epsilon(k)$.

Proof: Suppose there is a rival winning the game as defined in 2.2 in polynomial time t with non-negligible advantage ϵ (k), then there must exist algorithm C solving CDH problem with non-negligible advantage. Given an instance of CDH problem, this paper demonstrates how C constructs algorithm to solve CDH problem by using Adv.

C obtains the system parameters params = {EF (p), P, P0, H1, H2}, and sends params to Adv. Suppose qs is the maximum sessions number, it creates qo prophecy machine and executes qi (i = 1, 2) Hi queries. C randomly selects J ∈ [1, q1], T ∈ [1, qs], and answers the queries of Adv according to the methods as follows:

- H1 (IDi, *) query: C maintains an initially empty list L1 whose format is (IDi, *, hi). After receiving H1 query, C firstly queries L1. If the corresponding tuple already exists, return hi; otherwise random select hi ∈ Zq *, insert (IDi, *, hi) to L1, and return hi.
- Create (IDi) query: C maintains an initially empty list Lc whose format is (IDi, di, Yi). After receiving the query, C firstly queries Lc. If the corresponding tuple already exists, then ignore; otherwise execute H1 (IDi, *) query to obtain the tuple (IDi, *, hi), then:

If i=J, calculate Yi=aP−hiP0 and insert (IDi,⊥, Yi) to list Lc;

Otherwise, select randomly di ∈ Zq*, calculate Yi = diP−hiP0, and insert (IDi, di, Yi) to list Lc.

- H2 ($ID_a^u, ID_b^u, R_a^u, R_b^u, K_1^u, K_2^u, K_3^u$) query: C maintains an initially empty list L2 whose format is ($ID_a^u, ID_b^u, R_a^u, R_b^u, K_1^u, K_2^u, K_3^u$).If the corresponding tuple already exists and hu $\neq \perp$, then return hu, otherwise:

Detect tuple $(ID_i^s, ID_j^s, M_{i,j}^s, M_{j,i}^s, \Pi_{i,j}^s)$ in Lr. If $\Pi_{i,j}^s$ is initiator oracle, then satisfying equation $ID_a^u = ID_i^s$,

$ID_b^u = ID_j^s, R_a^u = M_{i,j}^s, R_b^u = M_{j,i}^s, K_1^u = r_{i,j}^s(Y_j + h_j P_0) + d_i M_{j,i}^s, K_2^u = d_i($

Otherwise $\Pi_{i,j}^s$ is responder oracle, and satisfying equation $K_2^u = d_j(Y_i + h_i P_0), K_3^u = r_{j,i}^s M_{i,j}^s$,

$ID_a^u = ID_j^s, ID_b^u = ID_i^s, R_a^u = M_{j,i}^s, R_b^u = M_{i,j}^s, K_1^u = r_{j,i}^s(Y_i$

. If the tuple exists, set $h^u = SK_{i,j}^s$, and insert $(ID_a^u, ID_b^u, R_a^u, R_b^u, K_1^u, K_2^u, K_3^u, h^u)$ to L2.

Otherwise select randomly $h^u \in \{0,1\}^k$, insert $(ID_a^u, ID_b^u, R_a^u, R_b^u, K_1^u, K_2^u, K_3^u, h^u)$ to L2;

Return hu, use $(K_1^u, K_2^u, K_3^u, SK_{i,j}^s)$ to modify the corresponding tuple in Ls.

- Public-Key (IDi) query: When receive the query, C queries Lr and return Yi.

- Corrupt (IDi)：When receive the query, if i=J, C will stop to query (Event1); otherwise C queries Lr and return di.

- Ephemeral-Secret($\Pi_{i,j}^s$)：When receive the query, if s=T (or $\Pi_{i,j}^s$ is the matched oracle of $\Pi_{j,i}^T$) and j=J, then C will stop to query (Event2). Otherwise C queries Ls and return $r_{i,j}^s$.

- Send ($\Pi_{i,j}^s$, M): C maintains an initially empty list Ls, whose format is

$(\Pi_{i,j}^s, r_{i,j}^s, M_{i,j}^s, M_{j,i}^s, K_{(i,j)1}^s, K_{(i,j)2}^s, K_{(i,j)3}^s, SK_{i,j}^s, f_{i,j}^s)$.

Where, $M_{j,i}^s$ is input information, and $r_{i,j}^s, M_{i,j}^s, K_{(i,j)1}^s, K_{(i,j)2}^s, K_{(i,j)3}^s, SK_{i,j}^s$ is initial NULL. And $f_{i,j}^s \in (0,1)$ is the success tag of oracle $\Pi_{i,j}^s$, whose initial value is 0. When receive the query:

If the oracle $\Pi_{i,j}^s$ exists and $M_{j,i}^s = M, M_{i,j}^s \neq \perp$, then return $M_{i,j}^s$;

Otherwise, if s=T, query Lc,

If dj $\neq \perp$, C will stop the game (Event3);

Otherwise C sets $r_{i,j}^n = \perp, M_{i,j}^s = bP$, update the list Ls, and return $M_{i,j}^s$;

Otherwise, C select randomly $r_{i,j}^s \in Z_q^*$, set $M_{i,j}^s = r_{i,j}^s P$, then update the list Ls and return $M_{i,j}^s$

Set $f_{i,j}^s$ to 1.

- Reveal ($\Pi_{i,j}^s$): C maintains an initially empty list Lr, whose format is $(ID_i^s, ID_j^s, M_{i,j}^s, M_{j,i}^s, \Pi_{i,j}^s)$. When receive the query, C

Query Ls, Lc and L1;

If $f_{i,j}^s$ =0, then return $\perp$;

Otherwise, if s=T, or $\Pi_{i,j}^s$ is the matched oracle of $\Pi_{j,i}^T$, then stop the game (Event4);

Otherwise, if $SK_{i,j}^s \neq \perp$, then return $SK_{i,j}^s$;

Otherwise:

If di $\neq \perp$, calculate $K_1^s = r_{i,j}^s(Y_j + h_j P_0) + d_i M_{j,i}^s, K_2^s = d_i(Y_j + h_j P_0), K_3^s = r_{i,j}^s M_{j,i}^s$;

If di= $\perp$, calculate $K_1^s = r_{i,j}^s(Y_j + h_j P_0) + r_{j,i}^s(Y_i + h_i P_0), K_2^s = d_j(Y_i + h_i P_0), K_3^s = r_{i,j}^s M_{j,i}^s$;

If $\Pi_{i,j}^s$ is initiator oracle, execute H2 ($ID_i^s, ID_j^s, M_{i,j}^s, M_{j,i}^s, K_1^s, K_2^s, K_3^s$) query; otherwise execute H2 ($ID_j^s, ID_i^s, M_{j,i}^s, M_{i,j}^s, K_1^s, K_2^s, K_3^s$) query.

Set $SK_{i,j}^s = h^u$, update Ls, and return $SK_{i,j}^s$.

Insert $(ID_i^s, ID_j^s, M_{i,j}^s, M_{j,i}^s, \Pi_{i,j}^s)$ to Lr.

- Test ($\Pi_{i,j}^s$) query: Finally, Adv requests Test query.

If s $\neq$ T or there exists a compromised oracle $\Pi_{j,i}^w$ which is the matched oracle of $\Pi_{i,j}^s$, then C terminates the games (Event5); Otherwise, C returns a random value $\varsigma \in \{0,1\}^k$ as the answer.

Once Adv completes the query and returns its estimate value b', C executes the following steps:

(1) Calculate $K_{(i,j)1}^s = r_{i,j}^s(Y_j + h_j P_0) + d_i M_{j,i}^s = abP + d_i M_{j,i}^s$;

(2) Select randomly K_1^l from the list L2, calculate $abP = K_1^l - d_i M_{j,i}^s$ as the answer of CDH challenge.

If $K = r_{i,j}^s(Y_j + h_j P_0) + d_i M_{j,i}^s = abP + d_i M_{j,i}^s$, and it does not appear in the H2 query (denoted as Event6),

then $\Pr[\overline{Event6}] \geq \epsilon$ (k).

Because H2 is modeled as random oracle, if the Event6 occurs, then Adv wins the game only through the following ways: (1) guessing randomly; (2) Adv knows that a compromised oracle $\Pi_{i,j}^{s}$ and challenge oracles $\Pi_{a,b}^{T}$ have the same session key.

It is known that from the simulation process above if the Event6 occurs in subsection (2), because every H2 query is identified through the session ID, only when the following circumstances, the probability of $\Pi_{i,j}^{s}$ and $\Pi_{a,b}^{T}$ have the same session key is bigger than 1/2k: (1) $\Pi_{i,j}^{s}$ is a challenge oracle $\Pi_{a,b}^{T}$; (2) $\Pi_{i,j}^{s}$ is matched oracle of $\Pi_{a,b}^{T}$. So the probability of Adv wins the game through the way (2) is less than 1/2k.

It is known that: Pr [Adv wins|Event6]≤1/2.

$\epsilon(k)+1/2=$ Pr[Adv wins]= Pr[Adv wins|Event6] Pr[Event6] $+\Pr[Adv \cdot wins \mid \overline{Event6}]\Pr[\overline{Event6}]$

$\leq 1/2+\Pr[\overline{Event6}].$

If C does not terminate the game, then the event (Event1, 2,3,4,5) does not occur, the adversary Adv counterfeits entity J, and chooses the oracle T as the challenge response (denoted as Event7), then the probability of this event happens:

$$\Pr[Event7]=\Pr[\overline{(Event1 \vee Event2 \vee Event3 \vee Event4 \vee Event5}]$$

If C finds the right Kl, it solves CDH problem successful (denoted Event8), then:

$$Advantage_{C}^{CDH}(k)=\Pr[\overline{Event6} \wedge Event7 \wedge Event8] \geq \frac{1}{q_1 \cdot q_o \cdot q_2}\Pr[\overline{Event6}] \geq \frac{}{q_1 \cdot q}$$

QED.

4.3 Analysis and comparison

Table 1 compares the cost of computing and communication of the proposed protocol in this paper with five other analogous protocols. About computing, citing the bilinear pairings operation (denoted as p) [3], point multiplication and modular exponentiation on the elliptic curve G1 (denoted as M1 and E1) and modular exponentiation on the elliptic curve G2 (denoted as E2) as the major computational cost. According to references computational cost in the literature [3], setting modular exponentiation operation E1 on G1 to 1, we can obtain the following approximate equation: 1P≈20E1，1M1≈1E1，1E2≈3E1.

Table 1 Computing performance comparison with other identity-based key agreement protocols (Time)

protocol	P	E1	M1	E2	Total cost	Security imagine
RWW-IDAK[4]	1	4	0	4	36E1	CDH/BDH
SU-IDAK[5]	1	0	3	0	23E1	CDH/BDH
GF-IDAK[6]	2	3	0	0	43E1	CDH/BDH
CXF-IDAK [7]	0	0	4	0	4E1	CDH
SHI-IDAK[11]	0	0	4	0	4E1	CDH
CAO-IDAK[8]	0	0	5	0	5E1	CDH
Proposed scheme	0	0	6	0	6E1	CDH

From the comparison of the table, the proposed scheme has lower computational cost.About communication, in addition to CXF-IDAK [8] protocol which requires 3 information transmission (initiator sends two times, the responder sends one time), the other solutions just need 2 information transmission (initiator and responder both send one time). As view of the bytes of transmission, the number of bytes of RWW-IDAK [4] is bigger. And it is not very different from other protocols. The number of bytes is approximately2G1+1l (l is the bytes of ID).

Table 2 compares ID-AKA protocol security of the unparalleled linear pair. " √ " indicates provable security, and "×" indicates that the security has been not satisfied.

Table 2 Security comparison with other pairing-free identity-based key agreement protocols

protocol	KKS	PFS	PKG-FS	KCI	NKC	UKS	KSTI
CXF-IDAK[7]	√	√	√	√	√	√	×
CAO-IDAK[8]	√	√	√	√	√	√	×
HE-IDAK[9]	√	√	√	×	√	√	×
SHI-IDAK[11]	√	×	×	√	√	√	√
Proposed method	√	√	√	√	√	√	√

It can be known from the table 2, only the proposed protocol has been proven to meet all the major security attributes, other protocols have been pointed out that there are some security flaws.

For SHI-IDAK [11] protocol, its security flaws have not been reported on the currently available literature. This paper presents an attack instance. Suppose after one session the session authentication key (dA and dB) leaks, then the attacker E owns news item sets of the session (dA, dB, IDA, IDB, RA, RB, TA, TB) [11]. E recovers the session key according to the following steps: WA= dA−1·TA= dA−1·a·PA= dA−1·a·dAP= aP， WB= dB−1·TB= dB−1·b·PB= dB−1·b·dBP= bP， KAB= KBA= dA·dB·WA + dA·dB·WB = dA·dB·aP + dA·dB·bP, calculate the session key sk =H2(IDA||IDB||TA||TB||KBA).

It can be seen that E restores the session key successfully. That is to say SHI-IDAK protocol does not meet the perfect forward security. Because PKG private key leaking can cause leakage of user's private key, so if SHI-IDAK protocol does not satisfy the perfect forward security, then it does not satisfy the PKG forward security.

5. CONCLUSION

This paper proposes an authentication key agreement protocol based on identity and elliptic curve CDH assumption, and its computational overhead is lower. On the basis of ID-AKA random oracle model proposed by Chen [3] and the eCK model under

traditional public key system proposed by LaMacchia [14] a standard security model of analyzing ID-AKA protocol is proposed. In the new model the new protocol is proven to satisfy the efficacy and security. It can be seen from the comparative analysis that the new protocol has lower computational and communication cost while it achieves strong security. So the proposed protocol can be used for the computing and storage capacity-constrained smart card equipment certification. In addition, the paper points out that the ID-AKA-eCK model proposed by Shu Jian [5] has too strong constraint, which cannot be used to analyze key compromise impersonation security. And this paper firstly proposes that the SHI-IDAK [11] protocol does not satisfy the perfect forward security and PKG forward security.

6. ACKNOWLEDGMENTS

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Discrimination and Simulation of Track Bolt Failure Forms

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Abstract: Track bolts play an important role in rail transit safety system. The stability of bolt-fastening influence the rail transit performance greatly. However, bolt-failures occur a lot of times in engineering practices, and the discrimination of bolts failure forms becomes important. In this paper, multiple discriminative models are built to classify bolt failure forms. Results of simulation show discriminative models can solve the problem well.
Keywords: Track bolt, Failure form; Model recognition; Bayes discrimination; Curvilinear regression

1. INTRODUCTION

Bolt axial pre-tightening force testing play an important role in railway maintenance system.[1] As a general way, torque control method is widely used to test pre-tightening force. However, in actual engineering, bolt-failures often affect the accuracy of pre-tightening force testing and lead to false twist.[2] So the discrimination of bolt failure forms become significant to railway engineering construction. In this paper, actual torque data are collected, analyzed and classified synthetically. Multiple methods are adopted to found math models to discriminate bolt failure forms.

2. TRACK BOLT FAILURE FORMS

2.1 BEARING SURFACE ABRASION FAILURE FORM

In actual engineering, due to initial installation deviations and surface friction coefficients, mechanical parts cannot meet the installation requirements perfectly. The abnormal torque curves caused by bearing surface abrasion is shown as the follow picture.

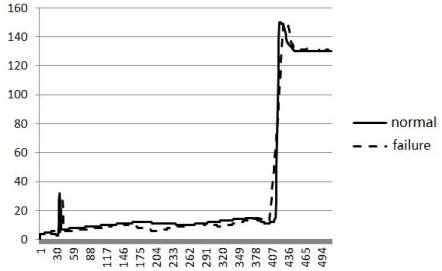

Figure 1 Torque curves from bearing surface abrasion failure form

2.2 THREAD TOOTH DAMAGED FAILURE FORM

Thread tooth failures often happens in actual work and make torsion-tension movements deviant.[3] To achieve typical torque data, the thread used to test torque data is being damaged artificially. The torque curves of thread tooth damaged failure form is shown as the follow picture.

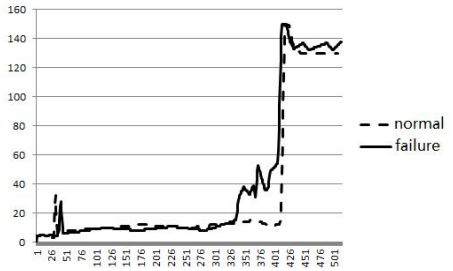

Figure 2 Torque curves from thread tooth damaged failure form

2.3 REUSING FAILURE FORM

In track bolts maintenance processes, bolt-twists happen a lot of times which influence contact surface indicators and fastening technical parameters deeply. The new and the worn bolts of the same type are tested for torque data comparing, and the 2 torque curves are shown as the follow picture.

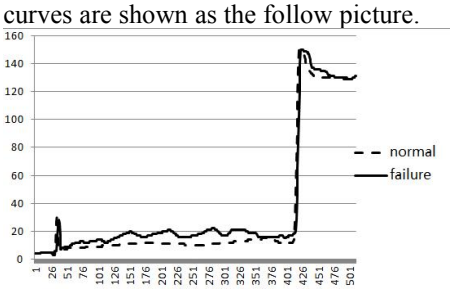

Figure 3 Torque curves from reusing failure form

According to Fig 3, long-time twisting enlarge the torque coefficients which can rise deviation values obviously.

3. DISCRIMINATION MODELS OF TRACK BOLT FAILURE FORMS

3.1 MODEL BASED ON FASTENING MECHANISM

According to torque curves characteristics shown in Fig 4, the entire fastening process can be regarded as 3 different periods including period A, period B and period C.[4]

In period A, differences among normal situation, thread tooth damages form and surface abrasion form count for little. However, torque deviations caused by reusing failures of the worn bolt are very obvious. After being bolt-twisted a lot of times, the protective film can be eroded seriously and bolts work in a poor workplace which influence friction coefficients and torque coefficients deeply and, finally, enlarge torque

values.

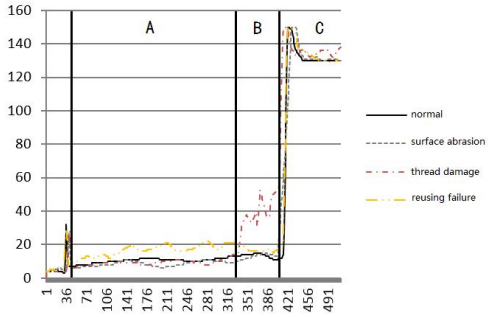

Figure 3 Torque curves in different forms

In period B, thread tooth damages can rough the contact surface, downward-deform thread crown and make fastening unstable. So torque coefficients raise greatly which can enlarge torque values in a great extent.

In period C, it is obvious that bearing surface abrasion will reduce pre-tightening force at the end of fastening process.

In this discrimination model, torque data will be curves fitted and calculated Euclidean distances to realize model discrimination.

3.2 MODEL BASED ON BAYES THEORY

In statistics, Bayes theory is an important branch. Its core concept tells that event posterior probability is decided by both prior probability and actual sampling results.[5]

The Bayes theory math-model is as the follow:

Firstly, events can be regarded as $G_1, G_2, \cdots, G_{k-1}, G_k$.

Then, the posterior probabilities of events can be represented as:

$$p_j = P(G_j), \quad j = 1,2,3,\cdots,k \tag{1}$$

$$\sum_{j=1}^{k} p_j = 1 \tag{2}$$

So, event-data spaces can be represented as:

$$G^{(i)} = [g_1^{(i)}, g_2^{(i)}, \cdots, g_n^{(i)}] \tag{3}$$

And the covariance formula of event G be represented as：

$$S = \frac{1}{n-1}\sum_{j=1}^{n}(g_j^{(i)} - \overline{g}^{(i)})(g_j^{(i)} - \overline{g}^{(i)})^T \tag{4}$$

And the unBayesed estimation matrix for 2 events can be represented as：

$$S = \frac{(n_1-1)S_1 + (n_2-1)S_2}{n_1+n_2-2} \tag{5}$$

Formulas above can lead to linear discriminating functions as the follow:

$$\begin{cases} W_1(x) = a_1^T x + b_1, a_1 = S^{-1}\overline{x}^{(1)}, b_1 = -\frac{1}{2}(\overline{x}^{(1)})^T S^{-1}\overline{x}^{(1)} \\ W_2(x) = a_2^T x + b_2, a_2 = S^{-1}\overline{x}^{(2)}, b_2 = -\frac{1}{2}(\overline{x}^{(2)})^T S^{-1}\overline{x}^{(2)} \\ \hat{W}(x) = \hat{a}^T(x-\overline{x}), \hat{a} = S^{-1}(\overline{x}^{(1)} - \overline{x}^{(2)}), \overline{x} = \frac{1}{2}(\overline{x}^{(1)} + \overline{x}^{(2)}) \end{cases} \tag{6}$$

So the posterior probability of event G_i can be represented as:

$$P(G_i|x) = \frac{p_i f_i(x)}{\sum_{i=1}^{k} p_i f_i(x)} \tag{7}$$

Suppose that the object researched is according to Normal Distribution, we can get the formula as:

$$G_i \quad N_p(\mu_i, e_i), \quad j = 1,2,3,\cdots \tag{8}$$

So the posterior probability can also be represented as:

$$P(G_i|x) = \frac{\exp(-\frac{1}{2}d_j^2(x))}{\sum_{i=1}^{k}\exp(-\frac{1}{2}d_j^2(x))}, \quad j = 1,2,3,\cdots,k \tag{9}$$

Finally, the generalized square distance function can be deducted as the follow:

$$d_j^2(x) = (x-\mu_i)^T E^{-1}(x-\mu_i) + \ln|E_j| - 2\ln p_i, \quad j = 1,2,3,\cdots,k \tag{10}$$

In the formula above, matrix E is regarded as the covariance matrix of event G.[6]

The Subsidiary probabilities of the research-object can be calculated by Bayes Theory. The failure forms can be discriminated in according to compare subsidiary probabilities of each torque data space.

3.3 MODEL BASED ON CURVES FITTING

According to the significance-test theory of curves fitting, residual sum of squares (SSE) and regression sum of squares (SSR) react curves fitting performance directly. The larger the SSE value is, or the smaller the SSR value is, the better fitting performances are.[7][8]

Formulas of SSE and SSR are as the follow:

$$SSE = \sum_i (x_i - \hat{x}_i)^2 \tag{11}$$

$$SSR = \sum_i (\hat{x}_i - \overline{x}_i)^2 \tag{12}$$

In the formula, x_i is data vector, $\hat{x}_i$ is regression function value and $\overline{x}_i$ is sample mean value. In this discrimination model, torque data are used to fit curves. SSE values and SSR values can be calculated to realize discrimination.

4.SIMULATION OF FAILURE FORMS DISCRIMINATION MODELS

Torque data of varies failure forms can be collected through actual engineer work, and data are as the follow:

Data vector of normal torque: N= [4 5 4 32 7 8 8 8 9 9 9 10 10 10 11 11 12 12 12 11 11 11 11 11 10 10 10 11 11 12 12 12 13 13 14 14 15 14 13 11 12 49 150 135 130 130 130 130 130 130]

Data vector of bearing surface abrasion failure form: H= [4 5 6 20 6 6 7 7 7 8 8 8 9 10 11 10 9 8 8 6 6 7 8 8 9 10 10 11 11 10 10 9 9 10 11 12 13 15 14 14 34 68 139 147 132 131 131 131 130 131]

Data vector of thread tooth damage failure form: C= [5 5 5 4 6 7 7 8 8 9 9 10 10 9 9 9 8 8 9 9 10 10 11 11 10 9 10 8 8 10 11 12 14 16 35 34 39 46 36 50 63 150 141 134 136 132 134 135 136 133]

Data vector of reusing failure form: R= [5 5 5 26 9 10 12 13 13 13 14 13 15 16 19 20 17 17 18 19 20 21 17 16 17 18 19 22 21 17 19 21 21 20 19 16 16 16 17 15 17 84 150 143 136 135 132 130 130 129]
Data vector of object A: A= [5 5 5 2 5 7 8 9 8 7 7 9 11 10 9 8 7 9 9 10 8 12 9 10 12 10 11 13 10 8 8 12 16 28 36 31 38 45 43 52 64 149 143 137 132 135 135 133 135 132]
Data vector of object B: B= [4 5 5 26 8 10 11 13 14 14 15 13 14 17 17 21 20 18 17 18 22 21 18 19 15 20 22 23 22 23 18 17 17 20 21 23 18 15 16 15 18 89 152 147 132 131 130 129 128 128]

4.1 SIMULATION OF MODEL BASED ON FASTENING MECHANISM

In period A, torque data vectors are used to realize curves fitting, and the results are as the follow:

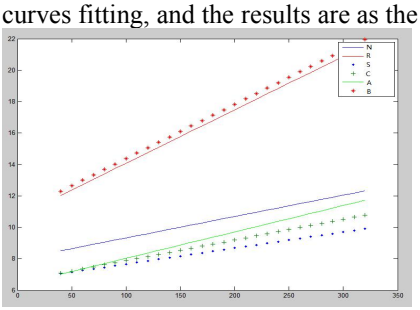

Figure 5: Torque data curves fitting in period A

Comparing fitted curves in the same coordinate system, it is hard to classify object A, however, curve of object B is very close to vector R (Reusing failure form).

In period B, torque data vectors are used for curves fitting, and the results are as the follow:

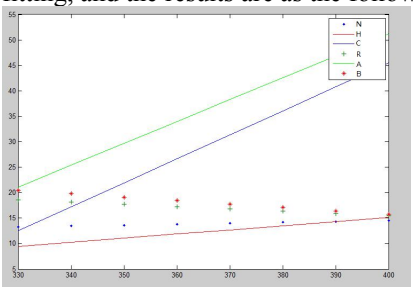

Figure 6 Torque data curves fitting in period B

According to simulation results, object A is very close to vector C (Thread damage failure form). In summary, it can be known the failure of object A is belong to thread damage form and the failure of object B is belong to reusing failure form.

4.2 SIMULATION OF MODEL BASED ON BAYES THEORY

Prior probabilities of each bolt failure forms can be ensured by numerous engineering practices. Based on sampling survey of hundreds of failure track bolts, 3 kinds of prior probabilities can be given as the follow:

$$\begin{cases} p\{Thread\_tooth\_damage\} = 0.6 \\ p\{Bearing\_surface\_abrasion\} = 0.3 \\ p\{\mathrm{Re}use\_failure\} = 0.1 \end{cases} \tag{13}$$

According to simulation data, covariance matrixes of sample spaces can be calculated as the follow:

$$E(A,H) = \begin{bmatrix} 2399.8 & 2164.2 \\ 2164.2 & 2158.8 \end{bmatrix} \tag{14}$$

$$E(B,H) = \begin{bmatrix} 1991.3 & 2055.7 \\ 2055.7 & 2153.8 \end{bmatrix} \tag{15}$$

$$E(A,C) = \begin{bmatrix} 2399.8 & 2398.1 \\ 2398.1 & 2403.2 \end{bmatrix} \tag{16}$$

$$E(B,C) = \begin{bmatrix} 1991.3 & 2072.6 \\ 2072.6 & 2403.2 \end{bmatrix} \tag{17}$$

$$E(A,R) = \begin{bmatrix} 2399.8 & 2075.8 \\ 2075.8 & 2020.3 \end{bmatrix} \tag{18}$$

$$E(B,R) = \begin{bmatrix} 1991.3 & 2003.1 \\ 2003.1 & 2020.3 \end{bmatrix} \tag{19}$$

So we can solve out the linear discriminating function formula:

$$W(x,H) = \hat{a} \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix} + \hat{b} \tag{20}$$

And objects' subsidiary probabilities can be calculated by the coefficient matrix of the linear discriminating functions

Table 1: Subsidiary probabilities of A and B

	Reusing failure	Thread failure	Surface failure
Object A	0.033	0.928	0.0327
Object B	0.9175	0.052	0.0305

The cross estimates of prediction error rate can be calculated by the follow formula:

$$p = \frac{n_{a1} + n_{a3} + n_{b2} + n_{b3}}{n_{a2} + n_{b1}} \tag{21}$$

The calculating result that p=0.003<1% show that the discrimination is convinced.

4.3 SIMULATIONS OF MODEL BASED ON CURVES FITTING

Torque data of each track bolts failure forms are used to realize nonlinear curves fitting, and simulation results are as follow:

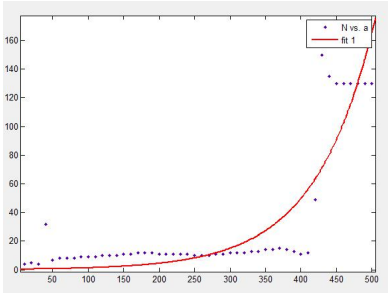

Figure 7 Normal torque curve $y = 0.411e^{0.012x}$

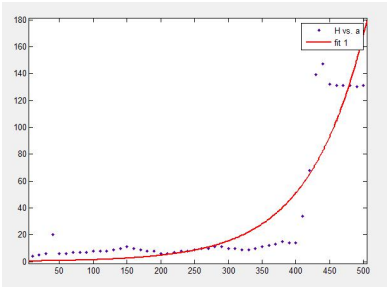

Figure 8 Curve of surface abrasion failure $y = 0.4298e^{0.01195x}$

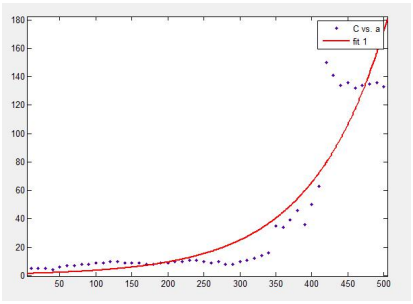

Figure 9 Curve of thread damage failure $y = 1.387e^{0.0098x}$

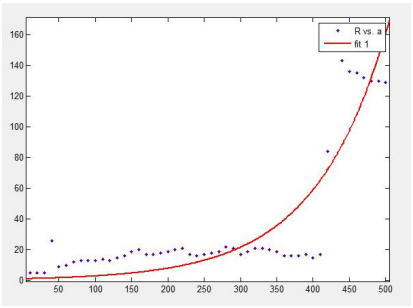

Figure 10Curve of reusing failure $y = 1.073e^{0.01002x}$

Torque data of object A and object B are put into fitting functions to calculate SSE and SSR. Then the sum of squares of total deviations (SST) can be determined with formula: SST=SSE+SSR, and the results are shown as the follow:

Table 2 Calculated results of object A

	SSE	SSR	SST
Normal situation	21178	89170	110348
Surface failure form	20350	92257	112607
Thread damage failure	16490	11677	28167
Reusing failure form	18153	81732	99885

Table 3 Calculated results of object B

	SSE	SSR	SST
Normal situation	25305	89045	114350
Surface failure form	25051	92143	117194
Thread damage failure	28189	119190	147379
Reusing failure form	23573	86899	110472

According to statistics theory, the one with smallest SST value can be regarded as the optimum solution. So the failure of object A can be discriminated to Thread damage failure form and the failure of object B can be discriminated to Reusing failure form.

5. CONCLUSIONS

Track bolt failure forms include bearing surface abrasion failure form, thread tooth damaged failure form and reusing failure form. In that torque curves show different characteristics in fastening process, the curves can be divided into 3 period to analyze.

Discrimination models, respectively, based on fastening mechanism, Bayes theory and Nonlinear curves fitting are built to classify objects failure forms. The simulation results show that the problem can be solved well.

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Key Technology of Health Assessment of Power Communication Network

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Abstract: To ensure the healthy operation of the power communication network (PCN), it is necessary to identify and analyze the key factors that affect the safety and reliability of the PCN. In this study, the concept of "health" is extended to the health of PCN, and the concept of health degree of PCN is put forward, then the health assessment index system of PCN is established. Similar to the "organ", "blood vessel" and "torso" of the human body, the complicated factors that affect the health of the PCN are extracted as follows: "equipment running quality", "cable performance quality" and "grid health degree". Through the analysis and identification of these three key factors, we established PCN health assessment index system by new algorithm to achieve the power communication network health degree of qualitative and quantitative analysis to guide the control and solve potential risks in the power communication network to enhance the health of the network degree.
Keywords: power communication network; health evaluation; reliability evaluation; comprehensive evaluation method

1. INTRODUCTION

The power communication network is an important infrastructure for the grid. How to reduce the operational risk and improve the reliability of power communication network to support the safe and stable operation of the power grid is an important issue. Power communication network is a multi-technology system, multi-level network structure coexistence of large and complex special communication network, complex network structure, transmission of information types, real-time requirements. With the ever increasing size of the power communication network, the structure is becoming more and more complicated, which means the greater potential risk to the safe and stable operation of the power grid. The performance evaluation of communication network not only has the great practical significance to evaluate the current situation of communication network, optimize the network structure and improve the safety and reliability of power supply, but also facilitate the standardized management of data of communication network, optimize the investment structure, which benefits both the economic and social state of the whole society.

Previously, the research methods of safety and health assessment of power communication network are not very effective. Some of the existing evaluation methods mainly focus on the system reliability evaluation method [1-7], business or network nodes [8-9] and system fragility [10-11] and risk [12-13]. In the assessment methods mentioned above, a few of simple technical performance indicators, such as resource utilization, protection success rate are estimated. Those methods lack of systematic and practical evaluation indicators, leading to the weakness of a comprehensive understanding of the performance of the network of the electric power stuffs, which in turn decreases the efficiency of operation and maintenance work. Therefore, there is an urgent need to establish a quantitative and evaluation system for the health assessment of power communication networks.

In this paper, the health degree of the power communication network was estimated based on the following factors: the network running status, safe operation level, fault conditions, scheduling, operation, maintenance. Finally, new communication network health assessment model and evaluation index system were built by estimating three key aspects i.e. equipment quality, cable performance and grid stability to complete the assessment of network health degree.

2. THE ESTABLISHING OF NETWORK HEALTH ASSESSMENT INDEX SYSTEM

2.1 TARGETS

The network health degree aims to reflect the influence of the state of devices and cables on the health of the whole network. The health degree of the whole network system is composed of the health degree of equipment, link and topology of the network. The main purpose of this section is to evaluate the health of the equipment and cables in the network and the network architecture, which can reflect the fault time, fault frequency and grid redundancy, and then evaluate the impact of network faults on the network system.

2.2 TARGETS DECOMPOSITION

The network is composed of equipment nodes, transmission links and network topology. A network system that is connected by multiple devices and multiple lines through a reasonable grid. Similar to the organs of the human body, any problem with an

"organ" will have a certain effect on the overall effect of the body. Therefore, the evaluation of the degree of health of the network also need to be analyzed from three "organs", namely, “equipment quality”, “cable performance” and “grid strength”. In particular, the factors that affect the three factors mentioned above are analyzed as follows: a) equipment quality lies in equipment failure interval rate and equipment defect interval rate; b) cable performance valued by the cable fault interval rate and cable defect interval rate; c) grid strength highlights the average size of the network, the average diameter of the network, the average strength of the network nodes, the node ringing rate, the average network aggregation factor, the average network distance, the average number of nodes and the network connectivity. The tree view of the indicator is shown in Figure 1.

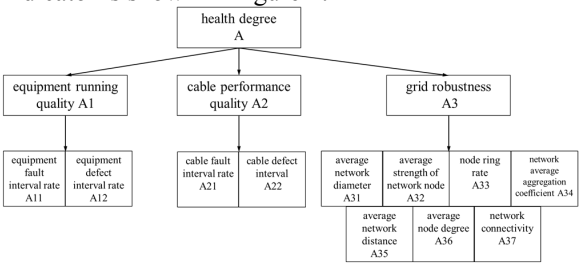

Figure 1 network health assessment index

3. INDEX SYSTEM ANALYSE

3.1 ANALYSIS OF PRIMARY INDICATORS

The network health degree of the power communication network directly affects the production scheduling and other business development, and ultimately embodies the power communication operation failure. Therefore, based on the concept of "network health degree", three secondary indicators (the equipment running quality A1, cable performance quality A2, grid robustness A3) can be extracted from the network health degree. They take the role of the "organ", "blood vessels" and “trunk”, respectively.

The operational quality indicator of the equipment is an indicator of the operating condition of a node device that is connected to the power communication network and is running. This indicator can reflect the status of the physical address of the fault.

The cable quality indicators are used to reflect the operational status of the service transmission link in the power communication network. The indicators directly reflect whether the business can reach the terminal node.

Grid robustness index is used to evaluate whether the power network network topology is scientific and reasonable. It plays a decisive role in the planning network distribution.

In the establishment of the index system, the first-level indicator value is based on the secondary index obtained by arithmetic weighting, and the formula is as follows:

$$A = {}_1\alpha A_{11} + {}_2\alpha A_{12} + {}_3\alpha A_{13} \quad (1)$$

Where α11, α12 and α13 are the weights of the secondary index.

According to the principle of scaling, this section sets up the judgment matrix of the network health degree, and the judgment matrix can only be filled in the upper right triangle, and the lower left triangle can be automatically introduced. Criteria for determining the health of the network is shown in Table 1.

Table 1 Secondary index judgment matrix

Indicators	Equipment Running Quality	Cable Performance Quality	Grid Robustness
equipment running quality	A11	A12	A13
cable performance quality	A21	A22	A23
grid robustness	A31	A32	A33

We invited a number of experts in the field to participate in estimating the relative importance of the three indicators and filling in the judgment matrix, as shown below:

Table 2 Secondary index judgment matrix by experts A

Indicators	Equipment Running Quality	Cable Performance Quality	Grid Robustness
equipment running quality	1	1/3	1/6
cable performance quality	3	1	1/2
grid robustness	6	2	1

Table 3 Secondary index judgment matrix by experts B

Indicators	Equipment Running Quality	Cable Performance Quality	Grid Robustness
equipment running quality	1	1	1/2
cable performance quality	1	1	1/2
grid robustness	2	2	1

Table 4 Secondary index judgment matrix by experts C

indicators	equipment running quality	cable performance quality	grid robustness
equipment running quality	1	3	5
cable performance quality	1/3	1	3
grid robustness	1/5	1/3	1

Considering the three judgment matrix from table 1 to table 4, three weight value index matrixes can be generated as shown in Table 5, Table 6 and Table 7, respectively.

Table 5 Weight value of secondary indicators by experts A

Secondary indicators	Weight
equipment running quality	0.1
cable performance quality	0.3
grid robustness	0.6

Table 6 Weight value of secondary indicators by experts B

Secondary indicators	Weight
equipment running quality	0.25
cable performance quality	0.25
grid robustness	0.5

Table 7 Weight value of secondary indicators by experts C

Secondary indicators	Weight
equipment running quality	0.63
cable performance quality	0.26
grid robustness	0.11

The final index weight value of secondary indicators can be obtained by average the three sets of data above, yielding Table 8.

Table 8 Final weight value of secondary indicators

	Equipment Running Quality	Equipment Running Quality	Grid Robustness
weight value of secondary indicators	0.1	0.3	0.6

3.2 ANALYSIS OF SECONDARY INDICATORS

In the operation and practice of electric power communication network, it is found that the three secondary indicators of equipment running quality, cable quality and grid stability can not be directly given by field parameters, and also can not be directly calculated. In order to quantify the secondary indicators, for each secondary indicator can be divided into the corresponding third-level indicators.

Considering of the occurrence of the problem, the equipment running quality can be divided into defect-level problem and fault-level problem, which can produce two third-level indicators, namely equipment fault interval rate A11 and equipment defect interval rate A12.

Similar to the situation of the equipment running quality, the quality of cable performance can also be divided into two third-level indicators, namely, cable fault interval rate A21 and cable defect interval A22.

As for the third-level indicators of grid robustness, it can be decided based on the point of view of “point","line", "surface" and “body”. Based on the "point", we can get the average strength of network node A32 and average node degree A36; Based on the "line", we can get the node ring rate A33; from the "surface", we can get the network average aggregation coefficient A34 and network connectivity A37; from the "body", we can get the average network diameter A31 and average network distance A35.

Based on the arithmetic weighting algorithm of third-level indicators, we obtained secondary indicators and the formula is shown as follows:

$$A_1 = \beta_{111} A_{11} + \beta_{212} A_{12} \quad (2)$$

$$A_2 = \beta_{121} A_{21} + \beta_{222} A_{22} \quad (3)$$

During the calculation of A3 indicators, we found that the average network diameter A31, the average strength of the network node A32, the average network distance A35, average node degree A36 and network connectivity A37 are not normalized, so after modified, the formula is shown below:

$$A3 = \beta_{131} * \frac{1}{A31} + \beta_{232} * (1 - \frac{1}{A32}) + \beta_{333} * A33 + \beta_{434} * A34 + \beta_{535} * \frac{1}{A35} + \beta_{636} * (1 - \frac{1}{A36}) + \beta_{737} * A37 * \frac{NUM}{2Numl} \quad (4)$$

Among which β_{131}、β_{232}、β_{333}、β_{434}、β_{535}、β_{636}、β_{737} are the weight of the third-level indicators. NUM=5，Numl＝9。

The relative importance of each third-level indicator can be calculated by the following judgement matrixes

Table 9 Third-level indicators judgment matrix on equipment running quality A1 by experts A

Indicators	Equipment Fault Interval Rate A11	Equipment Defect Interval Rate A12
equipment fault interval rate A11	1	2
equipment defect interval rate A12	1/2	1

Table 10 Third-level indicators judgment matrix on equipment running quality A1 by experts B

Indicators	Equipment Fault Interval Rate A11	Equipment Defect Interval Rate A12
equipment fault interval rate A11	1	1/3
equipment defect interval rate A12	3	1

Table 11 Third-level indicators judgment matrix on equipment running quality A1 by experts C

Indicators	Equipment Fault Interval Rate A11	Equipment Defect Interval Rate A12
equipment fault interval rate A11	1	1/3
equipment defect interval rate A12	3	1

Table 12 Third-level indicators judgment matrix on cable performance quality A2 by experts A

Indicators	Cable Fault Interval Rate A21	Cable Defect Interval A22
cable fault interval rate A21	1	1/3
cable defect interval A22	3	1

Table 13 Third-level indicators judgment matrix on cable performance quality A2 by experts B

Indicators	Cable Fault Interval Rate A21	Cable Defect Interval A22
cable fault interval rate A21	1	1/3
cable defect interval A22	3	1

Table 14 Third-level indicators judgment matrix on cable performance quality A2 by experts C

Indicators	Cable Fault Interval Rate A21	Cable Defect Interval A22
cable fault interval rate A21	1	1/3
cable defect interval A22	3	1

Table 15 Third-level indicators judgment matrix on grid robustness A3 by experts A

Indicators	Average Network Diameter A31	Average Strength of Network Node A32	Node Ring Rate A33	Network Average Aggregation Coefficient A34	Average Network Distance A35	Average Node Degree A36	Network Connectivity A37
average network diameter A31	1	3	5	3	1	2	3
average strength of network node A32	1/3	1	5/3	1	1/3	2/3	1
node ring rate A33	1/5	3/5	1	3/5	1/5	2/5	3/5
network average aggregation coefficient A34	1/3	1	5/3	1	1/3	2/3	1
average network distance A35	1	3	5	3	1	2	3
average node degree A36	1/2	3/2	5/2	3/2	1/2	1	3/2
network connectivity A37	1/3	1	5/3	1	1/3	2/3	1

Table 16 Third-level indicators judgment matrix on grid robustness A3 by experts B

Indicators	Average Network Diameter A31	Average Strength of Network Node A32	Node Ring Rate A33	Network Average Aggregation Coefficient A34	Average Network Distance A35	Average Node Degree A36	Network Connectivity A37
average network diameter A31	1	2	2	2	1	1	2
average strength of network node A32	1/2	1	3	1	1/2	1	2
node ring rate A33	1/2	1/3	1	1/3	1	1	1/2
network average aggregation	1/2	1	3	1	1	1	2

coefficient A34							
average network distance A35	1	2	1	1	1	1	2
average node degree A36	1	1	1	1	1	1	2
network connectivity A37	1/2	1/2	2	1/2	1/2	1/2	1

Table 17 Third-level indicators judgment matrix on grid robustness A3 by experts C

Indicators	Average Network Diameter A31	Average Strength of Network Node A32	Node Ring Rate A33	Network Average Aggregation Coefficient A34	Average Network Distance A35	Average Node Degree A36	Network Connectivity A37
average network diameter A31	1	5	3	2	1	3	5
average strength of network node A32	1/5	1	3	1/3	1/3	1	3
node ring rate A33	1/3	1/3	1	1/2	1/3	1/3	2
network average aggregation coefficient A34	1/2	3	2	1	2	1	3
average network distance A35	1	3	3	1/2	1	2	3
average node degree A36	1/3	1	3	1	1/2	1	3
network connectivity A37	1/5	1/3	1/2	1/3	1/3	1/3	1

According to judgment matrixes above, the calculated consistency index is less than 0.1, demonstrating that this method is reasonable. Therefore, according to the weighted average value of scoring table of the three experts, the effective third-level relative weight value can be listed as table18.

Table 18 Relative weight value of third-level indicators

Third-level Indicators	A11	A12	A21	A22	A31	A32	A33	A34	A35	A36	A37
Telative Weight	0.39	0.61	0.25	0.75	0.25	0.11	0.07	0.14	0.21	0.14	0.08

3.3 ANALYSIS OF THIRD- LEVEL INDICATORS

Third- level indicators are the foundation of the network health indicators. The details of the calculation formula of each third- level indicators are shown below:

(1) Equipment running quality A1

1) Equipment fault interval rate A11

The indicator will consider the situation of equipment failures, maintenance, quantity, etc. It can effectively reflect the quality of equipment operation situation.

$$A11 = 1 - \sqrt{\frac{1}{m} \times \sum_{i=1}^{m} \left(1 - \frac{T - TSD_i - TFoD_i}{(1 + NFoD_i) \times (T - TSD)}\right)^2} \quad (5)$$

Where m is the number of optical transmission devices in the backbone network, T is the length of the month calendar (the unit is min), TSDi indicates the time length of routine maintenance of the device i, TFoDi indicates the duration of the device i's failure, and NFoDi indicates the number of times the device i has failed.

2) Equipment defect interval rate A12

The purpose of this indicator is to strengthen the equipment defect management, and improve the equipment elimination rate and then eliminate the lack of quality, thereby improving the availability and health of equipment to ensure that the power equipment operate in a safe and reliable way.

$$A12 = 1 - \sqrt{\frac{1}{m} \times \sum_{i=1}^{m} \left(1 - \frac{T - TSD_i - TBoD_i}{(1 + NBoD_i) \times (T - TSD)}\right)^2} \quad (6)$$

Where m is the number of optical transmission devices in the backbone network, T is the month calendar (unit is min), TSDi indicates the time length of routine maintenance of the device i, TBoDi indicates the duration of the device i's key performance overdue time, NBoDi indicates the number of times that the device i's key performance is overdue.

(2) Cable performance quality A2

1) Cable fault interval rate A21

This is an indication of the probability of the interval between faults in the cable segment.

$$A21 = 1 - \sqrt{\frac{1}{n} \times \sum_{j=1}^{n} \left(1 - \frac{T - TSF_j - TFoF_j}{(1 + NFoF_j) \times (T - TSF)}\right)^2} \quad (7)$$

Where n is the number of optical transmission devices in the backbone network, T is the length of

the month calendar (unit is min), TSFj indicates indicates the time length of routine maintenance of the cable segment j, TFoFj indicates cable segment j's failure duration, NFoFj indicates cable segment j failure times.

2) Cable defect interval rate A22

This is an indication of the probability of a defective time interval for the cable equipment.

$$A22 = 1 - \sqrt{\frac{1}{n} \times \sum_{j=1}^{n} \left(1 - \frac{T - TSF_j - TBoF_j}{(1 + NBoF_j) \times (T - TSF_j)}\right)^2} \quad (8)$$

Where n is the number of optical transmission devices in the backbone network, T is the length of the month calendar (unit is min), TSFj indicates indicates the time length of routine maintenance of the cable segment j, TBoFj indicates the duration of cable segment j's attenuation and dispersion over limit, NFoFj indicates the times of cable segment j's light attenuation and dispersion over limit.

(3) Grid robustness A3

1) Average network diameter A31

This is an indicator of the average distance between nodes in the network.

$$A31 = \frac{1}{C_n^2} \sum D \quad (9)$$

D represents the maximum value of the distance between any two nodes in the network.

2) Network node average strength A32

This is an indicator of the average strength between nodes in the network.

$$A32 = \frac{W\left(\sum_{i=1}^{NUM} \sum_{j=1}^{NUM} Dijkstra(G(i,j), NUM\right)}{NUM} \quad (10)$$

Where G is the adjacency matrix based on the network topology, W is the weight matrix based on the weight of the network, and NUM is the number of nodes. Dijkstra algorithm has the shortest path and its nodes, and the design algorithm calculates the weight of the shortest path between nodes according to the weight matrix, and the Dijkstra algorithm can calculate the minimum path length between nodes and the nodes of the smallest path.

3) Node ring rate A33

This is an indicator of the probability of node generation in the network.

$$A33 = \frac{Numc}{NUM} * 100\% \quad (11)$$

Numc represents the number of nodes in the ring Numc, NUM means the number of nodes.

4) Network average aggregation coefficient A34

This is the indicator that the neighbors of the nodes in the network are also neighbors.

$$A34 = \frac{2^* \sum_{i=1}^{NUM} \sum_{j=i}^{NUM} G(i,j)}{NUM(NUM-1)} \quad (12)$$

Where G is the adjacency matrix based on the network topology and NUM is the number of nodes. The neighbors of the nodes in the network are also neighbors to each other.

5) Average network distance (hops) A35

This is the indicator of the minimum path length between nodes and the nodes of the smallest path.

$$A35 = \frac{2^* \sum_{i=1}^{NUM} \sum_{j=i}^{NUM} Dijkstra(G(i,j), NUM)}{NUM(NUM-1)} \quad (13)$$

Where G is the adjacency matrix based on the network topology and NUM is the number of nodes.

6) Node average degree A36

This is an indicator of the average degree between nodes.

$$A36 = \frac{\sum_{i=1}^{NUM} \sum_{j=1}^{NUM} G(i,j)}{NUM} \quad (14)$$

Where G is the adjacency matrix based on the network topology and NUM is the number of nodes.

7) Network connectivity A37

It indicates the degree of connectivity of the network topology, and also reflects the distribution situation of nodes within the network and the edge.

$$A37 = \min |Z| \frac{2^* \sum_{i=1}^{NUM} \sum_{j=i}^{NUM} Dijkstra(G(i,j), NUM)}{NUM(NUM-1)} \quad (15)$$

Where Z is a mixed set, that is, Z can be changed and can also have nodes. If we remove these edges and nodes, the map is divided into several parts.

4. CASE STUDY AND ANALYSIS

The comprehensive weight of the index system can be obtained by the comprehensive evaluation method. By using the basic parameters collected by the power communication network, the index value can be solved by layer and the calculation of the total index is realized in the end. In this section, we will enumerate the network operating parameters, and set up an example of the calculation of the index, then demonstrate the process of evaluating the example, and guide the evaluation process of the network, thereby explain and validate the index system and evaluation technology through examples.

Through the weight calculation results of the indicators at all levels mentioned above, the weights of the indicators are summarized as follows:

Table 19 Indicators weights at all levels

secondary indicators	weight	third-level indicators	weight
A1	0.1	A11	0.39
		A12	0.61
A2	0.3	A21	0.25
		A22	0.75
A3	0.6	A31	0.25
		A32	0.11
		A33	0.07
		A34	0.14

		A35	0.21
		A36	0.14
		A37	0.08

After the benchmark weight is determined, the underlying index of the system is collected during the actual operation of the grid according to the established index system structure, and then the higher level indicators are further calculated through the index hierarchy. Finally, the comprehensive evaluation results are obtained and effective comprehensive assessment to the network health is achieved.

For example, the parameters of the third-level indicators collected from the grid are shown as following:

Table 20 Bottom parameter statistics

m	T	TSDi	TFoDi	NFoDi	TBoDi	NBoDi	n	TSFj
3	30 day	0.2 day	0.5day	0.2	0.1 day	0.1	4	0.1 day
TFoFj	NFoFj	TSFj	TBoFj	NBoFj	D	NUM	Numc	Numl
0.25 day	0.15	0.1 day	0.2 day	0.1	25.5	5	1	9

According to the table parameters above and the formula of third-level indicators, we can get the final value of third-level indicators:

Table 21 third-level indicators

Third-level indicators	Value	Third-level indicators	Value
equipment fault interval rate A11	94.6%	equipment defect interval rate A12	90.6%
cable fault interval rate A21	86.2%	cable defect interval A22	90.3%
average network diameter A31	25.5	average strength of network node A32	246.93
node ring rate A33	68.0%	network average aggregation coefficient A34	10.78%
average network distance A35	11.25	average node degree A36	3.4
network connectivity A37	2	——	——

According to the above formula to obtain the secondary indicators A11, A12 and A13, and use arithmetic weighting method to calculate the secondary indicators:

$$A1 = \beta_{111} * A11 + \beta_{212} * A12 = 92.2\% \quad (16)$$

$$A2 = \beta_{121} * A21 + \beta_{222} * A22 = 89.3\% \quad (17)$$

$$A3 = \beta_{131} * \frac{1}{A31} + \beta_{232} * (1 - \frac{1}{A32}) + \beta_{333} * A33 + \beta_{434} * A34 + \beta_{535} * \frac{1}{A35} + \beta_{636} * (1 - \frac{1}{A36}) + \beta_{737} * A37 * \frac{NUM}{2Numl} = 34.4\% \quad (18)$$

Finally, continue to use the arithmetic weighting method to calculate a target A:

$$A = A1\alpha_{11} + A2\alpha_{12} + A3\alpha_{13} = 57.4\% \quad (19)$$

The health index was 57.4%, and the effective evaluation of the health of the power communication network was completed.

5. ANALYSIS OF HEALTH INDICATORS

In the evaluation system of this study, the first-level evaluation value of the health index of power communication network is directly determined by the second-level index, and finally is determined by the third-level index.

5.1 SECONDARY INDICATORS ANALYSIS

According to the example above, it can be seen that although the performance of the equipment running quality A1 and the cable performance quality A2 are 92.2% and 89.3% respectively, the weight determined by the experts is low (10% and 30%, respectively), on the other hand, the score of grid robustness is very low (34.4%) while the experts put a high weight (60%) on it, therefore the final health index is not high (57.4%). The grid robustness A3 of secondary indicators bears the role of "body", which is the foundation to complete the business in power communication network, and also the foundation to protect the operation within the link between the power communication network, so it is of the highest importance, and therefore it is reasonable to assign it the highest weight in the evaluation system. Therefore, to enhance the network robustness is important to optimize the entire network health level.

5.2 THIRD - LEVEL INDICATORS ANALYSIS

Through the experts' evaluation, we can get the relative weight value of the third-level indicators under each secondary indicators. However, since the weight value of each secondary indicators is of huge difference under the primary indicators, it is necessary to calculate the "direct weight" of third-level indicators to evaluate the relative importance between the indicators. And then we can identify the most important indicator to achieve most efficient network and provide specific guidance to increase the operability.

The direct weight calculation method of the third-level indicators is that the weight value of the third-level indicators to the secondary indicators multiplied by the weight value of the secondary indicators to the primary index.

For example, the direct weight of A11 is calculated as follows:

$$\omega_{A11} = \beta_{111} \times \alpha_1 = 0.039 \quad (20)$$

Table 22 direct weight of the third-level indicator

Third-level indicator	Direct weight
A11	0.039
A12	0.061
A21	0.075
A22	0.225
A31	0.15
A32	0.066
A33	0.042
A34	0.084
A35	0.126
A36	0.084
A37	0.048

As can be seen on the above table, the cable defect interval rate A22, the network average diameter A31 and the network average distance A35 are of the highest weight to the health degree of the power communication network. Cable defect interval rate A22 is an important reflection of cable quality A2, so to improve the cable defect interval rate requires to improve the quality of cable, which means you can appropriately increase the investment in the cable itself in order to obtain high yields. In addition, the network average diameter A31 and the network average distance A35 is the most important two indicators of grid robustness A3, so the network robustness can be significantly improved by increasing the network structure design investment to achieve compact design of network architecture, which can also greatly enhance the network health degree.

6. CONCLUSION

(1) The concept of health degree of power communication network is put forward, and the health degree evaluation system of power communication network is established.

(2) According to the proposed health assessment system, we analysis the assessment indicators of the power communication network health one by one. And according to the indicators' weight table given by three experts, we clearly figure out the weight of the indicators in the evaluation system.

(3) Through the basic parameters collected by the electric power communication network, an example is established to calculate the indicators, and the effective evaluation of the health degree of the power communication network is realized by the example.

(4) The concept of "direct weight" is proposed, which identifies the key factors that affect the health degree of power communication network. By analyzing the calculation results of the example, the important direction of improving the health of the network is put forward.

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A Preliminary Study on Intelligent Decision Making For Sustainable Development

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Abstract:The main content of this paper is in the premise of sustainability, combining the demographics, growth demand and geographical environment of cities. In order to design indexes to measure the success of urban smart growth in different cities around the world. First of all, through the hierarchical analytic method to determine the measurement of urban smart growth of indexes. Secondly, respectively through the city volume rate formula, quantitative method of land mixing degree, sampling analysis, GN China happiest city evaluation index system to quantify these indexes. Thirdly, from the consideration of urban population and geographical environment as two aspects, Arlington in the United States and Yushu in China were chosen as the research objects. Then through the sampling analysis to find relevant data and calculate the index values that are close to or the same as those of the indexes. Finally, according to relevant indexes develop a city plan indexes which is in line with the conditions of the city's own growth in 2050 and through all relevant indexes growth rate to assess the value of the indexes by 2050.
Keywords: Analytic hierarchy process; sampling analysis; weighted average method; comparative analysis

1. INTRODUCTION

Many communities are implementing smart growth plans to consider long-term, sustainable planning objectives. Smart growth is about helping each city and city become more economically prosperous, socially fair and environmentally sustainable place to live. The focus of smart growth is to build and embrace a sustainable developed city, economically prosperous, socially fair and environmentally sustainable. This task is more important than ever because the world is rapidly urbanizing. Predicted by 2050, 66 per cent of the world's population will be urban people which will result in 2.5 billion people being included in the urban population. Therefore, urban planning becomes more and more important and necessary to ensure that people have access to equitable and sustainable homes, resources and job opportunities.

Smart growth is an urban planning theory that originated in 1990′s as a means to curb continued urban sprawl and reduce the loss of farmland surrounding urban centers. The ten principles for smart growth are:

- Mix land uses
- Take advantage of compact building design
- Create a range of housing opportunities and choices
- Create walkable neighborhoods
- Foster distinctive, attractive communities with a strong sense of place
- Preserve open space, farmland, natural beauty, and critical environmental areas
- Strengthen and direct development towards existing communities
- Provide a variety of transportation choices
- Make development decisions predictable, fair, and cost effective
- Encourage community and stakeholder collaboration in development decisions

2. ASSUMPTION

- Suppose that the growth plan developed in question 3 spans from now to 2050
- Suppose there is no human disturbance in the process of investigation and statistical data on non-living things
- Suppose that the controlled detailed planning of all kinds of residential land in different cities is the sam

Table 1 Notation

Symbol	Definition
A	Conversion of the building area
K	The ratio of height above the ground in the basement to its height
A_1	Semi - basement floor area
F	Approved volume rate
F_1、F_2	Different types of building volume ratio

P_1、P_2	The proportion of different types of buildings
R	The effective area of open space
M	The actual usable area open to the public in open space
N	Effective coefficient
S	Area
L	Side length (L)
W	Width
S_1	Distance
V	Speed
T	Time
X	Per capita income
Y	The percentage of poor people
S_k	Actual expansion area
S_z	The total expansion area
S_v	Average annual expansion area
Z	Percentage of average poverty population
Phh	Area Mixing Ratio of Land Use
$RKMD$	Area population density (person / hectare)
EMK	For the area of the first K type of job density (one / hectare)

3.STUDY AREA

Establishment and model of the first question

The relation chart: Considering the three E's principles of sustainable growth and the ten principles of smart growth come to the conclusion whether the smart growth of city is a measure of sustainability of the three E's principle and smart growth of the ten principles successfully.

A quantitative analysis of the defined measures is given in the table below

Table 2 Index quantification

Index	Index Standard
Urban volume rate	>=1.2(m^2 / hm^2)
Land mixing degree	More than 50%
Traffic congestion rate (Average congestion delay index)	1.506
Urban expansion rate	Less than 10%
Percentage of poor people	Less than 10.9%
The overall educational level of residents	The percentage of high school graduates and higher students are more than 85%
Urban green area	Accounting for 30% of urban area
Urban happiness index	80-90

Rationality Demonstration of Index Standard:

City Volume rate:

Also known as the construction area of wool density, refers to a plot of the total floor area of land and land area ratio.

●In the calculation of floor area ratio, the basement floor area is excluded. But the basement as a shopping mall or other commercial public places, should be calculated construction area, and included in the volume rate.

●Semi-basement above the ground in the outdoor part of the height of more than 1m, according to the following formula to count the construction area:

$$A_1 = KA \tag{1}$$

●Control index of commercial building floor area

ratio, according to different nature of the building area ratio conversion synthesis.

$$F = (F1 \times P1\%) + (F2 \times P2\%) \quad (2)$$

Such as a construction site by a mixture of different types of buildings. It should delimitate different types of building area later. And then approved by the above formula their respective floor area ratio.

●Floor area ratio control index of commercial and residential complex building. According to different nature of the building area ratio conversion synthesis. High-rise commercial and residential building commercial building construction area should be at least 10% of the total floor area, less than 10% of the volume rate and building density control indexes according to the provisions of high-rise residential building to implement. Multi-storey commercial and residential building commercial space at least two or more (including two), provided only the bottom of the store, its volume ratio and building density control targets according to the provisions of multi-storey residential building to implement. Controlled detailed planning of various types of residential land prepared under the current urban planning and law system. In general, the floor area ratio is divided into:

Table 3 the volume ratio of different residential specifications

Residential type	Volume rate
Separate villa	0.2~0.5
Townhouse	0.4~0.7
6 floors below the multi-storey residential	0.8~1.2
11-story small high-rise residential	1.5~2.0
18-storey high-rise residential	1.8~2.5
19 floors above the residential	2.4~4.5
Residential volume rate of less than 1.0	Non - ordinary residential

Here select more than 6 layers as a measure, that is, volume ratio greater than 1.2.

● Land mixing degree:

Refers to a variety of land use, such as residential land, science, education and health facilities, land, government land, etc., but it hasn't an absolute majority of land use.

Model :

(1)Open space refers to indoor and outdoor space (including flat land, sunken plaza and roof platform) which are used for public use such as plazas, green spaces, passages, parking lots (libraries), etc. which can be provided to the public throughout the day, open space must meet the following conditions:

●Along the city roads, plaza set aside

●The net width of the direction of more than 5m, the actual use of the area of not less than 100 square meters

●To the width of 1.5m above the open staircase or ramp connection land or road, and with the ground or road in the height difference of ± 5.0m (including ± 5.0m)

●Providing a continuous indoor open space, the maximum height difference of -5.0m to +12.0 m, and the open ground layer

●Open to the public green space, the square should be set up seating and other resting facilities

●After the completion of the building, the corresponding signs shall be set and submitted to the relevant departments for management or approval by the construction unit
on behalf of the management

●Open all year round, without change of the nature

●Indoor or outdoor open space, should be barrier-free design space

●Indoor clear height of not less than 5m

(2)The effective area of open space is calculated as follows

$$\mathrm{R} = M * N \quad (3)$$

●The effective coefficient (N) is determined according to the following conditions:

Outdoor open space on the ground floor, Its ground elevation and road or when land surface height difference within ± 1.5m (including ± 1.5m) ， N=1.0

●Outdoor open space on the roof or sunken plaza. Its elevation and road or land surface height difference in + 1.5m to +5.0 m (including +5.0 m) or when -1.5 m to -5.0 m (inclusive), N=0.7

●Offering indoor open space. Its elevation and outdoor ground height difference in ± 5.0m or less or provide continuous indoor open space. Its elevation and the outdoor ground height difference in -5.0m to +12.0 m. N=1.0 (Model two).

$$Phh = \frac{RKMD}{Abs(RKMD * \log_{10}(EMK)) + \sum_{k=1}^{n} Abs(EMK * \log_{10}(EMK))} \quad (4)$$

Table 3 Classification of land chart

Since the Clarendon public market is widely acclaimed for the use of land, so we chose the Clarendon public market as a measure of land mix. Here Clarendon public market is a commercial and financial district, so the need for the second type of population In addition the total area of population density needs.

Table 4 Population density of the total area

index / Area	Population density (unit / hectare)
Total area	3871.8
Commercial Finance Area	1313.6

Into the formula available to the degree of mixing is about: 50%

Traffic congestion rate: Calculation method

●The average travel speed in the road network is obtained with 15 minutes as the statistical interval

●Count the percentage of road segments that are running at the road level

●Calculate the proportion of area (total) road network congestion mileage weighted by vehicle kilometers (VKT)

●Based on the linear conversion relationship between the 15 - minute traffic congestion index and the proportion of congested mileage, a 15 - minute traffic congestion index was obtained.

● Make morning and evening peak hours 15 minutes to take the average number of traffic congestion index, get the workday traffic congestion index. Take arithmetic mean traffic congestion index for 15 minutes during 6:00 am - 22:00pm. To get the holiday traffic congestion index.

Distance formula： $S_1 = V * T$ （5）

Table 5 Recommended value of vehicle mileage (VKT) ratio (working days)

	Freeway	Trunk road	Branch	total
Peak period	0.19	0.58	0.23	1.00
Full day average	0.20	0.57	0.23	1.00

Table 6 Recommended value of vehicle mileage (VKT) ratio (weekend)

	Freeway	Trunk road	Branch	total
Full day average	0.20	0.57	0.23	1.00

The following is a comparison of traffic congestion rates between China and the United States:

Table 7 Average Delay Time Index of Chinese Cities

Number	City	Average congestion delay index
1	Beijing	1.678
2	Jinan	1.689
3	Harbin	1.709
4	Hangzhou	1.717
5	Guangzhou	1.678
6	Shanghai	1.568
7	Shenzhen	1.591
8	Hefei	1.488
9	Fuzhou	1.506
10	Xiamen	1.456

Table 8 The average American city congestion delay index

Number	City	Average congestion delay index
1	Los Angeles	1.800
2	Portland	1.200
3	Washington	1.246
4	Chicago	1.246
5	Miami	1.246
6	San Jose	1.385
7	Seattle	1.430
8	New York	1.430
9	Honolulu	1.477
10	San Francisco	1.570

●Percentage of poor people:

Table 9 Sampling Statistics of Per Capita Income and Poverty - stricken Population in Mid - sized Cities

City	Per capita income	Percentage of poor people
Arlington	105763	7.1%
Virginia Beach	66634	8.3%
Raleigh	41032	19.9%
Miami	45184	14.8%
Auckland	67465	9.3%
Minneapolis	44408	8.9%
Tulsa	49759	15.9%
Wichita	57171	10.9%

Because the United States is relatively developed compared with other countries here only select the representative of the United States as a measure of the city.

$$Z=\frac{\sum_{i=1}^{n} X_i Y_i}{\sum_{i=1}^{n} X_i} \quad (6)$$

The percentage of the poor population is: 10.9%

●Residents' overall educational level:

Table 10 Sampling Tables for the Population of the Medium - sized Cities of the United States and the Population Ratio of the Senior High School or above

City	The population	The population ratio of high school and higher education
Arlington	229164	93.5%
Virginia Beach	452745	93.3%
Raleigh	77510	82.6%
Miami	35862	84.7%
Auckland	1242304	93.3%
Minneapolis	2002	91.3%
Tulsa	639242	88.8%
Wichita	389617	85.2%

As with the calculation of the percentage of the poor population, the final solution to the overall educational level of the resident indicators: 91.0%.

Urban green area:

（1）The public green space includes green land, river, lakeshore greenbelt and other belt-shaped and massive greenbelt at all

levels while meeting the width of not less than 8m and not less than 400 ㎡.

（2）The main difference between the central green space and the green space at the side of the house is that more than one third of the green space is outside the specified building spacing. It can be used as the center of green space, otherwise as the house next to (house) green space.

（3）The calculation of green area is as follows: the boundary of greenbelt is calculated to the roadside by the road between the house, the group road and the district road; when the pedestrian road is located in the district road, the calculation is made to the side of the sidewalk; along the residential area road and urban road Calculated to the red line; 1.5m away from the housing wall, the other walls, walls to the wall.

（4）Calculation of road green area: Calculated according to the planned green land in the red line of the road

（5）Courtyard green space area calculation starting and ending boundary is: the green border on the house road, group road and district road calculated from the roadside 1m, when the district road with pedestrian sidewalk on the sidewalk side; along the residential area Roads, urban roads are calculated to the road red line; from the housing wall 1.5m.

（6）The calculation of the starting and ending boundaries of the block and belt public green space is the same as that of the courtyards, and the public green space along the residential area road and urban road is calculated to the red line.

According to international standards, the most reasonable urban green area is 30% of the urban area.

City happiness index:

(1) The national happiness index = the incremental income / Gini coefficient * unemployment * inflation

The Gini coefficient in this formula is an index of inequality in income distribution, which measures inequality in social income distribution.

(2) The national happiness index = GDP index * a% + social health index * b% + social welfare index * c% + social civilization index * d% + ecological environment index * c%. a，b，c and d mean the social security index, the social welfare index, the social civilization index and the ecological environment index respectively. The weight of the specific weight depends on the economy and social goals that each government wants to realize. According to "GN China urban well-being evaluation index system" as the standard urban happiness index >=80 which is reasonable. Question two: We choose two cities of Arlington and Yushu in China as the research object. Arlington Growth Plan: Please refer to the attached page for details of the growth plan

Table 11 Arlington Growth Plan Sampling

Year / Project	2010	2013	2015
Population (people)	174589	211080	229164
Median household income (dollar)	58834	97843	105763
Percentage of poor people	16.8%	10.7%	7.1%
Residents' Educational Level	60%	73%	93.5%
Median price of house (dollar)	98837	497856	607700
Green area (Square kilometers)	39.7	45.1	56.8
Urban area (Square kilometers)	256	256	256

From this we can get:

Percent of poor people: 7.1%

Percentage Growth of Poverty Population: 3.5%

Percentage of the population as a whole: 93.5%

Percentage growth rate of residents as a whole:

Percentage of urban green area: 24.7%

Urban green area percentage growth rate: 2.7%

City happiness index: 75

Average annual population growth rate: 6.25%

Yushu growth plan:

Table 12 Yushu population and high school and above education population ratio of the sample table

Age(year) / Index	2000	2010
The population of high school graduates and higher education （person）	461	22779
Population(person)	268825	378439

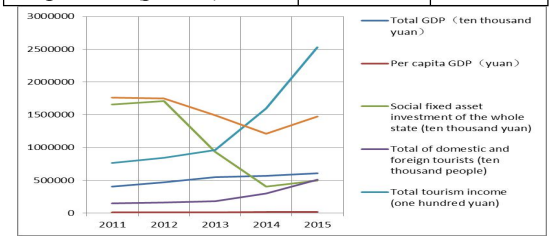

Figure 1 Yushu growth plan sampling chart

Table 13 Yushu poverty statistics

Year	2011	2013	2015

Index			
Real poor people of the whole state at the end of the year (people)	31818	94681	69060
Population out of poverty in the year (people)	3992	21234	12000
Population of returning to the poor (people)	798	4323	2553

The above data shows Yushu's growth plan has the following characteristics:
The annual growth rate of residents' educational level: 80.1%
Average annual population growth rate: 4.078%
Percentage of poor population: 16.62%
Out of poverty: 17.45%
Per capita GDP: 13072.6 yuan
Annual growth rate of domestic and foreign tourists: 60.9%
Total annual growth rate of tourism income: 57.5%
Annual growth rate of deposits in financial institutions: -4.06%
Yushu Tibetan people are more, the number of other ethnic are less.
For the success of the two cities in the calculation of the design model is as follows:
●Grade the indexes designed in question one
To improve people's living standards and then improve the people's living environment as a starting point, the above indicators are graded as follows
Table 14 Index classification table

Rank	Index
Level one	Percentage of poor people, the overall educational level of residents, urban happiness index
Level two	Urban volume rate, Land mixing degree, Traffic congestion rate(Average congestion delay index), Urban green area
Level three	Urban expansion rate

●The weights are assigned to each index
Assuming that the weights of the first-level indicators to the third-level indicators are L, M and N respectively,

$$\begin{aligned} 3L + 4M + N &= 1 \\ L > M &> N \end{aligned} \tag{7}$$

L=0.15，M=0.13，N=0.03（This weight is not unique but more reasonable）
●The degree of success is calculated using a weighted average

$$Z_1 = \frac{\sum_{k=1}^{n} A_i B_i}{\sum_{k=1}^{n} A_i} \tag{8}$$

A: Index weight, B: Index value
Arlington solution for the degree of success of 80.9%, Yushu degree of success of 30.7%
Yushu is the main source of income is the tertiary industry, per capita income is not very high, because of its geographical characteristics, Yushu biological resources, mineral resources, forestry resources, water resources are relatively rich, but higher mountain road leads to inconvenient traffic. In addition Yushu residents overall lower level of education. So according to the expected growth rate of Yushu to design the growth plan:
1. To strengthen the educational efforts
2. Make full use of their geographical environment resources to develop more income channels
3. Attention to social equity, to prevent the emergence of wealth gap, gender discrimination
4. Strengthen the legal construction of society, reduce the crime rate.
5. Pay attention to the rational use of land and mixed use
Comprehensive evaluation of the value of the indicators were: 40%, 35%, 15%, 10%.
Into the success of the second problem in the evaluation of the standard calculation of the degree of success Yushu 60.5%
In addition Arlington's main source of income is the secondary industry and tertiary industry, per capita income is higher, the number of enterprises in Arlington and the types of enterprises are more, and Arlington's Dallas - Fort Worth International Airport every day More than 170 flights from the busy traffic. Arlington residents of the overall education level is also higher 84.6%, Arlington has many ethnic groups, prone to national interests, ethnic discrimination and other issues. Arlington's crime rate showed an overall downward trend, so according to the expected growth rate of Arlington designed for Arlington's growth plan:
●Attention to social equity, to prevent racial discrimination, gender discrimination.
● Pay attention to the rational use of land and mixed use.
●Strengthen the construction of traffic.
●Rational use of land development rights to protect farmland, open space and so on.
Comprehensive evaluation of the indicators were 10%, 40%, 30%, 20%.
Into the success of the second question in the evaluation of the standard calculation of the degree of success Yushu can be 84.9%
Yushu:
The three problems in the Yushu growth plan for the five indicators are divided into two parts, stratification considerations:
First level: to strengthen the intensity of education
Make full use of their geographical environment resources to develop more income channels

Level 2: Attention to social equity, prevention of inequality, racial discrimination, gender discrimination

Strengthen the legal construction of society, reduce the crime rate.

Attention to the rational use of land and mixed use

The first level and the second level of comparative analysis of the potential of the first level than the second level, because Yushu the overall economic level is not very high, the city's infrastructure is not very perfect.

The first level of numerical analysis, because the residents of the overall education level is low, and the overall education level of the population was increasing year by year trend, so to strengthen the potential of education on the full potential than the use of their own geographical environment resources development The potential for more income pathways is large.

The second level from the city's overall economic level, urban ethnic variety and infrastructure construction analysis, because the overall economic level of Yushu is not very high, the infrastructure within the city is not perfect, there are basically ethnic Yushu Tibetan, Not prone to national interests disputes, ethnic discrimination and other issues. Therefore, considering the importance of social fairness, prevention of the gap between rich and poor, racial discrimination, sex discrimination is greater than the potential to strengthen the legal construction of society, reduce the crime rate is greater than the importance of rational use and utilization of land. The following table:

Table 15 Yushu smart growth potential of the table

Potential ranking (From large to small)	Growth plan indexes
1	Strengthen the intensity in education
2	Make full use of their geographical environment resources to develop more income channels
3	Value social equality , predict to prevent the gap between rich and poor, racial discrimination, gender discrimination
4	Strengthen the legal construction of society , reduce the crime rate and so on.
5	Pay attention to the rational use and mixed use of land

For Arlington:Because Arlington is a city with a certain development base, the infrastructure has been basically perfect, so the full use of infrastructure or reasonable expansion of the city most likely to build energy growth in the city, but the principle of smart growth is fully existing facilities development and utilization of land, so the potential importance of rational use of land and the potential of mixed use is greater than the rational use of land

development rights to protect the potential of farmland, open space and other programs, the use of land development rights to protect farmland, open space and other programs greater than the potential to enhance the construction of transport. Therefore, the following tableTable 16 Arlington Smart Growth Potential

Potential ranking (From large to small)	Growth plan indexes
1	Pay attention to the rational use and mixed use of land
2	Rational use of land development rights to protect farmland and open space
3	Strengthen the construction of traffic
4	Pay attention to the rational use and mixed use of land

If the population of each city increased by 50%, which means that the city's per capita area decreased, that is to bring housing congestion, rising house prices, traffic congestion, social order management difficulties, increased crime and many other issues. How to increase the per capita possession of land in the city as a breakthrough to solve the problem. Therefore, in view of these problems, propose the following solutions:

●Take a high-density, more compact development model

●As far as possible the development of mixed use city

●Replacement of private cars by providing public transport and pedestrian streets

●The right to use the right to transfer land use and reuse of the old city center downtown

●Rational use of land development rights to ease the shortage of urban area.

4. MODEL EXTENSION

We believe that the most fundamental purpose of urban construction planning is "people-oriented", starting from the human nature and convenience, can be considered in densely populated, economic prosperity, social equity and good environment in the central city, the use of urban sustainability, increase the number of urban population and well-being.

According to the data, a planning model with matching degree as the objective function is established and the city index is determined by using the relevant knowledge. This model can also

be used to assess a city's development potential, to judge the country's overall strength, but also can plan some public places such as the construction scale.

5. CONCLUSIONS

Through a comparison of population growth rates and the growth rates of the various components of the plan, to gain on the phenomenon that two cities will appear traffic congestion, housing shortage, urban social order management difficulties and so on, if counting the population of the two cities with annual growth of 50% from now to 2050. Therefore, how to improve the per capita possession of land has become an important breakthrough in addressing the excessive population growth. The following initiatives are proposed to address this situation： Take high-density, more compact development patterns, develop mixed-use city as much as possible, through providing public transport and pedestrian street to replace private cars, proper use the land use right to transfer, re-use of the old city and downtown, use land development right reasonably to relieve the shortage of urban area.

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The Research on Vehicle Distance Measurement Based on the Video and Radar Mixing

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Abstract: The video ranging technology is a multidisciplinary technology based on mathematical and digital image technology, which is an important branch in the field of computer vision research. In recent years, digital image processing technology has been constantly improved, especially the binocular distance measurement has become a new hot spot in the field of video distance measurement.The front distance measurement technology based on video and radar mixing can automatically detect the distance between vehicles and the front vehicles. The three-dimensional information of the shot scene is restored it through the image sequence of the time, and the working principle is to use the binocular digital camera to imitate the perception process of human vision. The two digital cameras are used to take pictures from two different view points at a certain distance and to obtain images at different viewing angles, that is, there is a certain parallax between the two pictures. Then through the Pythagorean theorem combined with the image, parallax to calculate the depth information of three-dimensional space. As the video ranging technology can only be closer to the target field of vision can reduce the measurement error, so in order to improve the system measurement range and measurement accuracy, we specifically introduced laser ranging as a means of assisting distance measurement to make up for the error caused by video ranging in a large distance range and image distortion.
Keywords: video ranging; digital image; laser radar

1. SYSTEM DESIGN

1.1SYSTEM PERFORMANCE REQUIREMENTS

Precision ranging has always been a hot topic research on the industry. With the improvement of electronic technology and manufacturing process in recent years, more and more high-precision sensors have appeared. However, even if various ranging devices have superior performance, but in some specific environments, ranging devices will be restricted by their own working methods that may not be able to work normally.

Measurement and navigation technologies based on computer vision continue to mature, and on the basis of application of the pattern recognition, the computers can recognize the external space environment like a human being. This laid a solid foundation for the developing autonomous visual servoing system. However, the current visual technology has a lot of room for improvement in terms of accuracy. In order to obtain accurate measurement results, the other sensors are introduced as an auxiliary means to the existing visual measurement.

In this paper, the video and radar based on the front vehicle distance measurement technology to explore mainly based on binocular stereo vision video ranging technology. In order to improve the stability and measurement accuracy of the system, the laser rangefinder method is specially introduced as an aid in it. The data fusion algorithm is designed, and the measurement results of the two are referenced in a reasonable range to realize the diversification of data sources.

The purpose of this course is to develop a set of devices that uses binocular vision to measure distance and correct the data with LIDAR, meanwhile, it also can explore the computer vision technology and data fusion algorithm. From a practical point of view, the urban roads are usually crowded, especially in the downtown area, the traffic is dense and the roads crisscross, so the probability of traffic accident is higher. Although the expressways are generally not crowded, the traffic speeds are fast. For the two kinds of intersections, it is necessary to measure the system with faster real-time, and to measure the distance between the front vehicles in time. In addition to intersection traffic flow density and speed, the weather conditions may also affect the probability of traffic accidents. When the rainy weather or foggy weather, the driver's vision range is low, which also laid a hidden danger traffic. Therefore, the system needs a strong anti-interference ability, which can measure distance when the field of view is insufficient or the visibility is not enough.

Because this design is equipped with a laser radar, so in the dim light or dark night can also rely on laser radar ranging and can guarantee the measurement accuracy within the measurement range of 1m or less, the above system includes IPC

and laser radar module, their operating temperature range from minus 10 ℃ to plus 50 ℃. The ranging system can measure both close objects and distant objects. The range of LIDAR used in this design is 200m, and the laser beam divergence angle at ± 5 '(plus or minus 5 points), because the less beam dispersion and energy loss is conducive to spot concentration and can improve accuracy.

1.2 VEHICLE DISTANCE MEASUREMENT SYSTEM COMPONENTS

From the perspective of system composition. The entire distance measurement system consists of four parts: IPC, LIDAR, LCD and Digital Video Camera. Among them, the IPC is the core control unit of the whole system, responsible for the management of monitors, digital cameras and laser radar, while the measurement results of camera and LIDAR are also processed. What's more the high speed ADC module / digital conversion module of laser radar can convert the level signal into digital signal in real time, and sent it to the engineering machine through the TTL serial port. When the engineering machine receives the data sent by both, the data are fused according to the preset intelligent algorithm to form the final measurement result. Finally, the test results and the real-time pictures captured by the camera will displayed by LCD. The structure of the system is shown in Figure 1-1.

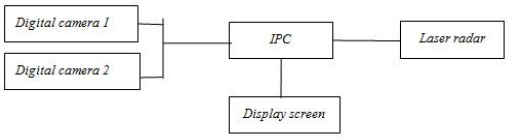

Figure 1 components of the system

1.3 VIDEO RANGING AND LASER RANGING DATA FUSION

The video ranging and LIDAR have their own advantages and disadvantages, in order to present more comprehensive and real measurement results than traditional ranging methods, and make the information source of the system more diversified. The design of the distance measurement technology combine the results of the LIDAR and video ranging. The two measures complement each other, that not only making the results more accurate but also providing real-time images of the front road condition.

The data fusion algorithm of this design chooses the primary source and the secondary source of the measurement data according to the distance of the front vehicle. When the distance of the front vehicle is less than two meters, the result of the final ranging is that 80% from the video and 20% from the laser radar. When the distance of the front vehicle happens to be two meters, the result of the final ranging is that 50% come from video ranging and 50% come from LIDAR; when the current vehicle was over two meters away, the final ranging result is that 20% from video ranging and 80% from LIDAR.

2. RESEARCH ON THE VIDEO RANGING TECHNOLOGY

2.1 CAMERA IMAGING MODEL AND CALIBRATION

The video ranging technology used in this design is the binocular stereo ranging technology. This technique aims to capture images of the same target object in parallel from two different angles and directions through the cameras with the two certain distance optical axis and use the specific mathematical method to calculate the appearance and space of the target object, and identify the image. And for the image to make identification. The following is a brief description of the specific implementation methods and steps of industrial computer to obtain images through digital cameras.

(1)small hole model. The key to video ranging technology is the imaging model, which is usually using the small hole model. The model used in this design is the small hole model. The so-called camera optical axis center point is the spotlight that located in front of the camera's lens. Many of the imaging sensor components of the camera are distributed in this imaging plane, they are responsible for converting the optical signal that the light incident on the camera's lens and reaching the light-sensitive surface into an electrical signal by means of photoelectric conversion. The electrical signal is converted to a digital signal by a high-speed digital-to-analog converter inside the camera to obtain a digital image. According to the imaging principle of the pinhole model, it can be judged that the object appears on the plane as an inverted real image. The real image compared with the actual object, the direction completely reversed, while the size is much smaller. Therefore, from optical signals to digital signals, the image needs to be flipped to make it consistent with the actual object in the direction, and then enlarged the image.

(2)camera intrinsic parameters model. The camera's intrinsic parameter model describes the relationship between scene points and image points. An image on an abstract plane is magnified to obtain a digital image, and a point on the imaging plane is transformed into an image point. The projective geometry can be inferred, the same image point can correspond to a number of different points in space. Using the normalized imaging focal point coordinates and the optical axis center point on the imaging plane, which can determine the spatial line of the object.

(3)lens distortion model. For the camera's distortion, the main part is the radial distortion. The radial distortion takes the image coordinate of the optical axis center point as the reference point, which is proportional to the square of the distance from the image point to the reference point.

(4)camera external parameters model. The camera's external parameter model is the description of the scene coordinate system in the scene coordinates.

After briefly introducing the principle of pinhole imaging, the concept of parametric camera model and lens distortion, the main work of calibrating the camera is to construct mathematical models and derive them to calculate these data. The video ranging part of the front distance measurement system in this design based on video and radar mixing is implemented on the Visual Studio development platform through the Open CV function library. There are many ways to get the camera intrinsic parameters in the Open CV function library, in which the camera calibration is achieved by its unique function cvCalibCamera2. As we all know that in the computer vision or video measurement working process, the calibration of the camera is usually based on the internal parameters matrix and the distortion coefficient, and then further calculate the camera's rotation vector and the translation matrix, according to these you can correct the image - Jingning County that captured by the camera and restore the three-dimensional coordinate system data.

2.1.1 NON-LINEAR MODEL CAMERA CALIBRATION METHOD

Because the picture obtained directly from the camera that exist the radial distortion problem, after comparing with the actual image, the resulting image is change to the non-linearly distorted. Therefore, in order to avoid this error caused by the radial distortion, the camera needs to be non-linearly calibrated.

Through the linear calibration method of non-linear model camera, using the planar target, the calibration of the camera is realized by using the target image at different viewpoints. The internal parameter model of the camera adopts five parameter model, and the scene distortion model with four order lens deformation.

Without considering the distortion, the five linear parameters in the camera's internal parameter model are calibrated to obtain the initial value of the linear parameter. Then use the calibrated value, and calibrate the nonlinear parameter, which we also called the distortion coefficient. Since the distortion is not considered when calibrating a linear parameter, the initial numerical accuracy of the calibrated linear parameter is very lower. On the basis of the initial values of these parameters, the accuracy of the nonlinear parameters is not high. In order to improve the calibration accuracy, it is necessary to recalculate the linear parameters by using the calibrated nonlinear parameters, and then use the new linear parameters recalculated the nonlinear parameters. After repeated calculations, until the value of the linear and nonlinear parameters of the parameter converges.

When using the planar target for calibration, several images of the same target are used in it. When using this method for calibration, the target needs to be collected from several different perspectives. In order to get a better calibration result, in this design we collect 20 checkerboard target images during the image calibration. The black squares and white squares inside the chessboard target are the same size with a length of 40 millimeters. The vertices of two adjacent black squares are counted as a corner point. As you can see from the figure below, the checkerboard target has 6 corner points per row and 4 corner points for each column.

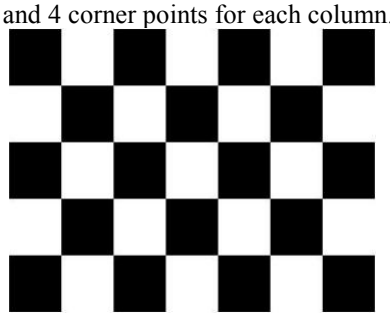

Figure 2 Acquired target image

2.1.2 CAMERA CALIBRATION BY OPEN CV

Microsoft offers three free stereoscopic algorithms in Open CV: which is BM, SGBM, and GC, but the BM and GC can only process 8-bit grayscale images, and the SGBM can handle 24-bit color images. What's more in these three algorithms, the calculating speed of the BM is the fastest but the effect is the worst, the calculating speed of the SGBM is faster and performs is better than the BM, and the calculating speed of the GC is the slowest but the effect is best. Considering the high real-time requirement of the system and the correction of the measurement result by LIDAR, so it is decided to adopt the fastest computing BM algorithm. The specific steps of camera calibration are as follows:

(1)Open the IPC program, compile and run. Let the two USB interface camera connected to the IPC, select the resolution of 640 * 480 after the user interface appears in the program, respectively the specific device numbers of left and right views. Click the start camera button, and the results are shown in figure 2.

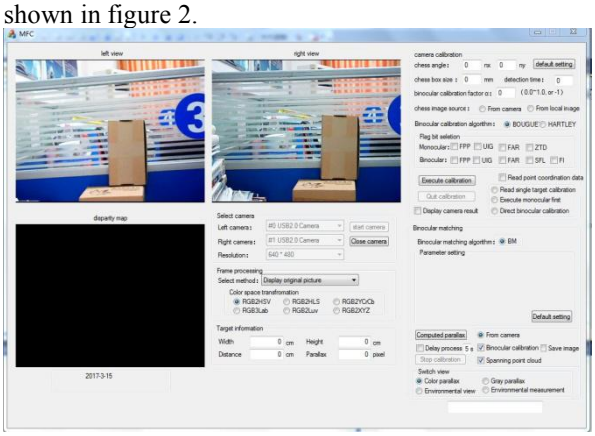

Figure 3 Starting Two Cameras

(2) Using Photo Shop software to draw on the A4 paper with the size of 40 * 40mm checkerboard, then print it out, and glue it to the cardboard to fixed it. Then put the fixed board into the camera's field of view, and try to fill the entire field of view. In the camera calibration area fill in the checkerboard points nx and ny, respectively the number 6 and number 4. The checkerboard box size is 40mm. What about the Binocular correction scaling factor, the Microsoft official proposal to fill in -1. All the parameters in the selection area of the mark position are fully followed by the official recommendation of Microsoft. The single target option will be selected as the first. As shown in figure 4.

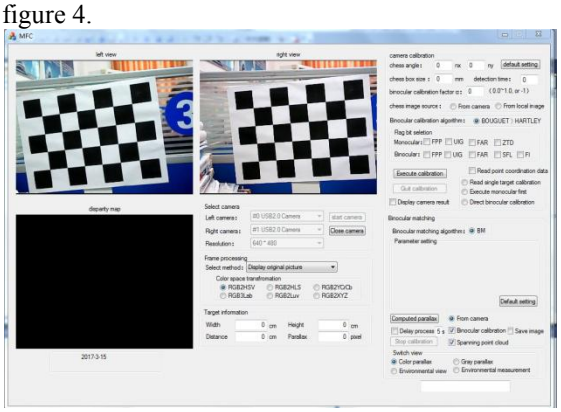

Figure 4 Camera calibration parameter settings

(3)After setting the parameters, click the camera calibration button, the program will start to automatically calibrate. During the calibration process, the position of the chessboard target in the screen should be properly moved, and at the same time, try to ensure that the chessboard target fills the entire screen and does not move beyond the frame border. As shown in Figure 2-4 below.

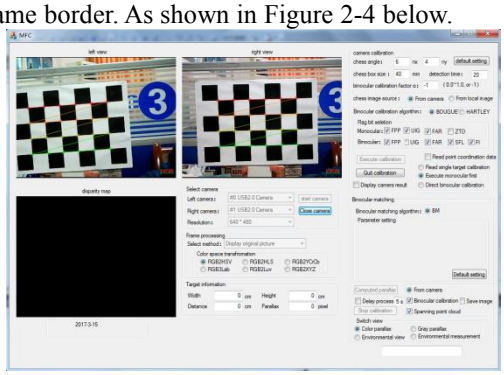

Figure 5 performing camera calibration

(4) After 20 times corner detection is completed, the program will pop up a message prompt to inform the user that the chessboard corner check is finished.

(5) After the corner detection is over, the program will calculates the calibration error according to the algorithm and it will pops up a message box to display the calibration error value.

(6) Finally, the program also uses the message box to inform the user to complete the binocular algorithm and save the parameters. The binocular camera calibration results will be saved in an xml file, the file is generated in the project folder that is the debug folder, the file name is calib_paras.

2.2 BASED ON BINOCULAR VIDEO DISTANCE MEASUREMENT

The visual system that can measure the position of the target object in the Cartesian space is called the stereoscopic vision system.The more common stereoscopic vision are the binocular vision, multi-vision and the results of light vision. This design the research on vehicle distance measurement based on video and radar mixing is for binocular vision measurement technology. Binocular vision measurement technology uses the two network digital camera to capture the matching points on the image, and then calculate the three-dimensional coordinates of the space point.

Generally, the accuracy of the image feature points and the calibration accuracy of the camera's internal and external parameters have a significant impact on the three-dimensional coordinates. In addition, by using the principle of two lines intersecting to obtain the three-dimensional coordinate, it is determined that the measurement accuracy is greatly affected by the error of the image coordinate, and anti-random interference ability is poor.

3. DIGITAL CAMERAS AND IPC COMMUNICATIONS

3.1 CAMERA SELECTION

The design of the binocular stereo vision measurement using two USB interface camera. With a megapixel imaging capability, the digital camera captures a 720p HD picture and allows manual focus adjustment by turning the front knob. Moreover, the digital camera has the function of intelligent noise reduction and sun screening, which can adapt to harsh outdoor environment, which is fully comply with the requirements of this design.

The design of the selected USB camera is equipped with a CMOS metal oxide semiconductor image sensor that can provide 1/3 to 1/100 seconds shutter speed, using the ICR filter, good imaging results, the maximum size of the picture can be shot is 1280 * 960, at the same time this kind of USB digital camera also provides a microphone interface, but also has a low power consumption function, and can supply 5 V power just need through the USB.

3.2 CAMERA COMMUNICATION

In this design, digital network cameras communicate with IPC by USB protocol. As the IPC motherboard only has two standard USB interface. Taking into account the latter part of the industrial computer with a mouse, keyboard and laser radar, so an additional HUB is added to extend the USB interface.

The front of the camera has a high-performance metal-semiconductor image sensor that can converts an external world's optical signal into an

electrical signal and then transform into an image signal. However, this image signal is an analog signal, although it can output and playback, but is not suitable for the design of this article. A high-speed analog-to-digital converter is built into the rear of the camera, the analog signal can be converted into digital signal in real time, and then output through the USB cable, passed to the IPC. The entire image output process shown in Figure 3-1

3.3 SET UP THE CAMERA

(1) The two digital network computer connected to the IPC through the USB interface to IPC automatically recognize the USB device and install the driver.

(2) Open the application of the IPC, then find "Select Resolution" in the "Select Camera" area of the program interface and choose 640 * 480 resolution for better image information. It can be clearly seen from the images that the shooting directions of the two cameras are basically parallel and the images have a small parallax. Therefore, it can be proved that the USB camera has successfully communicated with the IPC.

(3) After selecting the default parameters, click the Calculate Parallax will be located in the Debug folder, you can see in the folder before calibration xml file, and open the file will perform ranging work. As shown in Figure 3-2.

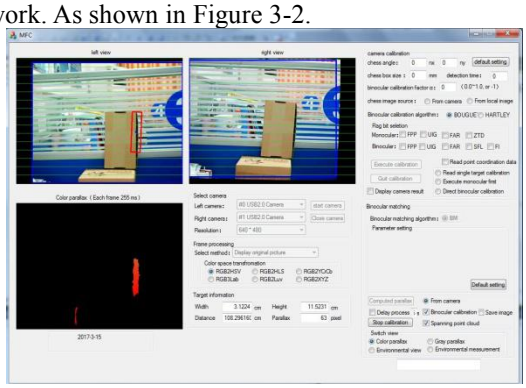

Figure 5 Digital camera image display

4. LIDAR RANGING TECHNOLOGY

In the design of the ranging system, in addition to using video ranging technology to obtain distance information with the front vehicles or obstacles, laser radar is also one of the means of distance measurement. LIDAR in this design is mainly used for the following aspects:

(1) assisting and correcting the error of video ranging by the working principle of laser radar;

(2) detecting the distance information in the case of low visibility or dim light to make up for the lack of video ranging;

(3)detecting the distance of the object at a far distance.

4.1 LIDAR RANGING METHOD

The common LIADR in the ranging method can be divided into two types: one is the laser phase method; the other is the pulse laser method. LIDAR emits the narrow laser light to detect the position, velocity and other information of a target in a particular direction. From the aspect of working mode, which is similar to the principle of microwave radar ranging, it can determine the position and shape by transmitting signals of certain wave length and frequency to the target and then analyzing the signal reflected from the target object. The LIDAR has the advantages of high precision, wide detection range and so on, but the LIDAR also has disadvantages. First of all, when the ambient light in the work environment is too strong, such as outdoor ranging using LIDAR at midday, and the receiving end of the LIDAR will also have a high intensity of sunlight, which can not clearly distinguish the background light and the laser light echoes, so the LIDAR may not be able to accurately detect the distance; Secondly, when the surface is coated with pure black or other materials that can absorb the same frequency with the laser frequency of the laser will also lead to inadequate reflection of the light intensity of the laser radar. Finally, when the target's surface is very smooth or mirrored, with a large angle of inclination, the light waves emitted by the LIDAR will be reflected to other angles, resulting that the echo energy is too low, so the laser radar can not work properly.

The design of the front distance measurement technology for the laser radar part of the requirement is to achieve continuous measurement and the corresponding rapid, so taking these actual needs into account, we decided to use pulsed laser radar as the design of the laser measurement aids.

4.2 LIDAR AND HOST COMPUTER COMMUNICATION

In this design, the laser radar communicates with the IPC through the USB-TTL, this interface mode will be converted directly to the wiring of the radar module USB type, which is easy to connect with the IPC. The radar module uses 9600bps baud rate to send data, a total of 8 bits, including a start bit, a stop bit, but no parity check bit.

Using the Serial Port API function to get the serial port in the host computer program and operate the laser radar module. Specify the port number by str. Format (_T ("TOM% d"), j + 1) function. Using HANDLE Creat File () function to open the serial port, after successfully open, the function will returns a handle, the handle will be used in the next other operations. There is only one parameter in this function, which is the handle generated in HANDLE Creat File (). Use the BOOL Read File () function to read the data received by the serial port.

5. CONCLUSION

5.1 DESIGN STUDY SUMMARY

Referencing to the development of computer and artificial intelligence industry, the design combines the most advanced research results of the current artificial intelligence robot vision control

technology, and aiming to explore binocular stereo vision technology and multi-sensor data fusion algorithm for a long time up to a half-year of scientific research.

This design gives a new solution to the specific problems of image acquisition, camera calibration and space modeling in the field of vision control based on previous research results. Through the actual test can be seen, the proposed camera calibration method works well, and the camera calibration is accurate, to a large extent, the camera has achieved low distortion. That also gives a concrete and feasible method to the Stereo vision measurement technology

At the same time, this design also discusses specific issues such as the imaging process and working principle of the network digital camera, and realizes the control of multiple digital cameras.

In order to improve the measurement accuracy and make up for the shortcomings of video ranging in the workplace and its own performance, this design also specifically enters the laser radar as an auxiliary tool. In the measurement of distant targets, the video ranging method of binocular stereo vision exposes its own defects, then the system increased confidence in the results of laser radar to ensure the accuracy of ranging in long-range conditions.

5.2 WORK PROSPECTS

This design only measures the distance of the front vehicles during normal traffic conditions. In the extreme cases, such as the high temperatures, severe cold and rain and snow weather is not considered. In addition, this design based on binocular

stereo vision video ranging method needs to be calibrated in advance, although the specific solutions have improved, but the initiative of the algorithm is still poor, and failed to achieve that can be used without calibration aims. For the future development, the design has the following expectations:

(1) Further optimize the calibration algorithm. Although the system has made up for the deficiencies of the various algorithms proposed by previous scholars, there is still much room for improvement in terms of calibration and measurement accuracy.

(2) Undefined visual algorithm research is attempted, and an algorithm with usability and universality is developed to realize that various types of mobile devices can be put into use without calibration and achieve the goal of working side by side Calibrate.

(3) Optimize data fusion algorithm. The data fusion algorithm used in this paper is very simple, but it still needs to be perfected at different trust levels of different surveying and mapping results in different measurement intervals.

ACKNOWLEDGMENT

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The Research On Virtual Display Of Woodblock Architecture Of Guangxi Dong Nationality

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Abstract：Among the Dong nationality buildings in Guangxi, the main ones are wooden buildings. Some ancient buildings have had hundreds to thousands years of history, they can still be preserved after the historical trend and years of erosion. In order to preserve the skills of wooden architecture and carry out extensive dissemination and diffusion, as well as to restore the ancient buildings and preserve the ancient buildings, so we comprehensive the all aspects of the framework structure, customs and design concepts of the Dong wooden buildings and use the modern information technology for three-dimensional virtual "restoration" , representing the true appearance of the building, and conduct related introduction, dissemination and protection.

Keywords ： Guangxi Dong Nationality; Wood Architecture; Art; Virtual Demonstration

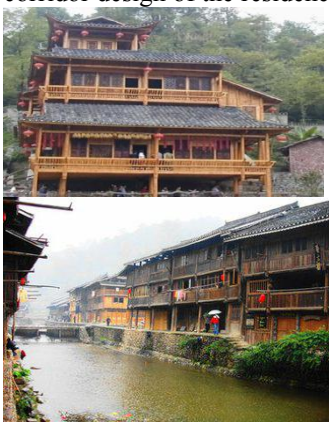
1. INTRODUCTION

The Dong people in Guangxi can be regarded as the born artists, and the artisans' architectural ability is superb. It is understood that they are in the design and construction of buildings, bridges and other buildings, they do not have to use any hand-painted manuscript，but only rely on the bamboo sticks to measure the mark, and they can only use the simple tools build different shapes, and combining the art beauty and formal beauty as one of the pavilions, houses, bridges, it is amazing.

But what worries us most now is that the architectural skills of the Dong people are facing the embarrassment circumstance that they have no successors. Due to the changing living style of local young people, superadd the current lack of sources of wood materials and the disadvantages of wooden buildings themselves: their ability to face fires is particularly poor that easy to destruction and difficult to recovery. Because of joint action of these internal and external causes, which makes the Dong ethnic wood buildings gradually fade out of people's perspective. Therefore, the Dong wooden architecture and its unique architectural skills are facing the inheritance crisis - have no successors. However, with the rapid development of science and technology and the wide application of modern information technology, the three-dimensional virtual design gradually approaches people's vision. Three-dimensional virtual technology with its sense of immersion and interactive characteristics has a tremendous influence on the heritage and protection of the wooden arts: which can carry on the inheritance of related building skills, restoration of residential and so on.

In order to study the wooden buildings of Dongs in Guangxi, we must first analyze and study the characteristics of Dong wooden buildings. Dong people generally build their houses into the form of stilts, mainly because that, on the one hand, Dong people live in areas where wildlife is more frequently infested; on the other hand, the local climate is mostly humid. Therefore, the design of Diaojiaolou is not only a peculiar shape but also has a reasonable layout and practicality, what's more the unique design can also fully reflect the unique culture and customs of the Dong people.

For example, the layout of a stilt house can be divided into three levels: farm tools, timber, adoption of poultry on the first floor; The second floor is mainly used as a residence for living and as a place for foreign exchange meeting. The third floor is used for placing food and some not commonly used idle items. The Dongs have the notion of "walking down the house without getting downstairs", so the design concept of the left and right sides with the two sides will be adopted in the corridor design of the residence.



The Pictures of Residential Diaojiaolou

2.THE SIGNIFICANCE OF THE THREE DIMENSIONAL VIRTUAL DISPLAY OF THE WOODEN CONSTRUCTION SKILLS OF DONG NATIONALITY

2.1 Restore the authentic appearance of Guangxi Dong ancient buildings, reproduce the authenticity of the building

In the Dong's ancient wooden buildings, which has been experienced the hundreds or even thousands of years wind and rain can still be preserved till now, fully shows us that the structural characteristics of these buildings are very good. However, the wooden buildings have some inevitable shortcomings, such as earthquakes, fires and weathering and so on, which resulting the damage to the building. Because of the transformation of modern life thinking, some damaged parts of the budiling, people use cement instead of wood, which makes the ancient building lost its original characteristics, and with the development of current living standard, in order to comply with the development of national urbanization that made the present young people slowly leave the shelter of wooden buildings, and leading the ancient buildings slowly entering the perennial disrepair situation. Therefore, we use the three-dimensional virtual to study the authenticity of these buildings to reproduce the wood structure, through the collection of relevant data, influence and so on to establish a three-dimensional database to preserve the original form of these artifacts, on the one hand it can achieve the Dong residential wood building construction protection; on the other hand the countries can achieve scientific and rational permanent preservation of the extinction historical relic and cultural heritage.

Figure 1 The Wooden Building Model

2.2 simulate the sence of the ancient buildings, enhance the dissemination of culture

The most restrictive factor for spreading the skill of wooden architecture in ancient buildings is the geographical environment, therefore, the static and local visual communication has always been adopted in previous communication and education, and the communication will be lack of living atmosphere, which will make people feel a bit hard and far away from themselves. However, the spread through the three-dimensional virtual technology enables people to interact, walk, watch, and so on in the virtual environment, which can bring a sense of immersion and increase the propaganda effect and force on the Dong wooden buildings, furthermore it can also use the network platform for publicity to achieve a real resource sharing, and let the wooden construction techniques, culture truly into people's lives to realize a new situation of cultural resources sharing.

3.THE THREE-DIMENSIONAL VIRTUAL DISPLAY DESIGN STRATEGY

The three-dimensional virtual exhibition design using the computer simulation technology, on the premise of obtaining sufficient and real valid data, using the three-dimensional modeling technology, combining with multimedia and other network multimedia technology to form a design.

Since Dongs have always had the traditional idea to build their own village in the mountain and living in the water side, so the people would gather around the drum tower and build their houses.

Figure 2 Dong residential and Drum Tower 3D model display design picture

The biggest advantage of 3D virtual display is that the simulation is very realistic and close to the reality, which can truly reflect the clear structural features of the Dong ancient buildings as well as the local people's living customs and cultural ideas, and also can save real and valid data for a long time. Take the Diaojiaolou for example: the structural features of the Diaojiaolou, the used wood pattern, the design features of the houses etc that can all be directly seen. For example: From the picture we can see that the Dongs is regarded the three or four floors as their living room and warehouses, so the design is following the balance of symmetry and harmony, and then use the columns, hanging and other parts to vertical and horizontal crossover, so the beauty of the structure reflects the excellence of architectural craftsmanship. Because these wooden structures do not use any nails or screws in the construction, they are all linked by a link. Therefore, in order to fully reflect this feature and the authenticity of architectural skills, we will strive for perfection the true and accurate refinement to every small detail when using 3D modeling.

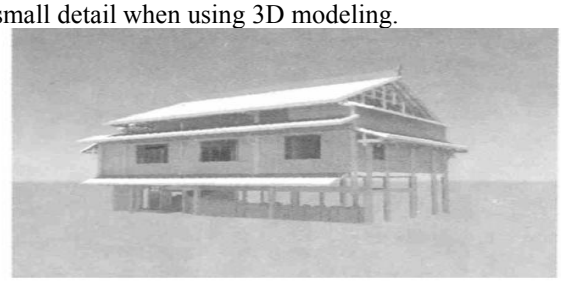


Figure 3 Dong residential and Drum Tower 3D model display design picture

Moreover, in order to better and effectively disseminate, protect and display the characteristics of the buildings, the interactive links will be added

to the virtual scenes to roam Dong folk houses by using roaming technology. As the roaming technology must ensure that the model is real and reasonable, so it needs to focus on the following steps:

First, the data and image acquisition are carried out for the real scene of the Dong wooden ancient buildings. We can obtained these by combinating the primary data and secondary data. For example: You can search for data through the Internet, collecting relevant books and literature etc, then screening to leave valuable information; secondly in the field of investigation and study, enter the real and effective complete data;

Second, design and product model. You can use Auto CAD or 3D MAX for internal and external model design, modeling and model cutting and so on. After the simulation in the environment, according to the real building for cutting, mapping and adjusting the light, etc, and finally restore it, then restore the real materials of the building to blend;

Third, roaming design. This stage is mainly the sensory experience of users and observers to achieve the specific interaction in the virtual scene;

Fourth, the final test and repair, testing and repairing links mainly through the contrast test between virtual and reality to find out the optimized integration.

Using 3D virtual technology in the production of Dong architecture, due to the needs to reflect the cultural characteristics in the display effect, so it is necessary to pay attention to the detail in the process of design and production. The more the details of these small things are designed, the easier it will be for us to discover that the new structure and has a new, comprehensive understanding of Dong's wooden construction skills. For example, the idea of building in a mountainous area and living close to the water generally brings the "Drum Tower" as the highest point of the building or the middle position, because the Drum Tower is not only an important place for Dongs to hold activities and entertainment celebrations, but also the most important signs in the Dongs, and then they in turn spread to all around, the Dongs regard the "Storm bridge" as the end of the first building. Due to the use of three-dimensional virtual technology for heritage restoration of ancient buildings, it is bound to excavate the Dong traditional stories, cultural customs and related historical events, so that the origin, experience and architectural structure of the Dong architectural arts will be greatly enlarged familiar by the most people and it is also conducive to the heritage of cultural skills.

4. CONCLUSION

It has great value and significant meaning to use the virtual technology to inherit and study the Dong architectural techniques. The use of data base collection, image acquisition, and then build the relevant model that is beneficial to long-term preservation and preview, furthermore the design and the use of virtual roaming increases the interaction between people and things, which can enhance people's understanding of ancient architectural skills, inspire people to curiosity and interest in learning the wooden construction techniques, that can conducive to the dissemination and the education of architectural skills and culture to solve the dilemma of lost construction skills.

5.Fund Project

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The Exploration and Discussion of the Content in Information Retrieval Course in Universities in the Era of Large Data

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Abstract: This age, the technical environment changes with each passing day including teaching reform of information retrieval course in higher education. The education of information literacy becomes more significant in the variation on college students' information retrieval behavior. This paper main focus on the content in information retrieval course from information retrieval ability which is the survival skill students should master in this era of large data.
Keywords: Information retrieval; Search method

1. INTRODUCTION

With the rapid development in computer and network technology, it is the key to grasp the ability to acquire information. We use large data to describe massive data which generated in information explosion era. Nowhere are beside the influences of data expansion in the word. Information retrieval skills are the basic survival abilities in large data age, for students, which also the capabilities must be got before graduation. Nowadays, every national university updates information retrieval course contents to make the courses much closer to the practical application. This paper briefly explores the content in information retrieval course from students use the library to network information acquisition.

2.THE SIGNIFICANCE OF INFORMATION RETRIEVAL COURSE CONTENTS

In the large data age, information quality will become an important criterion for measuring the quality of talents. The qualities and abilities of talents in the new century depend on the cultivation of comprehensive information literacy. Mastering the information retrieval skills is the basis of lifelong education which helps to reduce duplication of research, improve the success rate of scientific research and save time for scientific research efficiency. Information retrieval knowledge and skills have been the most momentous and indispensable part of human knowledge structure. It has significance to cultivate compound and pioneering type talents by learning information retrieval knowledge and operational skills.

3. THE MAIN CONTENT OF THE INFORMATION RETRIEVAL COURSE

3.1 INTRODUCTION TO LIBRARY BASIC KNOWLEDGE

Although every student goes to library, they have not fully grasped knowledge of the library. So it is needful to reaffirm how to use the library in the information retrieval class. The students at least should know how to check the books on the library's inquiry machine and making sure is there the book you need, and then determining the location of the book, recording books' number and the collection location. The right collection location needs every student remembers the distribution of library to avoid that you cannot quickly find physical book in the library when you find the book on the inquiry machine. How to use books' number also is the content should be mastered, because it represents the specific location of the book. For example, inquiring for student library card information, many know operating it on library borrowing station but not the library website which save time and effort. In addition to paper library resources, there are many electronic resources. The measure to get electronic resources is another skill must be mastered. There are massive tiny knowledge remain to learn in the information retrieval course. It aims to ensure that students take full advantage of the library, understand the distribution of library materials and how to use library, and improve students' reading and learning ability.

3.2 THE INTRODUCTION OF "CHINESE LIBRARY BOOK CLASSIFICATION"

Chinese book classification seems too esoteric to be understood by ordinary readers except for professionals. It is not true. Readers must master the basics of Chinese book classification which helps to find books and understand the development of a class of books. "Chinese Library Book Classification", referred to as "Zhong Tu Fa". It includes Marxism-Leninism, Mao Zedong Thought, philosophy, social sciences, natural sciences, comprehensive books, these five major categories and 22 basic categories. And under the social sciences category embarked 9 categories, Natural science category has expanded in 10 categories. Moreover, prior to the social sciences and natural sciences the "general" classes are listed. It is according to the features of books and materials, in accordance with the general system, from the general to the specific compilation principles, to form a complete system of social and natural sciences. Its

classification is one of the things that contemporary college students must master, as the basic understanding of books. It is helpful for students to locate a book effectively. The phenomenon that students cannot put back the certain place of books they take out in library will never appear. After students learning book classification, it is easy to distinguish books' number, and effective with amusing to find books in bookshelf.

3.3 RETRIEVAL AND UTILIZATION OF JOURNAL NETWORK

In the electronic resources of the library, the journal network is the resource that each library must order. Common Chinese journal net includes CNKI, VIP information, Wanfang Data, Full-text Database for copies of RUC and so on. Every student works on paper and searches for information in the journal online in the process of study or graduation. So the retrieval and utilization of journal network is one of content in the information retrieval course. Generally, we focus on retrieval and use of CNKI above these four nets. Because the retrieval method for journal network is analogous, we just choose one of them to learn at limited courses. The reason to choose CNKI is that it covers a relatively complete range, more functions than other journals, and more suitable for students researching and writing papers to find information. But these journal networks have a common character that it must be used within the campus network, because of the use copyright restrictions of database. Except these Chinese journals, library has some foreign journals, like IEEE/IEE Electronic Library，Elsevier Science which suitable for in-depth scientific research and master's degree to use.

3.4 ELECTRONIC BOOK RETRIEVAL METHOD

With the growth in mobile phones, readers and other electronic devices, E-books are becoming more and more popular and students open the phone can read their favorite books in their spare time. These e-books are limited to literature books, not natural science books (some have copyright restrictions) which cannot be found in these popular e-book sites. So, library's e-book database is necessary for students to learn, and the e-book database is of great help in doing research and professional learning. The current e-book database has done a better one such as, DSR, superstar digital library, Fangzheng Apabi digital library, scholar digital library and so on. As the representative of these electronic book databases in information retrieval course, DSR is not only an e-book with transfer function journals, newspapers and literature, but also connecting with the library electronic book database and collection catalog system which bring convenience. (Click on the "full text of the museum" can be linked to the store order superstar e-books; click the "Collection Paper" button to link to the library collection content) E-book database has become a necessity for each library. Nowadays is the era of the development of electronic books and paper books in parallel. It is necessary for students to learn to use e-books under the premise of borrowing economy.

3.5 VIDEO LEARNING SITE SEARCH

In this age, MOOC represents the prevalence of video learning. It makes those who cannot go to a famous university can also hear the teaching of a famous university teacher. For self-study person, video learning can save a lot of time in learning theory, and more time is left for practice learning. Video learning can increase learners' interests. Students can play a course of interest in leisure time. This stage that kind of online teaching is on the rise, there are numerous video learning website, MOOC, iCourse, Cloud classroom of Netease, National Library Open Course, Superstar teacher forum and so on. It allows the majority of students can stay at home to learn a lot of courses and eliminate to go outside or the resistance of the irresistible force. In order to improve students' self-learning ability, these free video learning sites are still very necessary for students. Not only for students, to the majority of citizens is also very applicable, It can achieve a lot of people's university dream. Each video learning site has its own characteristic, so the focus of the course is different. Some focus on social science, some focus on the natural sciences, other focus on the calculation of science and technology. First of all learners should understand the characteristics of each site, and then choose the part want to learn. There are so many choice, learners cannot participate in learning one by one, so choose the one suitable.

3.6 INFORMATION RETRIEVAL TECHNOLOGY

Information retrieval is a process and technology refers to the information organized in a certain way, and according to the needs of information users to find out the relevant information. Information retrieval is based on a certain search technology in order to obtain more accurate search results. Information retrieval is a shortcut to knowledge, a guide to scientific research, and the basis of lifelong education. It includes information awareness, information source, information acquisition ability and information utilization. Many information retrieval technology commonly used in information retrieval like Boolean, truncation, Position Search, fields, Weighted search, Clustering search. Boolean logic operator for the logical combination of search terms or codes is the most commonly used in modern information retrieval system. There are three commonly used Boolean operators, logic or "OR", logic and "AND", and logic no "NOT". Truncation is a very common technique used in computer retrieval systems. Due to the characteristics of the construction of the western words, in the search we often encounter the noun singular and plural forms are inconsistent; the same meaning of the word, British and American spelling is inconsistent; stemming with

different nature of the prefix and suffix can be derived from a lot of similar words. Location search is also called full-text search, proximity search. Full-text search is the use of natural language in the record to retrieve, and the logical relationship between words and words is assigned by position operator, and the relative position between the search terms is limited. This is a technical method that can be retrieved directly using free words without relying on the subject list. Fields is a search method that limits the search term to be searched within one or more fields of the database record. In the retrieval system, there are two types of fields available for database setup, the basic field that expresses the subject character of the subject matter, and the auxiliary field that expresses the external features of the document. Weighted retrieval is a quantitative search technique provided in some retrieval systems. Weighted search just like Boolean and truncation, is a basic search method of literature retrieval. But it different from them about its focus is not on determining the search terms and the relationship with other search terms or strings, or the string is present in the database or not. It focuses on determining the extent to which the search term or string does affect the hit of the document after satisfying the search logic or not. Clustering search is not classified thing; in the case of do not know how many categories should be divided, according to the different properties of things that are different from each other, putting the similar attribute information into the same class the following.

So, Mastering information retrieval technology is a very necessary skill. As an effective means of dealing with complex information, it occupies an important position in the information retrieval course can improve the retrieval efficiency.

3.7 SEARCH METHOD IN COMMON SEARCH ENGINE

Network age information is very developed, and the learning speed of the human brain has been completely unable to keep up with the speed of knowledge updates. Therefore, we should learn to give up some knowledge, but not completely give up, but when needed, and know where to find it, so-called "half of knowledge is to know where to find it". Search engines are the most effective tool for finding knowledge, but this tool is not as simple as using a physical tool. The user is required to have a certain Internet technology and high cultural level. Now mostly in the use of search engines only use the surface of box-type search, but not master the essence of search engines. Make full use of search engines can quickly and accurately retrieve the information you want and save a lot of energy. Contemporary college students are the elite reserves of the future society. It is necessary to learn to use search engines. In an increasingly competitive era, learning to control the Internet information is the homework forwards the success. Common search engine search method is the focus of the information Retrieval course. Common search engines have Baidu, google, Yahoo, Sogou, 360 search, Thunder search and search resources. For ordinary Internet users, it is merely a search engine query tool. As a tool, users should understand the search engine's function, performance, explore and master its use and skills. Chinese often use two search engines are Baidu and Google, Baidu as China's largest search engine and Google as the world's largest search engine. In Romance of the Three Kingdoms, Sun Ce told to Sun Quan when he give the throne to this brother, "Internal affairs ask for Zhang Zhao, foreign affairs ask for Zhou Yu." This is the same situation between Baidu and Google the two current major search engines. For Chinese, internal affairs ask for Baidu, foreign affairs ask for google.

4. CONCLUSION

Information retrieval and utilization courses mainly develop students' information retrieval ability. Retrieving ability in the Internet age is an important means for students to make a living in this society. The content of information retrieval and utilization course should change with the information age changes so that the effectiveness of information retrieval courses to achieve the best. I hope subsequent researchers continue to enrich the content of information retrieval courses which throughout the student's college career, and enhance the college students' information literacy comprehensively.

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The Application of "Liu Sanjie " Humanistic Symbol in Animation Products —A Case study of “Guilin Three Treasures”

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Abstract: Two-dimensional animation is a combination of a variety of artistic techniques, the use of a variety of moving image technology to create a dynamic image to express the art. Animation is a kind of art form which pursues artistic beauty, and it is also a comprehensive art. Excellent animation works to give the audience the aesthetic feeling of art, so as to get their recognition and appreciation. "Liu Sanjie" is the singer known to every family in Guangxi Zhuang Autonomous Region. She is industrious, brave and her songs are amazing. There is a large number of folk tales related to her in Guangxi. It has become a special art representing the Zhuang culture in Guangxi. Guilin Three Treasures refers to Guilin Sanhua Jiu , Guilin chilli sauce and Guilin pickled tofu. Guilin Sanhua Jiu tastes mellow, both Chinese and foreign visitors love it very much. And it is made of a special craft and has a long history. Guilin pickled tofu is quite famous. It's the representative of White Sufu. Guilin chilli sauce is famous for it's unique aroma and spicy, it is made of traditional mountain pepper. This paper focus on how to combine "Liu Sanjie" humanistic symbol with "Guilin Three Treasures" for creative animation.
Keywords：Liu Sanjie; Guilin Three Treasures; Animation Production; Design

1.THE PROBLEMS OF "GUILIN THREE TREASURES" TOURIST SOUVENIR MARKET

Animation is a kind of imaging technology that uses various dynamic images to represent artistic content. Because it brings together a variety of artistic elements, and two-dimensional animation is one of the most basic forms of animation expression. Through the character to shape the soul and construct its characteristics is the core of this performance. Liu Sanjie is a famous "Song Fairy" in Guangxi Zhuang Autonomous Region, and also a well-known brand. Animation industry is one of the fastest growing cultural industries in the 2l century, with great potential. And "Liu Sanjie" humanistic symbol communication also needs a certain carrier, the combination of the two has great advantages. It can carry more content than traditional media. Animation has the characteristics of "permanence", "regeneration" and "virtual reality". The information of "Liu Sanjie" humanistic symbol is more easily recognized and accepted by people, which is very beneficial to its inheritance and dissemination. "Guilin Three Treasures" is a special souvenir in Guilin. The three treasures are Guilin Sanhua Jiu , Guilin chilli sauce and Guilin pickled tofu. At present, there is no animation tourism souvenir that integrates "Liu Sanjie" brand and "Guilin Three Treasures" on the market. Because "Liu Sanjie" humanistic symbol does not have the physical form. It has some difficulties in professional identification and effective protection. And animation is different, because of its media characteristics play a very important role in the "Liu Sanjie" humanistic symbol. In the application of creative animation products, we should take "Guilin Three Treasures" image design as an example to give innovation and inheritance. Art itself is to improve the world, so that people have a better understanding of the world. This easy-to-understand representation of animation art is a good reflection of the vivid and interesting realities in society.

At present, there are very few tourist souvenirs related to the culture of Liu Sanjie in Guilin. Some of the tourist souvenirs associated with “Liu Sanjie” are made of rough workmanship. And these souvenirs are larger than the general native products, it is not easy for tourists to carry. The local specialty comes from the designer's humanistic characteristics, historical significance and commemorative events, and lacks the high level of design and creativity. Liu Sanjie's travel souvenirs can not keep up with the development of China's tourism industry. Tourism souvenir is the most effective way to retain personal travel experience, and they can share experience with others through souvenirs. The tangible travel souvenirs can keep the wonderful experience of

tourism in the form of entity for a long time. That is, the image of "Liu Sanjie" has not been well inherited. Sun Moon Lake in Taiwan is very famous in the world. I visited it some time ago, I found the scenery is very ordinary, just a small lake. I think the scenery in Guilin is more beautiful than its. However, the Sun Moon Lake travel souvenirs are very exquisite, especially the wooden music box of various scenic spots. They not only look good, but also can be used as table lamps and alarm clocks, and the price is not cheap. Such souvenirs have high ornamental values, just as tourists can take Sun Moon Lake home.

“The mountains and waters of Guilin are the fine st under heaven”. It not only has the unique tourism resources, but also has a long history and culture and unique Zhuang customs. This is a source of inspiration for the development of tourist souvenirs and gave birth to various tourist souvenirs in Guilin. A variety of tourist souvenirs are placed in various stores and scenic spots. There are more than 1500 kinds of food and beverage, mainly "Guilin Three Treasures", juice, cans and cakes. "Guilin Three Treasures" are favored by tourists, once become Guilin tourism must-have the souvenirs.

"Guilin Three Treasures" almost appear in every selling point, its sales showed a rising trend year by year, but the growth rate is extremely slow, far behind the total sales of tourism souvenirs in Hangzhou, Yunnan, Qingdao and other provinces and cities. The tourism economy of Guilin shows the trend of growth.

2.THE FEATURES OF "GUILIN THREE TREASURES"

Guilin Sanhua Jiu has a long history of brewing, it help people to strength the spleen and stomach, digest food and promote blood circulation. You know why it's called "Sanhua Jiu" when you shake the bottle. Because there's a clear, translucent hop on the wine. This is the feature of Guilin Sanhua Jiu.

The process of making Guilin pickled tofu is complete and rigorous. It is finished by grinding, filtering, molding, pressing, and mildew. The selection of tofu is also very elegant, it needs fresh soybean and sweet well water. The tofu need to make into small pieces, smooth and soft. And it is very nourishing.

Guilin chilli sauce is famous for its oil-spicy and mellow taste. It can not only be used to flavor, but also for seasoning. The varieties of chili sauce include lobster sauce and garlic sauce. Now, there is a new chilli sauce with Lijiang Shrimp.

The development of "Guilin Three Treasures" Tourism souvenir market is still in the basic stage. From the aspect of design planning, it lacks efficient means of packaging and selling. From its production, a large number of tourist souvenirs have not formed a competitive production base, and there is no strict regulation on the quality standards and production techniques of the production. It is understood that most of the manufacturers producing “Guilin Three Treasures” are small workshops, and they did not form large-scale operations. At the same time, the sales market is also lack of unified management, the price is very confusing, from a few dollars to hundreds of dollars. As a combination of tourism products in Guilin, "Guilin Three Treasures" did not do a good job of publicity, so "Guilin Three Treasures" has become a product of unclear concept. For example, some tourists do not know what the “Guilin Three Treasures” is, and some people think that” Guilin Three Treasures” is the same thing.

So how to apply the animation in the transmission and dissemination? How to develop and utilize the cultural resources of “ Liu Sanjie" so as to realize a win-win benefit between cultural innovation and economic development, and contribute to the regional culture? These questions will be discussed and studied in this paper.

The theme is based on Liu Sanjie's humanistic symbol, combining with the design elements of "Guilin Three Treasures", introducing animated cartoon image publicity, to design a series of cartoon characters that can represent the “Guilin Three Treasures”. The cartoon image of "Guilin Three Treasures" will be used as a medium to publicize the characteristic diet and culture, so that "Liu Sanjie" human symbols better integrated into the local community, into the public, into life and promote competitive products.

The research significance of the topic lies in the combination of "Liu Sanjie" humanistic symbol and the specialties of Guilin and promotes the creation of animation and animation industry. This not only provides a theoretical basis and practical support for the construction of "Liu Sanjie" as a national cultural brand, but also sets a benchmark for the image of Guangxi. It also expands the academic vision and application of aesthetic anthropology research, Zhuang studies and GUI studies. And to promote the inheritance, protection and development of Guangxi national culture, further enhance the international

competitiveness. It also can improve the level of cultural soft power, promote the development of cultural industry in our region, as well as the exchange and integration of foreign cultures.

1. We should investigate the Zhuang people's "Liu Sanjie" cultural allusions and their regional cultural characteristics in Guangxi. Based on the longitudinal historical and cultural inheritance, the horizontal culture acculturation and the current investigation of the cultural ecology in the nation, this paper analyzes and studies the Sanjie and its cultural ecology synthetically, comprehensively and systematically.

2. The mascot image design of "Guilin Three Treasures" tourist souvenirs series, fully integrated into the "Liu Sanjie" humanistic symbol, and combined with creative animation products. And strive to study and design a series young and energetic cartoon image that can represent "Guilin Three Treasures". Explore the "Liu Sanjie" culture and brand characteristics to achieve national cultural inheritance and animation image combination. Using the cartoon image of "Guilin Three Treasures" to do the special diet and cultural propaganda, to make the traditional Zhuang culture better integrate into the contemporary, public and life.

3. Animation as a "media", the traditional culture combined with modern technology, to make the "Liu Sanjie" human symbol of traditional elements into a new category of art to recreation. For example, the "Guilin Three Treasures" cartoon design and Guangxi national culture, Liu Sanjie culture, landscape culture fusion innovation made into cartoon movies, or animated TV drama. Let these precious cultural treasures not only be perpetuated and diversified, but also arouse young people's new understanding of the inheritance and dissemination of intangible cultural heritage.

4. We should design a series of creative products of "Guilin Three Treasures", explore how to enhance the brand effect and promote Guangxi national boutique. The inheritance of Liu Sanjie culture and its future development still need innovation. On the basis of affirming the thought of "people-oriented" in the Liu Sanjie culture, as well as learn from the essence of people-orie nted belief in modern society. To enrich the connotation of Liu Sanjie brand, and create a "new Liu Sanjie culture" that adapts to the economic globalization and the development of market economy. To achieve market share of products, so as to enhance the international competitiveness. This paper introduces the dissemination form of animation propaganda to study how traditional culture is combined with economic industry.

3. CONCLUSION

These ways contribute to the publicity of "Liu Sanjie" brand and create brand effect. At the same time, let the "Guilin Three Treasures" cartoon image deeply rooted in the hearts of the people, so as to promote the "Guilin Three Treasures" tourism image animation products sales. Moreover, to form a certain scale, and then achieve a certain brand of economic benefits, so the world know more about Guangxi, understand the folk culture of the Guangxi Zhuang Autonomous Region.

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An Aesthetic Exploration in Environmental Art Design Based on the Aesthetics Theory

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Abstract: Environment is an important part of urban construction. In the process of urban construction, good environmental design can not only beautify the environment, improve the quality of the environment, but also improve the environment design through artistic means, lighten the people's life pressure, so that people maintain the state of physical and mental pleasure, so as to enhance people's quality of life. As a new discipline, environmental art design courses include both natural science, architecture and engineering, as well as philosophy, aesthetics and humanities. In the teaching of environmental art design, teachers should pay attention to the important position of aesthetics. To give full play to the application value of art design aesthetics theory in environmental design discipline. This paper mainly expounds the application value of aesthetic theory in the teaching of environmental art design, and analyzes the specific application strategy of aesthetic theory.

Key words： Artistic Design; Aesthetic Theory; Environmental Art Design; Aesthetic Application

1. INTRODUCTION

Aesthetics of art design is the unification of aesthetics and design, and it is the result of human's constant pursuit of design beauty. At the present stage, design aesthetics is applied to various design industries as a theory, which evaluates and appreciates the quality of the design in terms of aesthetics. As a new discipline, environmental art design has many unfavorable factors in the teaching process, which influences the teaching effect of environmental art design, and restrains the students ' good learning and mastering the real meaning of environmental art design. Teachers are actively engaged in education and teaching reform, hoping to improve the quality of environmental art design teaching and improve student learning effectiveness. In recent years, the development of education industry, the aesthetic theory of art design has been applied to the teaching process of environmental art design, which greatly improves the teaching effect. How is art design aesthetic theory applied in environmental art design? This paper discusses this issue, hoping to help teachers and educators who are engaged in the teaching of environmental art design, and improve the application of aesthetic theory of art design in environmental art design.

2.THE IMPORTANCE OF APPLYING AESTHETICS THEORY IN ENVIRONMENTAL ART DESIGN

The application of aesthetic thought in environmental art design has a significant effect. The aesthetic thought not only runs through the whole process of the environmental art design, but also contains in every stage of the design. To ensure the success of environmental art design, The design should not only meet the aesthetic needs of people, provide comfortable and healthy atmosphere for the environment, but also adapt to the ecological system, so that the environment serves people, and does not affect the survival and development of other organisms. So as to create a harmonious and sustainable development of a good art environment. The application of aesthetic theory in environmental art design not only refers to the artistic design of external natural environment, but also includes the interior design of people's living. Most of the external environment design depends on the original natural environment for artistic treatment, to increase the artistic and aesthetic environment, so that the natural environment more in line with people's aesthetic needs. Interior design includes interior, decoration, lighting, etc. For example, the office is designed to be a quiet, relaxed atmosphere while the bedrooms are designed to be warm and inviting. In short, whether it is outdoor design or interior design, both through aesthetic theory and environmental art design to help people to enjoy themselves and their life. Therefore, the rational application of aesthetic theory in environmental art design is one of the important criteria for evaluating the design effect. In the teaching of environmental art design, teachers should adopt reasonable teaching methods to increase the application of aesthetic thought in the teaching, and improve the quality of teaching. In the process of environmental design with aesthetic theory, various factors related to aesthetics should be taken into full consideration. Such as

modeling, color and decoration. In actual environmental art design, it is necessary to design the environmental space accord with people's aesthetic according to the relationship among various elements, reasonable combination and arrangement. In the process of environmental art design, we should pay attention to aesthetics which emphasizes various artistic features and seizes the aesthetic theory related to environmental art design, to provide prerequisites for the promotion of environmental art design.

2. THE AESTHETIC STRATEGY OF RATIONAL APPLICATION OF AESTHETIC THEORY IN ENVIRONMENTAL ART DESIGN

2.1 applying the beauty of design and function in aesthetic theory for environmental art design.

The beauty of style and function are the core of aesthetic theory in environmental art design, they are the fundamental aesthetic theory of improving environmental art design. In the design of environmental art, only by ensuring the beauty of style and function, can we give full play to the value of aesthetic thought in environmental art design. Style beauty is the external expression of environmental design. It is mainly the external aesthetic of environmental art design after the design is completed, such as the beauty of color decoration and styling. In order to satisfy the external visual perception. While functional beauty is the intrinsic function of environmental art design, it is necessary to ensure its value in designing and meet the needs of people's life and work. This kind of value can be either physiological or psychological.

Style beauty and function beauty are mutual promotion and complementary. We can not just highlight the style beauty but ignore the function beauty in the design process, and vice versa. However, the actual design often pay attention to one kind of beauty which affect the quality of environmental art design. Especially for beginners, most of them in environmental art design only consider the beauty of style. They spend so time and energy on the design of the external image that they can not find their own problems after completion. Therefore, teachers should understand the relationship between style beauty and function beauty in teaching design, guide students to understand the intrinsic meaning of the two kinds of beauty and ensure that students know the relationship between style beauty and function beauty. Applying aesthetics theory to environmental art design to ensure that the environmental art design is not only in line with the aesthetic perception of people's visual experience, but also conform to their inner psychological aesthetic.

2.2 using the beauty of art and technology in aesthetic theory to design environmental art

The beauty of art and technology and the beauty of style and function have equal value in environmental art design. But just based on different angles of aesthetic. The beauty of style and art tend to perceptual aesthetics, which is based on the experience of people's daily life. But functional beauty and technical beauty tend to be more aesthetic in theory, which is the aesthetic standard of environmental art design from a professional point of view. Artistic beauty is the premise of technical beauty, and it is the artistic effect produced by the designer through mediating the factors of environmental design. Through continuous study of environmental art design, the designer transforms the style beauty into artistic beauty and improves the quality of environmental art design. Technical beauty refers to the continuous development of design techniques and skills. Designers have a new understanding of the technology of environmental art design, in order to enhance the artistic beauty of environmental art design, they take various means to strengthen artistic effect of art beauty. In recent years, with the development of technical beauty, a unique design faction has been formed, especially in the architectural industry. It has been widely recognized and gradually developed into a popular high-tech in modern society.

2.3 using the beauty of characteristic and wholeness in aesthetic theory to design environmental art

The beauty of characteristic and wholeness are also important parts of environmental art. In the process of environmental art design, we should pay attention to the characteristic beauty and the wholeness of the work. We can not ignore the importance of the wholeness in order to highlight the beauty of characteristic. Otherwise it will affect the application of the aesthetic theory in environmental art design.

Characteristic beauty is the main part of environmental art design. The designer attracts people's attention through the works with unique charm and enhances their market competitiveness. For example, in the process of urban construction, most cities have unique cultural and political features. Therefore, the design should highlight the various characteristics of the city, style, and realize the fundamental purpose of environmental art design.

The wholeness is the fundamental to ensure the effect of environmental art design. Only by ensuring the integrity of the design process can the wholeness of art design be realized. Each environmental art design is a whole, the wholeness is greater than the individual beauty. Designers should pay attention to the importance of the overall beauty in environmental art design. From the perspective of overall design, designers should fully demonstrate the value of aesthetic theory in environmental art design.

3. CONCLUSION

The reasonable application of aesthetics theory in environmental art design is a great significance to the development of environmental art design. Teachers should help students understand the application characteristics of aesthetic theory in environmental art design, master the relationship between artistic beauty and artistry, structural beauty and function beauty, characteristic beauty and wholeness in the process of design. To further improve the aesthetic value of environmental art design by using the interaction between various factors. Ensure environmental art design accords with people's aesthetic needs and improve the education of environmental art design.

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Feasibility Plan for Solving the Waterlogging Problems in Cities - Taking Shijiazhuang as an Example

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Abstract: We will push forward the pilot project of sponge city in Shijiazhuang City to comprehensively manage the rainwater through ecological technologies such as seepage, stagnation, net, storage, use and drainage, and systematically solve the wading problem in urban development and make full use of such aspects as building, road and green space Rainwater absorption, storage infiltration and slow release so as to alleviate the current city waterlogging, drought after the flood problem, to solve the urban stormwater management problems, water shortages, water pollution has advanced and effective significance, thus improving the living environment, To mitigate natural disasters and increase the utilization rate of water resources is ideological advanced, sustainable and effective, which is conducive to the promotion of the transformation of the traditional concept of urbanization and the modernization of urban agglomerations on the basis of ensuring the safety of urban aquatic ecology. Continuous development.
Keywords: Surface water;Sponge city;Waterlogging problem;Sunken green space

1. FOREWORD

At present, China has gradually carried out sponge city planning and construction of exploration, Qian'an City, as the first batch of sponge city construction pilot cities have been implemented in buildings and residential areas, green space and square, road and pipe network, water supply and sewage treatment, capacity Construction and other 189 categories sponge five major projects, the basic formation of a "sponge" ecosystem, can work together to effect. In addition, our country draws lessons from foreign sponge city construction, starting from the source of Britain, and serves dual purposes; the different forms of France to promote the cycle; South Korea's improvement of permeability, reshaping the water environment and other sponge city construction case to perfect our construction plan[1].

However, how to construct and plan a sponge city must be designed according to the specific conditions of the specific city and is a completely new area[2]. As the second batch of sponge-making pilot cities, Shijiazhuang City commenced implementation in 2015 and sponge-building projects have been started in Hutuo River and North Outer Ring Road and achieved certain results. In the certain sense, the construction of "sponge city" is perfected in the environmental development zone and the design and implementation of the task are relatively easy. However, the construction density of the Second Ring Road is relatively high and the urban development is earlier, The original design of underground drainage pipelines can no longer match the development level of Shijiazhuang nowadays and the renovation project is huge and the difficulty degree of implementation is large. Therefore, the construction of "sponge city" in the second ring of Shijiazhuang City is a comprehensive and urgent solution The project[3].

Shijiazhuang is in a period of rapid urbanization. Urbanization has achieved remarkable results. In addition to the rapid economic development, there is also a one-sided phenomenon of high development intensity but insufficient protection of the ecological environment And other issues, which in turn led to over-hardening underlying surface, changing the city's original natural ecosystems and sponge base, and the design standards for underground drainage network is low, less urban drainage outlets, drainage limits and congestion problems, the ecological environment has become economic development , The development and construction of the city undermined the natural "sponge body" and led to high-rise buildings, roads, plazas and roadways that squeezed the green space and wetlands. In the case of heavy rainfall, the dried up cities not only can not "satiate" but form huge Of the surface runoff, resulting in waterlogging, that is, "Every rain will flood, more rain after the rain", but also brought a series of water problems such as water pollution (black and smelly water), water scarcity, lack of security and other water security[4].

2. SHIJIAZHUANG "SPONGE CITY" OVERVIEW

Sponge city, as the name suggests is the city can be like a sponge, on the one hand when it rains, water, water seepage, water purification, on the other hand sponge with compression, rebound characteristics used in urban construction, if necessary, will be stored Water is "released" and utilized, and cities are well adapted to environmental changes and responses to natural disasters[5]. Traditional urban construction under the surface of the stormwater management model is the use of pipelines, pumping stations and

other facilities, "fast discharge" of runoff, due to urban understory hardening, ground penetration and rainwater absorption capacity is insufficient, surface runoff increased, short time Within the body to absorb water and drainage facilities can not cope, so it caused the city waterlogging[6]. At the same time a large number of pollutants with the surface runoff into the water, the water environment is also polluted. Moreover, a large amount of rainwater is drained directly and wasting a lot of water resources. The sponge city controls the rainwater from the source and reduces the surface runoff generation and discharge by building engineering systems of "seepage, stagnation, storage, net use and drainage" so as to avoid destroying the original natural hydrological environment characteristics and building the city into a natural reserve , Natural penetration, natural purification of the "sponge."

Shijiazhuang City, Haihe River Ziya River system. Plain from the north and south of the main river Shahe, Zi River, Hutuo River, Jiaohe, Huai River from west to southeast through the area. Among them, Hutuo River originates from Fanzhi County, Shanxi Province, with a total area of 3,089 km^2, which is as long as 540 km. Most of the remaining rivers originate in the foothills of the Taihang Mountains. Most of the river has been cut off since the 1980s or has water only in flood season. Well Jingtao River basin mainly Gan Amoy, Mianhe two rivers and Hengnan convergence called Yehe In addition there Jinliang small river and other domestic rivers. Shijiazhuang currently has 4 large reservoirs with a total storage capacity of 1.31 billion m^3, 8 medium-sized reservoirs with a total storage capacity of 314 million m^3, and 35 small-sized reservoirs with a total capacity of 0.916 billion m^3. In addition to the rainy seasons, most of the river courses are in a dry state. The surface water in urban areas mainly consists of landscape works such as Minxin River and two sewage drains in the east and west open channels. There is no surface water in any other areas. The surface water reserves are far from adequate Meet the needs of industrial and agricultural production[8].

3.RESEARCH AND ANALYSIS OF SUNKEN GREEN SPACE

3.1 Concave green origin

Sunken green space, also known as concave green space, that is, in the planning of urban green space, make the construction of green space height lower than the surrounding ground level, so that in the rainy season, rainwater can be hardened along the road into the green, absorb a certain amount of rain , Make full use of rainwater, improve soil moisture, at the same time to a certain extent, greatly reduce the surface runoff, reduce the burden on the urban drainage system and reduce the frequency of waterlogging. As a saving and transporting surface water, the concave green space can regulate the effects of runoff[9].detention and runoff pollutants, and can be installed on the roadside to replace the traditional drainage network[7]. As a typical low impact development (LID) measure, sunken green space has the advantage of easy understanding and operability. Therefore, the construction of sponge city in Shijiazhuang adopts the construction concept of concave green space to control urban waterlogging.

3.2 Concave green space calculation

Rainwater infiltration of the principle of water balance is the basic principle of sunken green space design, which is described as follows:

$$Q = S + U$$

Among them, the parameters involved in each part are shown in Table 2.2-1:

Table 2.2-1 Sunken green space design parameters

Symbol	Meaning	Unit
Q	A certain period of time submerged infiltration of green space, that is, design control capacity	m^3
S	Submerged green infiltration of rainwater	m^3
U	Submerged green water storage capacity	m^3
&	Integrated runoff coefficient	Reference to national regulations
h	Design rainfall	mm
Fn	Service catchment area	m^2
Fg	Sunken green space	m^2
k	Soil stabilizes infiltration rate	m/s
J	Hydraulic gradient	Vertical infiltration when the 1
T	Hydraulic gradient	60min
H	Under infiltration of green height	mm

Rain design control volume Q, the following relationship:

$$Q = 0.001h (\& Fn + Fg)$$

Sinking of green water infiltration, there is the following relationship:

$$S = 60 kJFgT$$

Submerged green water storage, the existence of the following relationship:

$$U = 0.001HFg$$

The runoff coefficient values for various types of

land use are as follows:

Table 2.2-2 Correspondence of surface type and runoff coefficient

Roofing, Floor Types Runoff Coefficient &	Runoff Coefficient &
Concrete and asphalt pavement	0.90
Stone pavement	0.60
Graded gravel pavement	0.45
Dry brick and gravel pavement	0.40
Unpaved pavement	0.30
Park Greenland	0.15

Integrated runoff coefficient:

$$\& = \Sigma A_i \& _i / A$$

A_i--Area of various types of land within catchment area (hm^2)

$\&_i$--Corresponds to all types of land area runoff coefficient value (hm^2)

The above is related to sunken greenfield calculation formula, the formula used to calculate the design of Shijiazhuang City, according to the design of concave green undercut green space when the depth of concave, with this depth as the Shijiazhuang sponge construction-concave green Design volume[10]. Calculated as follows:

According to the designed rainfall h calculated above, take h is 20.3mm-28.9mm, annual runoff total control rate of 75% -85%, service catchment area Fn is $1.07 * 10^6 m^2$. It is known that the inner area of the second ring in Shijiazhuang is 105.69 km^2, of which the green area Fg is $1.0774 * 10^6$ m^2, the water area is 1.074604 km^2, the hardening rate has reached 97.3%, and the steady infiltration rate k of the soil is $7.83 * 10^{-6}$ m / s, hydraulic gradient J is 1, the storage and infiltration calculation time T is 60min. From the calculation we can see:

Average runoff coefficient &:

$$\& = \Sigma A_i \& _i / A = 0.98$$

When the design rainfall is 20.3mm, rain design control volume Q:

$$Q = 0.001h (\& Fn + Fg) = 43305.1056 m^3$$

Sinking green rain infiltration S:

$$S = 60 kJFgT = 506.16252 m^3$$

Submerged green water storage U:

$$U = Q-S = 42798.85308 m^3$$

Sinking green design sinking depth H:

$$U = 0.001HFg$$

Got it

$$H = 39.72mm$$

When the design rainfall is 28.9mm, rainwater design control volume Q:

$$Q = 0.001h (\& Fn + Fg) = 61650.9828 m^3$$

Sinking green rain infiltration S:

$$S = 60 kJFgT = 506.16252 m^3$$

Submerged green water storage U:

$$U = Q-S = 61144.82028 m^3$$

Sinking green design sinking depth H:

$$U = 0.001HFg$$

Got it

$$H = 56.75mm$$

3.3 Summary

Calculated from the above data shows that, Shijiazhuang City Second Ring subsidence green subsidence height between 39.72mm-56.75mm. Sunken green space is a typical Low Impact Development (LID) mode that can be used to retain storm water while still providing some landscape effect. Design, should pay attention to the actual situation of green space in Shijiazhuang Park or greening area, do not have to build into sunken green space, some raised green space can better expand the contact area of rainwater, increase the stagnant water time, but also play a very Good landscape effect[11].

4.WATERLOGGING PREVENTION AND CONTROL CONCLUSION

Urban waterlogging refers to the drainage due to heavy rainfall or continuous rainfall that causes it to discharge more than the drainage capacity of the urban drainage system, that is, the precipitation can not be drained out of the city through the drainage pipe in time, resulting in the backlog of precipitation from the drainage gutter to the road surface and the residential area. The formation of the local area of water disaster phenomenon. Objective causes of waterlogging include rainfall intensity, concentration range and so on. Of course, Shijiazhuang drainage system is imperfect, drainage system damage, increased displacement and so on are one of the causes of waterlogging. In fact, rainfall is a universal natural law. Waterlogging in urban areas is only a bit of a wrong water resource. Compared with the shortage of water resources in Shijiazhuang, a huge contrast effect is formed. Therefore, solving urban waterlogging is an extremely outstanding means to ease water problems.

The overall plan for the construction of sponge city within the second ring of Shijiazhuang City has formulated corresponding planning plans from the macroscopic and microcosmic levels. The macroscopic aspects are divided into three different functional systems on the regional division to construct a spatial pattern of sponges. At the microscopic level, Runoff total control rate and design rainfall analysis methods, planning specific construction measures. Based on the macroscopic and microcosmic analysis and thinking, based on the characteristics of different land use such as parks, construction-intensive areas, schools and government,

combined with the concept of sponge construction, concrete measures for prevention and control of waterlogging are put forward, which are the measures for urban construction and waterlogging control in Shijiazhuang Proposed a possible solution.

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IoT Survey: Research on Architectural Design of IoT-based Home Security System

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Abstract: The home security services based on the Internet of things (IoTs) technology has broad prospects for development. In this paper, on the basis of the unified planning of the family security service, a home security service framework is proposed. The home security business scheme carries on the services with the security controller, supports the expansion connection, all kinds of security terminals, and realizes data centralization and remote transmission by the home gateway, so as to provide security management, alarm and reminder services for users. Home security business platform mainly includes business management, terminal management, configuration management, network management, system self-management, business statistics and analysis, business logic control, interface adapter, and management / configuration portal for users.
Keywords: home security; IoT; home gateway; SMS

1. INTRODUCTION

With the development of broadband services, simple access to the Internet cannot meet the increasing demand for information. As the main representative of family life business, home security is an important means to fill the gap in this demand. At the same time, on the basis of the satisfaction of the material life, the demand for the sense of security is increasing.

At present, there are many research achievements in the design and implementation of home security [1], such as a PZT based home safety monitoring system [2], and a GSM (Global System for Mobile Communication) based home security scheme [3] was proposed, respectively. A home security system for the elderly is proposed in [4]. A DIY ("Do It Yourself) security protection against invasion was proposed in [5]. There are some research on optimization for home security system, such as increasing the methods and steps of face recognition in the home security system [6]; security mechanism of family security system with multi-level authentication [7]; in order to strengthen the home management efficiency based on the method of logic sensing [8]; optimization of home security system efficiency and robustness [9], and etc..

This paper is based on the unified planning of home security services, and puts forward a home security service system based on the Internet of things (IoTs) technology. Based on the design framework, a home security business platform is designed to provide users with remote sensing and transmission of images, sounds and alarm signals, so as to achieve unified management of all kinds of sensing devices. Moreover, we provide different levels of solutions for users of different needs to meet the urgent needs of consumers for home security products and achieve the growth of new home business security.

2. HOME SECURITY SERVICE ARCHITECTURE

Home security is a new IoT-based information scheme combined with broadband access technology and sensing technology. The whole home security service and management system architecture is illustrated by the following three parts: the peripheral sensing device, the security host (including the home gateway) and the security management platform.

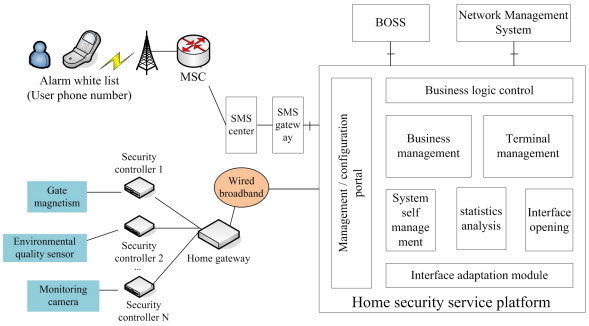

Figure 1 Home security system architecture

The door, smoke, gas, air detection, camera and other equipment through wired / wireless access security controller, security controller to LAN/USB/WiFi connected to the home gateway, the home gateway communicates with the service platform. When the security external plug-in is connected to the home gateway in the USB way, the external plug-in is only responsible for the communication function, and the home gateway will undertake a part of the security service function.

User can arm / disarm operation via PC/ mobile phone client login platform, view real-time video, at the same time when the alarm condition is triggered, the business platform can be set by mobile phone short / MMS to send alarm information to.

The home security platform does not realize the functions of video storage, transcoding, distribution, etc. these functions are undertaken by the video surveillance capability platform (such as Ali video cloud platform), and the security business platform is only the related functions provided by the call

capability platform.

3. HOME SECURITY SERVICE PLATFORM

The home security service platform is the core system equipment that provides the logic of the home security business and the business management. All family related security business (including video surveillance) order management is completed by the security business platform, and realizes unified authentication, unified authentication, unified access and unified management of user identity.

The home security service platform software consists of functional modules, such as portal, business management, terminal management, system management and interface adaptation, as shown in Figure 2.

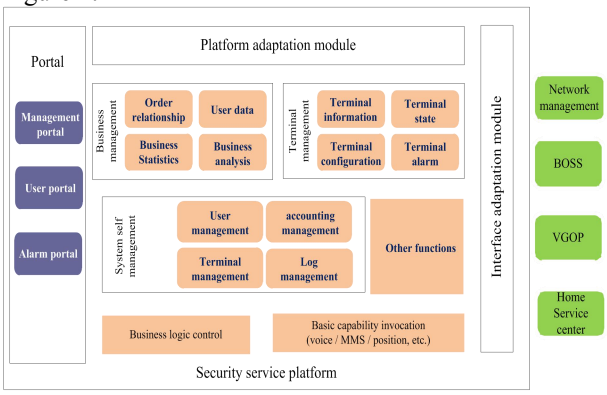

Figure 2 Function module diagram of security service platform

3.1 Portal system

The portal system of the home security service platform is divided into three types, namely, the management portal, the user portal and the alarm portal. The management portal is provided to the system administrator (the service buyer related), including all the functions provided by the platform. User portal is a portal for end-user self-service. Users can use this portal to configure security and control and manage front-end devices. The alarm portal is provided to third party police units, which can find the police situation, deal with the police situation and record the processing results through the portal.

3.2 business management

3.2.1 Order relationship management

The business platform obtains the business order relationship from the BOSS (Business & Operation Support System), mainly including the terminal sequence number, service ID, and SPID (Service Providers Profile Identifiers) used by the security controller for the ordering business.

(1)Business admissibility

If this function is realized by the way of docking BOSS, the business platform only needs to complete the butt work; otherwise, it will be realized by the home security service platform. Business platform to provide account, stop, transfer, change the number of reversibility and a series of complete business functions, and generate the corresponding type of business work orders, a detailed record of the single circulation logs, such as single initialization, single audit, single installation, receipt and completion.

The business platform provides all kinds of device types, manufacturers and price information, and dynamically loads them into the business acceptance module according to the settings of these parameters, so as to realize the flexible customization and acceptance function of manufacturer equipment type and equipment price.

(2)Work order management

If this function is implemented by BOSS, the business platform only needs to complete the butt work; if BOSS does not implement it, it is implemented by the business platform. Business management functions, the user can accept business process detailed records, according to the business operators operating characteristics, automatic formation of work order management workflow, automatic business work order flow to specific responsible departments and personnel, such as opening process may involve the equipment installation, the operating personnel entry after the data, the system automatically generates a business ticket, transfer to the audit department audit, through the audit, automatic transfer to the installation department (can be the third party installation company), the installation department can be installed or printed, on-site installation after the completion of work order receipt, report completion, finally the system automatically after acceptance of business the user account processing, success.

In the above process, the system automatically generates four working orders: account opening, account opening audit, work order, installation and completion list. Administrators can check the status of work orders at any time, and check the information of each link at any time.

In addition, the business platform includes: management, account transfer, shutdown, recovery, replacement, removal, installation of accessories such as work order, in the business of formal operation, but also to the management function added at any time according to the requirements of operators.

3.2.2 User account management

Users can log on to the user's self-service portal provided by the Web portal, and carry out the operation of alarm information query, user information query and modification. Each user is registered as a legitimate user, the system will automatically be registered as a mobile phone user registration login (service platform with the user to set the landing Web Portal from the BOSS system of mobile phone number, and user related information, such as identity information and address information etc..), the first login password is also registered mobile phone number, convenient for users to log in, login users can modify their own password.

3.2.3 Business statistics and business analysis management

The business platform provides statistics for the following information by analyzing and managing all kinds of information, such as the opening and use of the business.

- Business according to a variety of time granularity statistics, including: daily tables, weekly reports, monthly reports and many other time granularity statistics;
- The statistics of the volume of business according to the region;
- The analysis and statistics of the business development trend;
- The function of user activity statistics;
- Terminal set in use statistics;

3.3 Terminal management

Through this function module, we manage the security host (home gateway) and peripheral sensors, and combine all kinds of devices freely into business sales suite, so as to facilitate the salesmen to enter the norm. The administrator can log on to the business platform, add, delete and modify the information of security host and sensor, including device name, device type, device manufacturer, equipment quantity, equipment price and relative remarks information.

Business and management platform to save the host security serial number, manufacturer number, host types, parts information, sensor serial number, sensor type, host security switch state, disarm state, sensor state, home gateway information, network information, Family Customs set USB (Universal Serial Bus) security information platform and other external plug-ins required the physical information terminal.

3.4 Business logic control

It provides alarm logic, terminal configuration logic, data synchronization logic and other main business logic, and the corresponding alarm module, terminal configuration module interface, to achieve alarm, terminal configuration and other functions. The home security service platform needs to have the function of checking the alarm white list.

3.5 Interface adaptation

The platform needs to provide interface modules with BOSS system, family business center, network management system, VGOP (Value-added Service General Operation Platform) system and video monitoring system, so as to realize all kinds of functions of billing, network management, monitoring and so on.

The video surveillance capabilities provided by the home security service platform are provided by the third party video cloud platform (such as the Ali video cloud).

3.6 Basic capability invocation

The home security service platform can be called and integrated, including but not limited to SMS (Short Message Service), MMS (Multimedia Messaging Service), location, maps, voice and so on.

3.7 System self-management

It mainly includes the functions of user management, equipment management, alarm setting and alarm processing.

4.HOME SECURITY SERVICE CLASSIFICATION

Under the support of home security business system, we integrate the Internet of things and communication technology, use various kinds of sensor terminals to monitor and protect houses and vehicles, so as to provide users with comprehensive information services for security.

Target users mainly include family users (including families and small shops, street shops, and other families with family attributes).

On this basis, a series of home oriented security business is launched, which includes five kinds of businesses, including security alarm, video surveillance, air detection, tracking and anti-theft, and third party applications.

Table 1 Service classification of home security system

No.	Typical service	service content
1	Security alarm	Information is obtained through the sensing equipment, such as the magnetic and smoke sense of doors and windows, and provides a stable and reliable security alarm function.
2	Video surveillance	Based on video cloud platform and intelligent video analysis platform, video monitoring and intelligent alarm service can be provided.
3	Indoor environmental quality monitoring	The indoor CO2 and VOC (Volatile Organic Compounds) concentration are detected. The sensor data is transmitted to the platform through the security controller and the home gateway, and actively synchronize to the user service terminal.
4	Positioning and tracking	GPS (Global Position System) and other positioning technology are combined with short distance communication technology to realize the tracking and anti-theft of cars and assets.
5	Third party business	Based on the home security open platform, the third party security category applications that meet the requirements can be quickly introduced.

5. CONCLUSIONS

On the basis of the unified planning of home security services, this paper proposes a framework for the implementation of a family security service system. Under this system, we propose the functional requirements of a home security service platform, including portal system, business management, terminal management, business logic control,

interface adapter, basic ability calls and system management, which are based on the IoT technology to achieve home security service solutions and implementation method.

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On the Movement Technique of Arms and Legs of Swimmers in Open Water Competition

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Abstract: After in-depth research of the movement technique of arms and legs of swimmers in open water competitions, the following three technical viewpoints are proposed based on different water characteristics: 1) re-interpretation of streamlined body position in open water competition; 2) arms and legs movement technique in water with strong wind and wave; 3) reasonable distribution of physical agility of swimmers in open water competition. Discussion and theoretical foundation are provided for the above three techniques.
Keywords: Open water; Swim; Technique

1. INTRODUCTION

Open water swimming differs from pool swimming in facilities, swimming conditions, and swimming techniques. First, the external environment of open water swimming is complicated, which requires simmers to be equipped with certain skills to adjust movements based on the changing water environment. The adjustment of rhythm and technique generate difference from the technical structure formed by training.

2. THEORETICAL FOUNDATION

The basic law of fluid mechanics must be paid attention for the competition result and speed: When the speed of an object in the water increases, the resistance is directly proportional to the square of the velocity. The resistance of approximate streamlined object is less than the square of velocity, while the resistance of non-streamlined object is greater than the square of velocity.

3. DISCUSSION AND ANALYSIS OF BODY POSITION IN OPEN WATER COMPETITION

3.1 Phenomenon Discussion and Analysis

In open water competition, the influence of wave caused by tidal motion, water flow, and wind is significantly greater than that of training. Due to the conditioned reflex formed in long-term training, swimmers will perform in the following manners in water with strong wind and wave:

1) Due to the influence of the waves, swimmers turn more to the breathing side for more ventilation time, which interrupts the original nerve conduction rhythm. Therefore, swimmers are forced to use nonstandard arm and leg movements to keep balance. Athletes with training experience all have the following experience: When training with speed slower than competition speed, the leg frequency is relatively lower, while the leg extent is greater. When swimming slow, the resistance of legs is smaller than the push force. Therefore, the push force obtained by the body is greater. That is to say, low frequency and great extent generate good efficiency of leg movement. Therefore, when swimming with lower speed, athletes will instinctively use this method featuring energy saving and good efficiency.

2) In the beginning of the competition, athletes will increase the leg frequency while maintaining the original extent when they are strong in physical agility and power. In denser water (the density of sea water is 1.03 t/m3, while the density of 4 centigrade fresh water is 1 t/m3), the buoyancy and push force athletes received is greater than that in freshwater. With the acceleration inertia and the water buoyancy, the body rises to the surface of the water. Despite the unchanged leg extent, part of the legs are out of the water after the body rises, which generates great white water when legs touch the water and brings a large of number of air. Some of the leg movement is completed in the air above the water, which leads to the momentum imbalance of the longitudinal direction of the body. The athletes will adjust the longitudinal momentum balance by adjusting the extent of head rising. The higher the legs move, the higher the head rises. The whole body is in the anti-arch shape.

3.2 Corresponding Countermeasures and Methods

According to the basic law of fluid dynamics mentioned above in this paper, the resistance of approximate streamlined object is less than the square of velocity, while the resistance of non-streamlined object is greater than the square of velocity. Therefore, it is important for athletes to keep streamlined position. For the first condition, waves are generally coming from one direction, athletes can breathe from both sides to avoid the wave, save energy, reduce imbalanced and unstable factors, maintain correct body position, and reduce the unnecessary resistance from body shape. For the second condition, to stay streamlined position in water with strong wave and wind, athletes should take the manner of slow frequency and small extent, with using power striking down the water and reduce

extent rising up the water. With the reducing of leg extent, the push resistance generated by leg movement is reduced accordingly. But what is desirable is that the push resistance generated by small extent and slow frequency of leg movement is reduced in the square. In this way, small extent and slow frequency of leg movement can help athletes keep streamlined body position and reduce the force resistance to provide greater push resistance.

4. ARM AND LEG MOVEMENT TECHNIQUES IN WATER WITH STRONG WIND AND WAVE

In open water swimming competitions, athletes are subjected to varying pressures. Due to changing of water direction during the competition, the movement of athletes' arms is easily to be disturbed. In which case, athletes cannot feel the static water or even lose control in the water. In the process of drawing water, athletes may feel that water is losing between their hands, without obtaining resistance force. Let's put it this way for better and easier understanding: When we go uphill, our feet gives the ground force while the ground returns it back. In which case, we are not feeling particularly strenuous in this situation. However, if the ground is filled with sands, the force from our feet to the sand will be partly transferred to the momentum of sand flow. In which case, we cannot obtain great resistance force from the sands. It is clear that which condition requires larger external force while another doesn't.

4.1 Arm Technique Movement

In open water swimming competitions, the route of athletes' arms is different from that in swimming pool from any perspective. Small change in the arm movement will probably generate greater push resistance. In water with stronger wind and wave, the track athletes' in the air is rounder, with changing from will high elbow bending arm to straight arm movement. In the process of moving arm, athletes try to move the arm over the wave to prevent the wave from disrupting the arm movement rhythm, and avoid the generation of excess forward resistance. During the process, athletes should put arms before their body flexibly based on the arm movement timing and wind and wave condition. In the competition, the entry points should be wider than usual based on different waves and dark surges and on or outside the extension of the shoulder. At the same time, athletes should draw the water immediately after entering to prevent unnecessary wave resistance and make full use of the momentum generated by arm movement. During the arm movement, athletes should find and use the static water around them. In the preparation stage before drawing water, athletes should find out the direction and volume of the water. In the push and pull movement, athletes should start drawing the water after entering the ideal position. Quick and strong arm movements can generate great push force for the body. The body revolves around the midline to facilitate the movement of the breathing. The back of the arm may act as a brake on the coming water. It is unusual in static water that arms are forward while the body is static. However, this may happen in open water competition. In the case that athletes are swimming against the water, they may retreat. The frequency is important. With the increasing of frequency and reducing of distance, the speed is prevented from slowing. Actually, the sliding effect in open water is not as good as in static water.

4.2 Leg Technique Movement

Athletes are normally trained to be equipped with several techniques of arm and leg movements including 6:2:1, 4:2:1, and 2:2:1. Among which 6:2:1 is most common, which means six strikes, two draws, and one breath. In denser water, athletes are able to keep balance with less leg strikes thanks to the buoyancy. Therefore, they usually use 2:2:1 to save energy. In water with strong wind and wave, athletes need to adjust their rhythm of leg strike based on the water characteristics. In water with weak wind and wave, athletes instinctively adopt the automatic rhythm of leg strike formed in training. However, in water with strong wind and wave, athletes, under the influence of wave and dark surge, adopt different leg strikes featuring the following: 1) more energy consumed during the medium and lower leg strike than usual;2) less energy consumed during medium and upper leg strike than usual; and 3) more leg strikes in stronger wave and less leg strikes between waves. Flexible use of leg strikes can enable athletes to maintain a high speed in wind and wave while effectively save energy.

In static water, we can see the wave in front of the head formed by arm and leg movements after the water drawing movement. But in water with strong wind and wave, the continuously changing of wave direction and water flow, and increasing air content in the water lead to the decreasing of water density. In this case, the push force generated will be 15 to 30 cm farther than in static water. Therefore, athletes need to strengthen their speed, momentum, and extent of water pushing and pulling in the arm movement. In addition, athletes may need to change their route for better static water condition; and adopt wider and deeper arm movement, or more spiral curve to fully use the push force generated by static water. If the water surface fluctuates significantly, the effective push stage might be generated in the later part. On the contrary, significant push force is generated in the former part of the arm movement in static water. Athletes need to develop their central muscle coordination mechanism to complete similar movements.

5. REASONABLE DISTRIBUTION OF PHYSICAL AGILITY

There are many uncertainties in open water swimming competitions that affect physical energy consumption. In water with strong wind and wave, athletes sometime ride on the wave when their direction is the same with the wave. At this time, their speed will be increased significantly. After that,

their speed decreases when they are in the bottom of the wave. Good athletes can extend the time they ride on the wave, which is highly dependent on the arm and leg technique movements. Keep swimming fast by strengthening the leg and arm movements can help athletes to swim on the surface of the water. In this case, it's not realistic to get push force consistent with the speed. On the contrary, applying different pushing forces based on different water conditions generates good swimming effect and save unnecessary physical consumption.

6. CONCLUSION

In open water competition, correct streamlined posture and position of athletes are the basis for the correct and effective use of swimming movement techniques; athletes need to breath both side to avoid excessive body rotation; active low frequency and small extent leg strike can help maintain the streamlined posture; In water with strong wind and wave, athletes adopts straight arm movement to cross the wave and draw the water in the extension of the shoulder to reduce the resistance; athletes need to develop special swimming skills for different water conditions. Reasonable changing of arm movements can generate better push force. In water with strong wind and wave, athletes ride on the wave when their direction is the same with the wave by strengthening their arm and leg movement and keep swimming fast to increase speed and save energy.

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Research and Application of A high Temperature Resistance Agent

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Abstract: To the conditions of reservoir heterogeneity, high temperature, developing a high temperature resistance gel plugging agent. using simple variable method to optimize the ratio of the of proportion the plugging agent and Static and dynamic performance are evaluated; combined the experimental data with CMG numerical simulation software to optimize the plugging process parameters.[1] The formula of high temperature resistant gel type plugging agent system: 0.03% coagulant aid+2.75% cross-linking agent I + 2.1% cross-linking II +8% high temperature resistant main agent; the gelling viscosity is between 2000 ~ 5000 mPa· s， PH=6~8 is applied, heat-resistant > 280 ℃, plugging rate > 90.39%; Using the single fluid method and low-pressure low-emission to inject. Optimizing the radius of profile control is 20 m, valid for 11 ~ 12 months, it has the obvious effect of increasing oil and controlling water. This study provide Theoretical basis for high-temperature profile control technology research and has a guiding significance for site construction applications.

Keywords: Thermal recovery; Steam channeling; profile control; single fluid process

1.INTRODUCTION

At present, the study of high temperature profile control technology is limited to the plug of the steam well, Lack of high temperature gel plugging agent with low liquidity.[2] high temperature Resistance agent can effectively adjust the problem of the uneven vapor suction on plane and vertical and can be used as frontal displacement medium, it can effectively improve mobility ratio under the condition of meeting requirement of heat-resistant, improving the steam sweep volume, And can transport to the zone far from wells. To achieve the purpose of deep profile control.[3,4] This project adopts the modification technology to improve the heat-resistant ability of the traditional high temperature resistant main agent, With coagulant and two types of cross-linking agent to form a quadripolymer gel, The system has a low flow deformation. Through the perfect evaluation system to systematically describe the sensitivity, adaptability and effectiveness of the blocking agent to the formation environment, This study provide reference for other high-temperature profile control technology research and has a guiding significance for site construction applications.[5,6]

2.THE DEVELOPMENT OF HIGH TEMPERATURE RESISTANT MAIN AGENT

After the high temperature resistant main agent nitrified by humus acid, then neutralized with sodium. humus acid which is nitrified, the temperature resistance is improved, molecular weight is Lower, It has better solubility and dispersion. when the mass fraction of the main agent 14%, the solubility is saturated, After neutralized, the PH of product ≈10.2, The solution is dark red, High temperature resistant experiments show that the gel of the system generated at least can withstand 280 ℃.

3.RATIO OPTIMIZATION EXPERIMENT OF PLUGGING AGENT SYSTEM

Ratio optimization experiments are performed under the simulated formation temperature 200 ℃and the plugging agent solution PH = 7

3.1 The Influence of Coagulant Aid HPAM on the Plugging Agent System

Main agent content is selected 6 wt. %, the content of cross-linking agent I is 2.2 wt. %, the content of cross-linking agent II 2.1 wt. %, Investigation into the effects of the content of HPAM on the gelling properties of the plugging agent system.

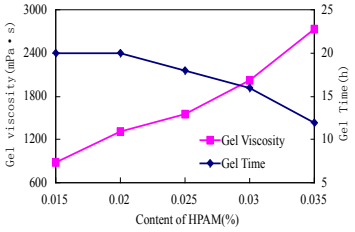

Fig.(1).The influence of HPAM on the gel system

As shown in Fig.(1), the content of HPAM is proportional to the initial viscosity of the solution, the viscosity increases with the content of HPAM increases, but the gelling time reduces. So， the content of HPAM is 0.03wt.%.

3.2 The Influence of the High Temperature Resistant Main Agent on the Plugging Agent System

The content of HPAM is selected 0.03 wt. %, the content of cross-linking agent I is 2.2 wt. %, the content of cross-linking agent II 2.1 wt. %, Investigation into the effects of the content of high temperature resistant main agent on the gelling properties of the plugging agent system.

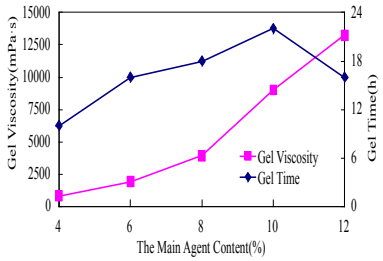

Fig.(2).The influence of he content of main agent on the gelling time and the gelling viscosity

As shown in Fig.(2), when the content of main agent is less than 10%, the content of the main agent is proportional to the gelling viscosity and gelling time, When the content of main agent is more than 10%, the gelling time is shorter;, initial profile control agent solution viscosity increases with the increase of the content of main agent, So, the content of the main agent is 8%.

3.3 The Influence of the Cross-linking Agent I on the Gel System

Main agent content is selected 8 wt. %, the content of HPAM is 0.03 wt. %, the content of cross-linking agent II 2.1 wt. %. Investigation into the effects of the content of cross-linking agent I on the gelling properties of the plugging agent system.

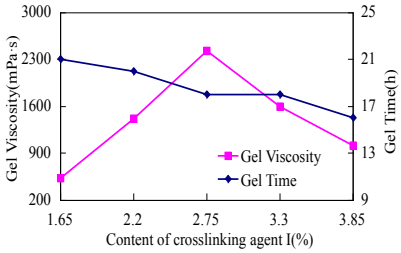

Fig.(3).The influence of the content of cross-linking agent I on the gelling time and the gelling viscosity

When the content of Cross-linking agent I is between 1.65% ~ 3.85%, the change of the gel law is non-monotone, The content cross-linking agent I is 2.2%,the mole ratio of cross-linking agent and cross-linking agent I II is 2:5,the gelling viscosity is

Table 1.The influence of temperature on gelling time and viscosity

T/℃	200	240	280
gelling viscosity /mPa·s	2423	37592	1123
gelling time /h	20	17	11

The experimental results show that under the temperature of 240℃, the gelling viscosity is bigger than others, Under the temperature of 200℃ and 280℃,the gelling viscosity is between 3000 mPa•s and 1000 mPa•s. it meets the requirements of low liquid viscosity of plugging agent.

4.2 The Influence of Salinity on Gel Properties

Setting PH = 7 and the temperature is 200 ℃, research the influence of salinity on gel properties.

largest and the gelling time has the trend of decline (Fig.(3)). So, the content of cross-linking agent I is 2.75%.

3.4 The Influence of the Cross-linking Agent II on the Plugging Agent System

Main agent content is selected 8 wt. %, the content of HPAM is 0.03 wt. %, the content of cross-linking agent I 2.75wt. %. Investigation into the effects of the content of cross-linking agent II on the gelling properties of the plugging agent system.

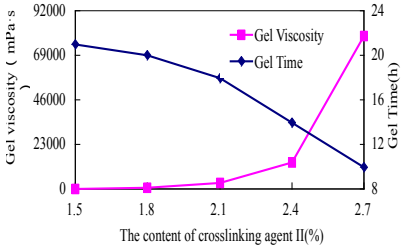

Fig.(4).The influence of the content of cross-linking agent II on the gelling properties

The content of cross-linking agent II is proportional to the gelling viscosity, is inversely proportional to the gelling time, it plays the role of facilitating the cross-linking reaction and increasing the gelling strength.

At last, through the experiment of ratio optimization, the formula is 0.03% coagulant aid 2.75%cross-linking agent I + 2.1% cross-linking II + 8% high efficient main agent.

4.STATIC PERFORMANCE EVALUATION OF PLUGGING AGENT SYSTEM

4.1 The Influence of Temperature on the Gel Properties

In the production process of steam injection of steam flooding, Because the formation of steam chambers, the temperatures of injection wellhead and can reach 300 ℃, the temperature of near well bore zone is above 200 ℃nearly a week after shut-in Wells. Set the temperature 200℃, 240℃, 280℃, examine the impact of temperature on the gel properties(Table1).

Table2.The influence of salinity on gelling time and viscosity

No.	salinity mg/L	gelling time /h	gelling viscosity / mPa·s
1	1600	14	2190
2	3200	13	60
3	4800	15	312

The experimental results show that salinity has a big influence on gelling viscosity. When salinity is 1600 mg/L, gelling viscosity is about 2200 mPa•s, When salinity is greater than 3200 mg/L, the gelling effect is worse, the gelling viscosity reduces to 400 mPa•s (Table2).

4.3 The Influence of PH Value on Gel Properties

Set reaction temperature 200℃, studying the effect of PH on gel properties.

Table3.The influence of PH on gelling time and

viscosity

No.	PH	gelling time /h	gelling viscosity / mPa·s
1	6	15	1918
2	7	17	2020
3	8	21	901.2
4	9	No gelling	No gelling

Experiments show that the PH has a great influence on the gelling viscosity and time, when PH is between 6 ~ 7, it has a little influence on gelling viscosity and gelling time, When PH is 8,gelling viscosity is smaller, Overall, gelling time increases with the increase of PH value. When the PH is 9, the plugging agent system can not gel(Table3).

5.DYNAMIC EVALUATION TEST

5.1 Plugging Ratio and Residual Resistance Factor

Turn the sand filling tube into vacuum, water-saturated. Then, measured the pore volume and the permeability before plug, displace 3PV profile control agent into sand filling tube at a constant speed of 1 ml/min, sealed, and put it into thermostat at the temperature of 200℃ for 12 hours until gelatinized compare the plugging ratio and residual resistance factor of gel system and composite system at different temperature. As is shown in table 3, plugging rate achieves at least 90.39% under different reaction temperature. Maximum plugging ratio is 96.47% at the temperature of 240℃(Table 4).[7]

Table 4.Result of plugging ratio and residual resistance factor

Type	T（℃）	perm-plug method（mD）	Water permeability measurement（mD）		plugging ratio（%）	RRF
			before plugging	After plugging		
Gel	200	3467	801	69	91.39	11.61
	240	2619	708	25	96.47	28.32
	280	3576	770	34	90.39	10.41

5.2 Scouring Resistance and ThermalStability

(1) Scouring resistance

Injecting 30PV steam into the sand filling tube at the rate of 3 ml/min after sealed, Simulation environment temperature is 280℃, back pressure is 2.4MPa. Measure water phase permeability after scouring, compare the plugging ratio before and after scoured The test shows that plugging ratio is still above 80% after 15PV steam washing. when it increases to 30PV, permeability become 49.75%.Permeability decline in half is enough to adjust the formation permeability differences, it still reflects the characteristics that plugging agent can be degraded and broke(Table 5).

Table 5.The result of scouring test

perm-plug method（mD）	Water permeability measurement（mD）				plugging ratio（%）		
	before plugging	After plugging	15PV	30PV	After plugging	15PV	30PV
3467	804	69	132	404	91.39	83.58	49.75

(2) Thermal stability

Under the condition of high temperature, polymers are prone to degradation to hydration. In the steam flooding, retention ability of profile control agent can be measured by thermal stability through the curve of time-plugging ratio. The simulation of formation temperature is 280℃. At a temperature of 280℃，plugging ratio still above 85%,after 8 days, the thermal stability curve gradually to be steady. The plugging profile control agent is little degraded under high temperature.[8]

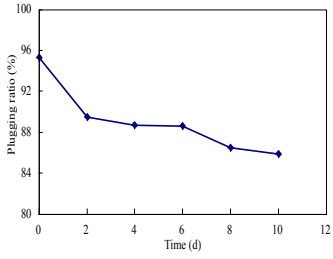

Fig.(5).Result of thermal stability

6.NUMERICAL SIMULATION OF PROFILE MODIFICATION AND OIL DISPLACEMENT AND THE EFFECT EVALUATION

Combined with the parameters that provided by experiment, such as :the nonlinear viscosity curve of main agent, sorption isotherm, maximum adsorption amount, the residual resistance coefficient. Using of CMG numerical simulation to predict production effect, optimal radius of profile control agent, then evaluate the effectiveness[9,10].

6.1 Modifying and Flooding Agent Injection Process

Adopting the method of two-fluid process at low pressure and low emissions, injection speed range from 0.2m^3/min to 0.4 m^3/min. climbing pressure range from 3.0MPa to 5.0MPa,No more than 80% of the formation fracture pressure. Displacement fluid is usually 15% of the dosage of profile control agent.

$$V = \pi R^2 H \phi \quad (1)$$

Where V is dose of profile control agent, H is processing layer thickness, R is average of process radius, ϕ is porosity.

In addition we should consider the scene construction wastage.

6.2 Optimization of Plugging Radius

Selected plugging radius of 5 m, 10 m, 15 m, 20 m, 25 m, compared with no plugging measures, analysis the factors of moisture content, cumulative oil output to optimizing the radius of profile control. The results of numerical simulation is shown in figure 7.

(1) Daily oil output

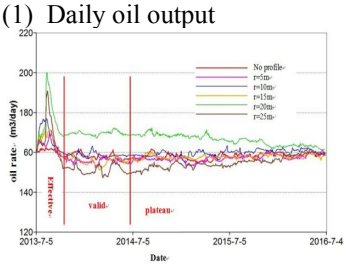

Fig.(6).Daily oil production curve of different plugging radius

When the radius of profile controlling and flooding is 20m, oil production increased obviously, oil increased ratio is 5.98%,the period of validity of profile control and displacement range from 2013.7.5 to 2014.6(Fig.(6)).

Moisture content

Due to the displacement radius of 5 m, 10 m, 15 m of daily oil quantity gap is not big, Follow-up studies main switch drive radius of 20 m compared with not displacement

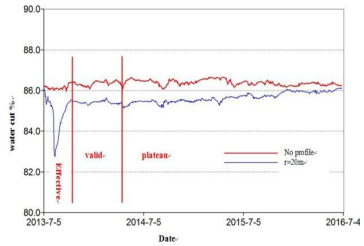

Fig.(7).Moisture content curve in different plugging radius

When it is not plugged, the average moisture content is 86.35% after three years' production. When the radius is 20m, the ratio is 85.54%, An average 0.81% decline, When the displacement radius is 20 m, moisture content down to a minimum 82.77%. Later there is still a steady oil water control ability(Fig.(7).).

7.CONCLUSION

(1) High temperature resistant main agent, after modified, combined with cross-linking agent,Coagulant can generate high viscosity semisolid quaternary copolymer gel colloid at high temperature, withstand at least 280℃. After shearing, micelle of plugging agent gel can transport into deep of formation to achieve a deep profile control.

(2) Plugging agent has low initial viscosity, a large range of reaction temperature, plugging ratio above 96.75%, With excellent thermal stability and souring resistance, And can flush broken down with the steam washing.

(3) Using the method of double-fluid under the condition of low pressure and low emissions during the inject operation, the optimum plugging radius is 15m, has a long period of validity, can improve oil production and Reduce the moisture content effectively, there is still a steady oil water control ability follow-up. Numerical simulation parameters adopts the actual experimental data and the actual production data, has reliable reference value.

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The Current Situation of Rural Infrastructure Construction in China and the Choice of Investment Modes

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Abstract:With the development of China's economy, the central government increasinglyvalues the investment for Chinese rural areas,realizes that the strengthening of rural infrastructure is the key of the promotion of the economic development in the rural areas. At present, problems concerning the source, amounts, structure and returns of investments arising in the rural infrastructure constructionrestricts the development of new socialist rural construction. Therefore, the government should take corresponding measures to improve the rural infrastructure investments.

Key Words:Rural infrastructure; Investment mode; Investment structure; Investment strategy

1. INTRODUCTION

Rural infrastructure is a key part of the new countryside construction. Rural infrastructure construction can reduce various costs andavoid put peasants at the natural and economic risks; it also plays a key role in accelerating the construction of modern agriculture and urbanization. The effective completion of rural infrastructure construction can contribute to the agricultural production efficiency, help peasants to increase their outputs and incomes and to improve their quality of life, helping to make the urban and rural economies to grow together.

Public investments are the economic activities which transform some public expenditures into public capitals by the government, in order to complete the expected social and economic benefits, to promote the social and economic stability and harmonyas well as the sustainable development [1]. According to the Keynes's theory, government's investment for the infrastructure will give a positive stimulus to the production in the private sector, and thus it's generallyconsidered as a driving role in the economic development. The positive functions of rural infrastructure investment policies are mainly reflected in the following two aspects. First, financial support can effectively resolve the external problems of many public goods which are needed for the agricultural development; meanwhile, it can form the advantage of scale economy. Secondly, government public investment policy as the basic means for the government to regulate and control the agricultural production, by which the income levels of peasants can be improved.

2. LITERATURE REVIEW

For the definition of the rural infrastructure, there are many different understandings in the fields of theory. In this article, the rural infrastructure will be interpreted as the basic infrastructure and artificial manufacturing environment which provides basic services to the agricultural production, is needed in the agricultural production and plays key function in the agricultural development. Although China has begun to strengthen its financial investment in rural infrastructure since 1998, make preliminary improvements to the imperfection of rural infrastructure. Butthe overall backward situation of Chinese rural infrastructure construction has not been changed completely. At the beginning of this century, theParty and the State Council tried best to carry out tax reform in rural areas butlead to new problems of rural infrastructure in the process of minimizing the tax burden on peasants. Before the abolition of the agricultural tax, for some economically undeveloped rural areas, different financing tools (fund-raising by villagers included) were provided; there also used to be public-private and infrastructure projects such as road construction. However, after the abolition of the agricultural tax, the rural organizations lost their income sourceand the short supply of capital supply for rural infrastructure, resulting to the slowly grow of the Chinese rural infrastructure.

3. EXISTINGPROBLEMS OF CHINA'S RURAL INFRASTRUCTURE INVESTMENT

Rural infrastructure is one of the public products. In the past, it provided by thelocal governments. In particular, during the periods of 1949-1978, government used to be the main investor for the rural infrastructure investments. From 1978 to 2004, the sources of rural infrastructure investment projects tending to diversity. From 2004 till now, with the implementation of tax reform, rural infrastructure has been financed by the "one issue, one negotiation" measure. On the whole, the scale and effect of the current investments can't meet the actual needs of social and economic developments in the rural areas due to the deficiency in the structure, subject, amount and efficiency of the investments.

3.1 The Absence of Main Investor

Generally, the main investor for rural infrastructure projects should be the government and villagers. But, there remain few incomes for the domestic peasants

to invest after they purchase properties, pay for their children's education and daily spending because their incomes have just maintained slight increase. However, rural infrastructure usually needs a large amount of investments for support. The peasant individuals and rural communities do not have the capacity to invest such projects, thus, the government becomes the only investor in the rural infrastructure construction.

3.2Inappropriate of the Investment Structure

The difference of financial situation and investment preference ofthe localgovernmentslead to the investment structure of the agriculture infrastructure construction imbalanced. As for the present investment structure of the domestic rural infrastructure, the investment inthe river conservancy accounts for a relatively high proportion in the total investments while the investments in optimizing the agricultural production environment and villagers' living condition are relatively low. Huge water conservancy construction projects are indeed beneficial for people. But the are the real countryside infrastructure construction because the villagers can not fully benefit from it. In addition, the rural infrastructure construction only serving for local community, which makes the policy-oriented financial organizations and commercial-type financial organizations have a preference for investing in the industry infrastructure projects.

3.3 Insufficiency in Total Investment Amount

Under the long-term development system of urban and rural dual economy, the investment provision mechanism of the domestic infrastructure has slowly shaped dual investment modes in which urban and rural areas are diverge. All the capitals for the urban infrastructure construction are supplied by the national finance, but the capitals allocated to infrastructure in the fields of rural living, production and education are relatively limited. At the end of the last century, few capitals were invested in the infrastructure of living and education, only investing in relatively large infrastructures such as river conservancy projects. By the 1990s of the 20th century, financial expenditure allocated to the agriculture infrastructure was only 20%-30% of the total fiscal expenditures [2], which was not compliant with the foundation of the agriculture sector. Generally, since the start of reform and opening-up, the total amounts and ratio of fiscal investments in our country have been low. Especially, the government of different levels could not recognize their obligation limits for the infrastructure investments, which has resulted in a limited amount of financial support for agriculture and unavailable of the capital, lead to the insufficiency of the total investments.

3.4 Low Investment Returns

Our country is on the condition of improving market economy, hence the ongoing investment policies subjected to economic policies to some extent. In practice, expenditures for agricultural infrastructure are charged by different departments, which can cause conflict among different departments in terms of the recognition of investment policy, the measures and regulations of investment application. At present, it is impossible to make a consensus on the investment policies understanding among the National Development and Reform Commission, the Department of Finance, the Department of Agriculture and Department of Science and Technology. It is also hard to establish an efficient and unified coordination system in terms of the capital management. What's more, there will appear disagreements in the internal organizations of the different departments, so the investment and fund fail touse of funds as ear-marked, thus the investment returns for the rural infrastructure construction remain generally low. All of the above issues have greatly increased the management fees used for supporting agriculture fund and caused inefficiency of capital.

4. SELECTION CRITERIA FOR CHINA'S RURAL INFRASTRUCTURE INVESTMENT MODELS

4.1The Invest Property of Rural Infrastructure

Public products are of non-exclusive and non-competitive in consumption cause market failure in terms of supply. Namely, the market become inefficient in allocation of public goods. With the market failures arising in the process of allocation public goods, even for the countries with highly developed market economy such as the United States, it is required that the government implement efficient intervention. In the situation in which public products donot provided by market like private goods, in order to satisfy public's needs, in factthe government directly provide public goods for the rural society. Most of the rural facilities do not belong to the pure public products, but they apparently have the characteristic of the public goods. For various kinds of infrastructure construction projects, they chose and set out specific operation measures and investors, because the agricultural facilities own the properties of public production and the public production can be further divided into expectantpublic goods and pure public goods. According to the economical character, the rural infrastructure construction projects can be classified into operational, non-operational and semi-operational projects. For the rural facility construction projects with pure public production nature and non-operational property, they are basically financed by fiscal investments. The nationwide rural facilities are mainly financed by the financial investment of central government while the cross-regional rural items are mainly financed by the financial investment of province. For the rural infrastructure projects with the expectant public goods nature and semi-operational property, central

government functions as the main investor and the community and social forces act as ancillary investors, involved in capital gaining, construction and operation management.

4.2 Standards of Economic Development Level

The growth of rural economy influences the development of rural infrastructure. Steady and harmonious economic growth will raise the social demand for rural infrastructure and at the same time funding for rural infrastructure. In the coastal areas of China, the economy is well-developed, especially the developments of agricultural enterprises are quite active, and the allocation of various infrastructure is relativelydeveloped. Moreover, with the convenient transportation and good natural environment, rural infrastructures in these areas require less investments. With the agricultural enterprises and rural community growing strong quickly, they have actually become the major investors in rural facilities. And there are also some individuals with strength have taken part in the rural infrastructure investments. Under such circumstances, most of the rural facilities with the characteristic of public products, the corporate, individual and collective investments have caused "crowding-out effect"to the government somehow. In the central and western regions of our country, the rural areas are in relatively poor status because the collective economy is still under development. Meanwhile, due to the complicated natural environments and terrain factors, most of the infrastructure projects need much more investments. Most of the funds come from government, but the government is very limited in providing investments. Sometimes even the most basic rural facilities investment not be provided, and it needs to raise funds from villagers to resolve such problem. Therefore, when attracting investments in central and western regions, applying the financing measures of "BOT", "PPP"can help to promote rural infrastructure construction.

4.3Standards of Economic Efficiency

(1) Economic efficiency of agricultural infrastructure. The rural infrastructure investment can enhance economic efficiency. Firstly, infrastructure can effectively promote the development of rural economy and plays an important role in enhancing the rural economy. Secondly, the output of the rural economy grows together with the capacity of infrastructure. Finally, with the further development of economy, rural infrastructure has also changed in structure and needs to be adapted to the current development needs. In addition, infrastructure can effectively improve the efficiency of agricultural production. Infrastructure can also promote the development of social division of labor and cooperation, which can effectively enhance economic efficiency.

(2) The loss of efficiency in government investment. Firstly, the financial funds have some limitations. Secondly, companies will lose the motivation of increasing the economic efficiency and reducing the costs because of a monopoly market for the infrastructure which causes no pressure for competition. Finally, it is the "crowding-out effect". According to the relevant principles of economics, this effect will force individuals out of the investment market. So the efficiency of government investment is very low.

(3) Construction efficiency of agricultural infrastructure. Firstly, the social benefits gained from the public welfare sector are usually high, its economic benefits are very low. This is why companies and private individuals are unwilling to invest in it. Generally, what make the decision and then provides the financial support from fiscal appropriationis government by evaluating the scale of investment, and it isfree funding. Secondly, the economic and social effect of the investments in the basic industries not only have the feature of public welfare, but also have the feature of profitability among the competitive industries and public welfare sectors. In general, the scale of investment in such industries is relatively large with a long construction period and slow cash flow. For investment in basic industries, if there is only one main investor it will be very difficult and also unreasonable. Thus, various investment methods should be adopted. Thirdly, the investments in the competitive industries boast of the highest economic efficiency but with limited social benefits. Investment effects are apparently exclusive and investors have their own property, which directly determines that the corporations and individuals to participate in the investments in competitive sector instead of the government of different levels. And the government only provides policy and information services for support [4].

5. MEASURES TO IMPROVE THE RURAL INFRASTRUCTURE INVESTMENT

5.1 Fulfill the Dominant Position of the Government

Local government should further enhance their investment in rural facilities, make efforts to become the main investor in rural facilities and ensure that rural infrastructure should help the rural economic growing effectively through effective investments. And the government is necessary to recognize and evaluate scientifically the real needs of villagers for the infrastructures in living and production, which leads them to make reasonable choices of investment and carry out effective management for the costs. Moreover, it should be clarified what the "financial rights" and "administrative rights"of the government at different levels, leading the social funds to the rural areas through policy [5].

5.2 Optimize the Investment Environment

Central government and the local governments should establish supporting policies that contribute to the social investment, promote effective taxation and lending policies, and support and guide investors

from different fields in joining in rural infrastructure. Based on the benefits of public goods and low profitability of the rural facility investment, the government can implement corresponding preferential measures to further attract the investor to the infrastructure projects.

5.3 Establish Government-led and Diversified Funding System

Under the leadership of government, the investor of the rural infrastructures should be diversified by setting up overall efficient and diversified funding system for the infrastructure facilities and applying comprehensively networked investing system of different channels and levels through building and perfecting the dominating financial capitals and the supporting loan capitals, with the capitals from communities and peasants as a foundation and the foreign capitals or the horizontally introduced capitals as supplements.

5.4 Establish an Effective Mechanism of Investment Management

Different levels of government should form a management mechanism which should be standardized and boast of a clear division of labor and operation in order. According to project, the government can also adopt the system of government procurement or the principal and agent system in which the government can entrust the intermediary agency to evaluate the implementation status of the project, promote the monitoring mechanism for the capital operation of the project , then moderately increase or reduce the capital according to the specific situation of the project, and finally complete the project acceptance, guaranteeing the effect of investment operation.

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The Research on Sustainable Landscape Planning Strategy-- Taking the planning and design of new West Ham Linquan health city of Xi'an city as an example

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Abstract: in view of the gradual disappearance of the regional characteristics of urban landscape in the process of urbanization, the concept of "sustainable" garden landscape is put forward in this paper. It also explores the planning strategy of sustainable development landscape based on practical projects, hoping that this research can provide ideas and methods for improving the quality of landscape architecture.
Key words: Research on the planning strategy of sustainable garden landscape

1. INTRODUCTION

The word "sustain" comes from Latin "sustenere", meaning to keep, maintain and continue to improve. In view of urban landscape, it should be understood to maintain the sustainable and safe development of ecological resources and good production. At the same time, the natural environment, the artificial environment and the social environment can be better sustainable development.

Landscape architecture is an important part of the urban construction and development, and plays an important role in the image molding and local ecological space composition of the whole city. With the rapid development of information technology today, we can clearly feel, people pay more attention to the environment, we start from the perspective of sustainable development of city landscape design rationality perception, can be said that now the landscape in the whole city construction from supporting a gradual transition to the "leading role" position. Therefore, exploring sustainability of urban landscape design is not only to achieve urban ecological security and achieve sustainability of environmental development, but also to meet people's requirements for environmental improvement. In view of this, this paper takes the planning and design of city health Linquan Xi'an-Xianyang District of Xi'an city as an example, to explore the sustainability of landscape design.

2.STARTING FROM THE SITE AND ACCORDING TO LOCAL CONDITIONS AND CHOOSE THE PROJECT.

"Yuanye- the lan". Said: "the land is appropriate, constructing appropriate "1 said is China selection process of traditional landscape gardening. Reference to sustainable landscape design process, is to start from the site situation, analyze the location and internal co-ordination and choosing the feasible project approach and combined with the needs of the city construction and the development of the space vision project plans to use the upper bearing protection and reconstruction and.

The planning project of West Ham - Linquan health city is located in the ancient capital of Xi'an (Figure 1). The advantages of the project are obvious, and the base area is about 630 mu (Figure 2), and the site conditions are open and smooth, which is beneficial to the construction of the project. At present, the ecological environment of the project is good. The hot spring + Lin Yuan (orchard + cherry orchard + osmanthus + ginkgo forest) + water surface (Figure 3) is the outstanding feature resource of the project. The existing service facilities of the project include: Fuyuan + Hot Spring + pension homes, badminton hall and so on. After upgrading and transformation, it can serve as a core resource to drive regional development.

Combining the above advantages and resources in the strategic context of developing an international metropolis in Xi'an, we should take advantage of geographical location, and make effective use of existing resources, and adapt to the situation, and adjust our thinking, and transform and upgrade, and start from the current situation of the site and the hot demand of the society.

First of all, we should construct the whole humanities landscape space, on the basis of city development, the development of high-tech research and development and incubation, sports, business exhibition, cultural tourism, modern agriculture and the development of real estate industry focus, build for the western region science and technology resources demonstration base planning. First of all, we should build the overall humanistic landscape space, according to the city development focus on the development of high-tech research and

development and incubation, sports, business exhibition, cultural tourism, modern agriculture and the development of real estate industry, and build for the western region science and technology resources demonstration base planning. Then, we use the project good ecological environment and service facilities, the establishment of business and leisure, living endowment, functional areas of medical care, in order to solve people's leisure and sports, to provide a good pension demand, it also provides a business and leisure relaxing facilities for the surrounding high talent.

Then, we take advantage of the good ecological environment and services of the project, and establish the functional areas of business leisure and old-age living and medical care. It provides a good place to solve the people's needs for leisure, sports and old age. It also provides a business negotiation and leisure relaxation for the surrounding high skilled personnel.

Figure 1 Figure 2 Figure3

3. ADHERE TO THE ECOLOGICAL SECURITY AND MAINTAIN THE SUSTAINABLE DEVELOPMENT OF THE ENVIRONMENT

We should proceed from the ecological security of the site environment, with the purpose of conservation and improvement of the environment by resources. To create a pleasant ecological environment and a beautiful city landscape is the topic of life that people are more concerned about. Sticking to the ecological safety is to protect the natural environment and make full use of land resources under the guidance of the scientific factors of "eco city" and the aesthetic experience of garden city [2].

scope of carrying out natural environment, by protecting and sorting out the existing site environment, the factors that are not conducive to the development of the ecosystem can be improved through design means. The ecological environment of the original site will be well turned, the conditions of regional microclimate can be improved, and a more comfortable and pleasant environment is created. As the landscape ecologist Mike Haag said: "according to the regional natural environment and natural resources performance, the ecological suitability analysis, to determine the land use and development planning, so that the nature of the use and development and other human activities and natural characteristics of natural process, coordination of"[3].

The City health planning and design new West Ham Linquan is from the place bearing range of the considered safe, and according to the park function area and the layout of the project, and then refer to city land classification and land use planning and construction standards GB50137-2011. The park land is divided into the low level pension land, the middle and senior pension land, the exhibition exhibition facility land, the cultural land, the hospital land, the commercial land, the dining industry land, the road land, the park green space and the water area. All kinds of land use control indicators are shown in the table (Figure 4). In accordance with the hydrogeological conditions of the project, the control of water safety is also made (Figure 5). Referring to the national sewage discharge standards of tourist areas, we should set up water system, drainage system, water conservation, prevent surface water from draining away, and rationally discharge water for life and production, and maintain the existing ecological environment. Because of the nature of land use planning in this unit is clear, so according to the "city water supply project planning standards" (GB50282 ~ 98) the water consumption index and different nature of land and land area, land use unit water consumption prediction method, calculated the total planning area of the water for 2806m ^{3}/d.

The sustainable development of landscape planning advocates the creation of natural landscapes to maintain and simulate the reproduction of natural plant communities. Under the premise of maximizing the original ecological environment, we should take full account of the interaction and influence of species in the community according to the planning and construction objectives of the site Project and the local climate and floristic characteristics. The plant landscape planning project West Ham Linquan health city park in order to create obvious geographical characteristics of rich plant community landscape, full use of local tree species. In this way, while maintaining the stability of the community, it also provided the original ecological survival environment for the local organisms. At the same time, it also realized the alternate existence rule of the local plant communities. [4]. (Figure 6).

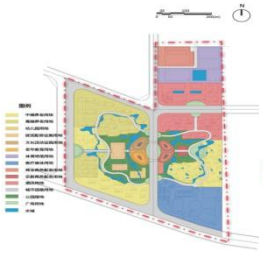

Figure 4 Figure 5

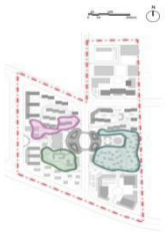

Figure 6

4.FROM THE PERSPECTIVE OF SUSTAINABLE DEVELOPMENT OF THE ENVIRONMENT, CITING THE IDEA OF GARDEN CREATION IN TRADITIONAL CHINESE GARDENS

The core essence of "sustainable" garden landscape is ecological construction, and is committed to building a harmonious community environment which is consistent with the development of sustainable humanity in the land. In this process of construction and development, there is no unified and mature mode that can be replicated for each of the different project sites. According to the local conditions, we should start from the site, look for the relationship between human and geography, guide the garden landscape construction with the idea of Chinese traditional garden, and find the right balance from the principles and methods of Chinese traditional gardens, and protect and develop the direction of sustainable development of green humanities and ecology [5]. Under the guidance of this idea, and through research and project pre feasibility studies, new West Ham Linquan healthy city project was determined as follows: (1)the planning of regional characteristics of the Forest Park garden. (2)The green farm of the pastoral style - ecology. (3)A comprehensive community of vacation and leisure - livable. Such a planning concept and warm, intimate, romantic and natural healthy city and the overall design vision and the spatial layout of "one heart", "one area" and "three districts" (Figure 7) reflect the overall harmony of the park. Take the center of healthy life as the core of the landscape, create the landmark landscape and the point of sight of the whole park. With the diversity of techniques to The Springs Hotel, plants Space Museum, pension apartment subjects such as the formation of the park main landscape nodes. It takes the square and the public service space as the main body to form the open space in many parts of the park. With the ecological health movement ring as the main line, a number of landscape nodes are connected in series, and the landscape radiation zone of the park is formed and the overall landscape system in series is connected with the park (Figure 8). West Ham Linquan healthy city is a complete and complex natural complex ecosystem in the function and space organization. In this compound ecosystem, there is an exchange and exchange of material, information and energy between every functional area and outside the system. Therefore, the traffic network planning in the park is smooth and smooth, without obstacles as the main body (Figure 9), in order to realize the symbiotic harmony between the society and the landscape.

5. CONCLUSION

City health planning project West Ham Linquan holistic approach to the humanities, starting to develop pre construction projects from the upper site situation plan. This is a sustainable landscape construction project, which keeps the sustainable and safe development of ecological resources and the basic unity of good productivity in internal structure and function.

According to local conditions, from the establishment of ribbon plant communities, hydrology, geographical ecological communities and the composition of traditional culture in the traditional culture, we should find the relationship between human and geography. We should coordinate the development and restriction of landscape architecture with the idea of Chinese traditional garden. In the process of adhering to the ecological safety and maintaining the sustainable development of the environment, we should embody the fair development of human, ecological environment and society, so as to achieve the sustainable development of the landscape.

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Comprehensive Study on Resource-Based Cities of Western China

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Abstract: Western China is quite a resources dependent area due to its great demand to the natural resources during the social and economical development process. The thesis comprehensive evaluate the social and economical levels of the resource-based cities of western China. Considering the life stages of the resource-based cities, the cities were divided into 11 types and the thesis gave a few development suggestions combined with the characteristics of each city.
Keywords: resource-based city, classification study, comprehensive evaluation, city life cycle.

1.CLASSIFICATION STUDY ON THE RESOURCE-BASED CITIES

The western area is a land of resources, abundant natural resources and huge market potential. But due to the natural, historical and social reasons, the economic development of the western region is relatively backward. The western region economic structure is unreasonable, lack of endogenous growth momentum, against abnormal economic fluctuations, prevent systemic economic risk ability is still not strong, weak infrastructure bottlenecks, the fragile ecological environment constraints is still outstanding. In December 23, 2016, the CPC CCPBSC, Premier Li Keqiang chaired the meeting, passed the "western development" 13th Five-Year "plan, carrying out a comprehensive urban relocation and reconstruction of old industrial areas: Support resource exhausted cities, independent industrial and mining areas, coal mining subsidence areas and other regional transition development, jump out of resource oriented development strategy, and promote social harmony and stability.

1.1 The definition of resource city

The resource-based cities are grew up with the exploit of nature resources and developed gradually. The resource industry occupied a great share of the cities' industries. In the year 2013, China officially confirmed 262 numbers of resource-based cities for the first time, more than 50 resource-based cities whose resources come to exhaustion.

1.2 The classification of resource-based city

The classification study of resource-based cities is not common in literatures as the cognition of resource-based cities is mainly based on their mining industry type, for Daqing city is oil-type city, Datong city is mine-type city and so on. There is also scholar divided mining industry cities into leading in stage city, growing up stage city, mature stage city and decay stage city according to the development stage of resource-based cities consulting the product life cycle theory[2].

The thesis will comprehensive evaluate the social and economical levels of 30 resource-based cities in the western district and going to analyze the data of the economic and social development of the city group to find the similarity and diversity feature of the city development and classify the cities based on their diversity and assemble types.

1.3 Classification method

There are many classify methods, and the most simple one is the single index classification method as it is mentioned before that classify resource-based cities based on their mining industry type and the life cycle. The thesis used multi index comprehensive evaluation method to classify the 30 resource-based cities.

As to the same chemo taxis and non-dimensional of different index come down to the multi index comprehensive evaluation method, the chemo taxis and non-dimensional equations is:

For high quality index, there is Eq. 1 For low optimal index, there is Eq. 2.

$$d_{ij} = \frac{V_{ij} - V_j^{\min}}{V_j^{\max} - V_j^{\min}} \tag{1}$$

$$d_{ij} = \frac{V_j^{\max} - V_{ij}}{V_j^{\max} - V_j^{\min}} \tag{2}$$

In Eq. 1 and Eq. 2, V_{ij} represents the reality value of the No. i evaluate object on the No. j index, $V_j^{\min}$ and $V_j^{\max}$ separately represent the reality minimum value and the reality maximum value of the No. j index, and d_{ij} represent the evaluation index value of the evaluate No. i object on the No. j index after non-dimensional.

The thesis uses the simple weighted averaging method to confirm the final value of comprehensive evaluate and the computational equation. In Eq. 3, n represents the number of the evaluate index and P_i represents the comprehensive evaluate value of the No. i evaluate object.

$$P_i = \frac{1}{n}\sum_{j=1}^{n} d_{ij} \tag{3}$$

1.4 The independence test method

The contingency analysis is an analytical approach to analyze the relevance of two component type variable, and the usual used methods are the goodness of fit test and the independence test. [5] The test statistic is chi-square value, recorded as χ^2 . In Eq. 4, f_{0ij} represents the distribution of observation value; f_{eij} represents the distribution of expectation value. The computational equation of f_{eij} is Eq. 5. In Eq. 5, N represents the number of sample unit, m represents the number of rows (which is the number of categories of the first variable), n represents the number of count (which is the number of categor Eq. 5ies of the second variable).

$$\chi^2 = \sum_{i=1}^{m}\sum_{j=1}^{n}\frac{(f_{0ij} - f_{eij})^2}{f_{eij}} \tag{4}$$

$$f_{eij} = \frac{1}{N}\sum_{j=1}^{n} f_{0ij}\sum_{i=1}^{m} f_{0ij} \tag{5}$$

The test progress of contingency analysis is a statistic test method to estimate the relevance of the test statistic and the critical value to decide whether to accept the original hypothesis or not. The original hypothesis is that the two component type variable is independent and the alternative hypothesis is that the two are interrelated.

2. The index of Resource based cities in Western China

2.1 the determination of resource-based cities comprehensive ranking

5 kinds and 34 indexes were adopted to comprehensive evaluate the social and economical levels of 30 resource-based cities of China considering the attainable and integrity of the data. Due to the huge original data size and the length of the thesis, it is not listed all the details.

According to the 2015 statistics data obtained from China's Provinces and Cities Economy Development Yearbook, 30 resource-based cities of western China were comprehensive evaluated and the result can be seen in table 1.

Table 1 Comprehensive ranking of 30 resource-based cities in Western China

No.	City	Value	No.	City	Value	No.	City	Value
1	Erdos	0.4085	11	Guang'an	0.1660	21	Baiyin	0.1217
2	Baotou	0.3551	12	Liupanshui	0.1621	22	Hezhou	0.1213
3	Yulin	0.2962	13	Karamay	0.1586	23	Chongzuo	0.1197
4	Chifeng	0.2526	14	Panzhihua	0.1506	24	Shizuishan	0.1191
5	Qujing	0.2451	15	Hechi	0.1487	25	Pu'er	0.1191
6	Bijie	0.2213	16	Wuhai	0.1477	26	Wuzhong	0.1184
7	Hulun Buir	0.2172	17	Zhaotong	0.1347	27	Guangyuan	0.1178
8	Luzhou	0.1967	18	Jinchang	0.1324	28	Ya'an	0.1163
9	Yinchuan	0.1876	19	Baoshan	0.1227	29	Lijiang	0.0975
10	Baise	0.1725	20	Lincang	0.1220	30	Wuwei	0.0964

Table 2 The regional distribution of 30 resource-based cities in Western China

Level	Very good > 0.4	Preferably 0.3-0.4	General 0.2-0.3	Not good 0.1-0.2	Bad <0.1	Sum
Western China	1	1	5	21	2	30

Defining by the comprehensive evaluated value, we can ensure the district distribution of the resource-based cities. The result can be seen in table 2.

2.2 Independence test of Western China's resource-based cities and their district

According to the data from table 2, we can get that χ^2 =38.4925. If the significance level is taken as 0.01, the critical value can be check as $\chi^2_{0.01}(12)$ =26.2170<38.4925, which means there are significant correlations between the district which the resource-based city located and their development level under the 0.01 significance level.

Divided according to the resource-based city type published by the state council, combined with the classify result, we can get the result of table 3 by taking the unlisted cities as regeneration type city.

It can be seen that most of the resource-based cities in regeneration stage developed well, the resource-based cities in mature stage developed situation between general and not good, in the decay stage ones developed the worst. And most well developed cities are in regeneration stage, preferable developed cities are in regeneration stage or in mature stage, general and not good developed cities are in mature stage, and the three worst developed cities did not show their life cycle stage obviously.

Classifying the comprehensive developed type, the 30 resource-based cities can be divided them into three kinds, the good ones(including the very good ones and the preferable ones), the general ones(just including the general ones) and the bad ones(including the not good ones and the bad ones). Then it can be seen that there are 23 cities belongs to the bad type which taking 76.67% of the whole resource-based cities, 2 cities belongs to the good type taking6.67% of the whole and 5 cities belongs to the general type taking 16.67% of the whole.

Table 3 types of 30 key resource-based cities in West China

City	Development Stage	Life cycle	City	Development Stage	Life cycle	City	Development Stage	Life cycle
Erdos	A	G	Guang'an	D	M	Baiyin	D	D
Baotou	B	R	Liupanshui	D	G	Hezhou	D	G
Yulin	C	G	Karamay	D	M	Chongzuo	D	R
Chifeng	C	M	Panzhihua	D	M	Shizuishan	D	D
Qujing	C	M	Hechi	D	M	Pu'er	D	M
Bijie	C	G	Wuhai	D	D	Wuzhong	D	R
Hulun Buir	C	G	Zhaotong	D	G	Guangyuan	D	M
Luzhou	D	D	Jinchang	D	M	Ya'an	D	M
Yinchuan	D	D	Baoshan	D	M	Lijiang	E	R
Baise	D	M	Lincang	D	M	Wuwei	E	G

Table 4 The types of 30 key resource-based cities in the West

Development types / Life cycle type	Good	General	Bad	Ctiy number
Regenerative(R)	Baotou		Chongzuo,,Wuzhong, Lijiang	4
Mature(M)		Chifeng, Qujing	Baise, Guang'an, Karamay, Panzhihua, Puer, Baoshan, Hechi, Ya'an, Jinchang, , Guangyuan, Lincang	13
Growth(G)	Erdos	Yulin, Bijie, Hulun Buir	Liupanshui, Zhaotong, Hezhou, Wuwei	8
Decline(D)			Luzhou, Yinchuan, Wuhai, Shizuishan, Baiyin	5
Ctiy number	2	5	23	30
Propotion(%)	6.67	16.67	76.67	100

3. Study on life cycle of resource based cities

The 30 resource-based cities is divided to 8 types.

The first type is the well developed cities in regeneration stage. They are not longer belongs to resource-based cities any more. They have little pressure on urban transformation that they can realize development without resource just by their own established economic foundation.

The second type is the badly developed cities in regeneration stage. This kind of cities is basically located at the area far from centre cities. They are in the stage that the develop pattern is just change from leading by mining industry to finding a replaceable leading industry. Their development are depended on whether an industrial developmental pattern with local characteristic can be set up rapidly, especially with long-term competitive edge relied on science and education, it is the key role on realize the urban transformation. [6]

The third type is general developed cities in mature stage. This kind of cities is far away from large-scale center city where radiation and diffusion effect is not enough. And their resource is pouring into the external of the cities. The press of urban transformation is huge for them. The way of remission is to set up systems and regulations of exploitation and utilization of existing resource, especially the resource protection. And they also need to exploit resource rationally and enforce the integration forward and backward of advantage resource industry to realize chain development or cone type development.

The forth type is the badly developed cities in mature stage. This kind of cities owns relatively single kind of mineral products which has comparably influence and competitiveness within this range of resource. The key point to develop is to work out the inferior position of transportation, communication and urban service. The work will last long for training their internal force of development needs insist in the long round. [7]

The fifth type is the well developed cities in grow up stage. This kind of city is just Ordos, whose economy advanced rapidly with its particularly favorable natural conditions especially full of coal. Besides coal, Ordos is also full of gas and kaolin which reserves 1/3 and 1/2 of the nationwide reservation separately. Within its churchyard, there are 12 categories and 35 kinds of nature resources can be exploited that Ordos is considered to be continuing well develop using its advantageous nature resource. The economy of Ordos gets impact when the coal market is depressed, and its development showed great volatility. The long plan should change the developed pattern from single to various, from extensive to intensive, from spot to chain.

The sixth type is the general developed cities in grow-up stage. The feature of these cities is all take energy minerals as their leading industry. These cities were poor before and the development is rapid. With the disadvantage of the location which is always at the edge of the province and has inconvenient transportation and weak foundation facilities, the development subject to a great degree of control and the influence of the negative factor is still exist up to this time. These cities need to solve the bottleneck of the development progress by enhancing the infrastructure construction to achieve social and

economic integrated development.

The seventh type is the badly developed cities in grow-up stage. This kind of cities is taken up 50% of the whole grow-up cities and their locations are all in the western district. This type of cities is located further compared to the eighth type and are aloof from the coastal area. There are not either distinct resource characteristics, nor have location advantage and the peripheral areas are the undeveloped areas. To achieve the sustained and stable development, the inevitable choice should be building characteristic economy.

The eighth type is the badly developed cities in decay stage. They are raised and declined by the mine. But they all have relatively preferable economy foundation and have advantage in the aspect of certain type of manpower resource and technology due to their glorious past. They should exploit their core capability to achieve relevance and concentric diversified development. [7] [8] [9] [10] [11] [12]

4. Conclusion

The similarity of the resource-based cities is that they are dominant by resource no matter which type of resource-based cities they are. Because of the non-renewable of nature resources, all the resource-based cities will go through the process from input to grow-up and from mature to decay. The urban transformation is a sooner or later issue. When the resource-based cities realized this point, they can take precautions to grasp the timing of transformation and choose replaceable industry by adjusting measures to local conditions. In the mean time, talent reserve work should be done well in advance. The macroscopically policy and preferential policy should be studied and utilized ahead of time that the exhaustion of resource would not result in the urban social economic recession.

The possibility of long and stable development based on natural resources and policy advantage is rare. When the economy developed to a certain stage and a certain degree, a series of phenomenon such as the Dutch Disease, the Resource Curse and the Middle-income Trap can appear. The transportation situation and water conservancy project condition is the two short slabs of western region, and also to the urban and rural infrastructure construction. The government of the western region need serious check up of the work of stage one-laying foundation, and they also need to aquatinted and practice differentiation region development policy[6] [7]~[12].

First, the western region should get started according to the characteristics of resources and its own advantages develop rationally and protect resources, promote resource advantages into economic advantages. Secondly, relying on the progress of science and technology, the western region should develop characteristic economy and advantageous industries with market prospect, cultivating and forming new economic growth point. Thirdly, the western region should accelerate the pace of industrial restructuring, restructuring and transformation, and vigorously develop the three industry of tourism. The western region should rely on reform, opening up and innovation to increase endogenous power, implement the overall upgrading of economic industrialization, mercerization, ecology and regional distribution of specialized areas, and achieve the leap forward of economic growth.

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Research on Architecture and Protocol Technology of New Generation Internet of Things

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Abstract: The Internet of things(IoT) combines sensor technology, embedded computing, Internet and wireless communication technology, distributed information processing technology, and has broad application prospects. Therefore, the revolution of the Internet of things has attracted the attention of the government, academia and industry at home and abroad. There are still many problems in the definition, architecture and key technologies of the Internet of things. Based on the analysis of existing Internet of things research results, this paper discusses the basic concepts of Internet of things from the point of view of system structure and key technology. The five essential elements of Internet of things are summarized. Secondly, the architecture of the system is proposed. Its structure and function are described. Third, the key technologies of the Internet of things, including identification technology, sensor technology, network technology and intelligent technology, are analyzed. Finally, this paper puts forward some suggestions for the development of Internet of things.
Keywords: Internet of Things; Architecture; Key Technologies; Sensor technology

1. INTRODUCTION

As the rapid development of sensor technology, embedded technology, wireless communication technology, high-performance computing and related fields, Internet of Things (IoT) as a new generation of intelligent network came into being. It takes the RFID and the wireless sensor network as the sensation foundation, through the integration of Internet and database technology for data transfer and sharing and using high-performance computing technology to achieve information management and decision-making [1,2]. Internet of Things has obtained the national government and research institutions broad support, IBM proposed the "Smarter Planet", Japan and South Korea proposed the "U-Japan" and "U-Korea" strategy. In view of this, China proposed the “Sensing China". Internet of Things is called the third wave of Internet information technology which after computer, Internet and telecommunications networks.

The paper first analyzes the basic concepts of the Internet of Things, then has a specific research on its architecture and key technologies and summarized the future existing opportunities and challenges finally.

2. WHAT IS THE INTERNET OF THINGS ?

Internet of Things has a great value and development prospects which attracting a wide range of industrial and academic attention. However, the concept, architecture and key technologies of Internet of Things are still in the initial chaotic phase. From now on, researchers are still unable to give a clear concept and structure.

International Telecommunications Union (ITU) believed that IoT is mainly realized the Interconnection which between Thing to Thing, Human to Thing and Human to Human[2], some scholars also proposed other concepts, such as Machine to Machine[3], Cyber-Physical Systems[4], Pervasive Network, Next Generation Internet.

The paper summarized that IoT should have following five features which based on the analysis and research on the IoT concepts.

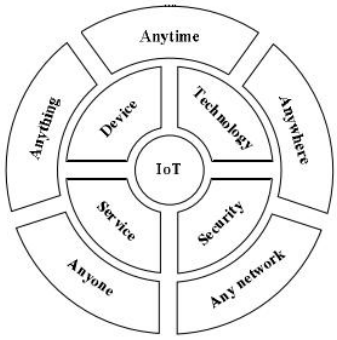

Figure 1 The Internet of Things

First is the things, in IoT, the so-called "Things" will no longer be confined to the traditional range of physical devices, people and other mobile entities will greatly expand the scope of application of IoT, They existing and moving in time and space, we can discovery and identification them by relevant attributes which attach on themselves; Next is sensing, IoT take the outside physical information as a sensing foundation, using RFID and other technologies to realize identification of things, using sensor nodes to achieve dynamic sense of environmental information, then making things with sensing ability and building network by using various wired and wireless network communication technology to achieve information transmission;

Third is connection, it will realize the distributed data sharing by integrating sensing subnets with existing networks. Fourth is intelligence, IoT using high-performance computing technology to achieve intelligent data management, decision-making; Fifth is control, IoT feeding back the decision information to the nodes, then realize the control of things and environment.

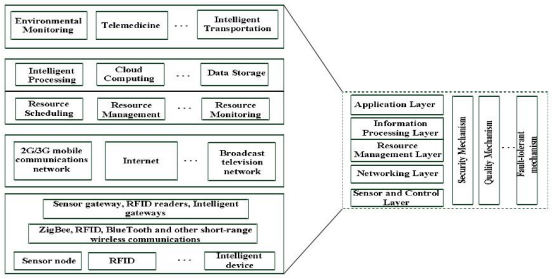

Figure 2 Architecture for the Internet of Things

As shown in Figure 1, in IoT, anyone and anything can seamless integration with any network in anytime and anyplace, to form a real new generation of intelligent information network.

3. A RCHITECTURE FOR THE INTERNET OF THINGS

The architecture of IoT should be an open architecture, using open protocols to support a variety of existing network applications; In addition, it should also include some scalability, security and semantic representation middleware to promote data world integration with Internet. Therefore, by summing up some literature's research work [5~10] and combing with our proposed features of Internet of Things, we try to design this architecture (Figure 2) to guide theoretical research. Model focuses on the qualitative description rather than specific protocol definition, Therefore, IoT should be a five-layer structure, it contains sensing control layer, networking layer, resource management layer, information processing layer and application layer.

Sensing and control layer: It is the foundation of the development and application of IoT, including RFID readers, smart sensor nodes and access gateways, etc. A variety of sensor nodes sensing the relevant information of the target environment and pass it to the nearest gateway, then gateway submit the data which collected via the Internet to background processing platform.

Networking layer: It is mainly responsible for the different types of networks integration, such as Internet, Mobile Communications Network, and Broadcast Television Network. In addition, it will also provide routing, format conversion, address conversion, etc.

Resource management layer: It will provide the initialization of resources, monitoring the operation status of resources, coordination of work between various resources and achieve cross-domain interactions between resources. Information processing layer: This layer realized reasoning and semantic understanding of sensing data, it also provide data query, storage, analysis, mining, etc. Cloud computing could provide a good platform for sensing data storage and analysis. It is an important component of information processing.

Application layer: After analyzing and processing the sensing data, application layer using these data to provide users with a variety of different types of services. IoT application can be divided into network monitoring (logistics, pollution control), control type (intelligent transportation, intelligent household), scanning type (mobile purse, highway no parking fees), etc.

In addition, the IoT should also include some support technologies such as network security, fault-tolerant mechanism and quality control which throughout all levels to provide application support.

4. KEY TECHNOLOGIES FOR THE INTERNET OF THINGS

Key technologies for the Internet of Things as shown in Figure 3 ,such as RFID, IPv6 which responsible for things identification, sensor technology which responsible for the dynamic information sensing, communication technology and network integration technology which realize the information transmission and intelligent information processing technology, they were called four key technologies of IoT.

(1)Identification technology

Internet of Things is a vast network that contains millions of things, various intelligent equipment forms a network through interconnection ways. Therefore, what we first need to solve in the application of IoT is recognition of things. Identification technology is associated with the things, and it is a globally unique value which used to unambiguously identify the object. The essence of identity is encoded and digitize to all things. There are many coding rules, such as EPC coding which used RFID technology, IPv4 and IPv6 which based on TCP/IP. Mapping and compatibility between different coding rules, mapping between coding and service, all these problems need to solve in future.

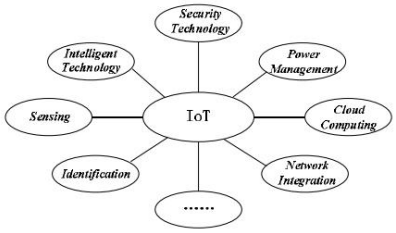

Figure 3. Key technologies of IoT

Radio Frequency Identification (RFID)[11] is a non-contact identification technology, it can automatically identify targets and collecting data through its radio frequency signal which identify process without human intervention. FID tag technology has the ability to uniquely identify the

object which can ensure object located and managed correct in communications and information processing.

IPv6 technology which based on TCP/IP uses stateless address allocation scheme can solve the massive address efficient allocation, it can meet the needs of the vast network address in IoT. What's more, IPv6 protocols take some questions fully into account at the beginning of design, such as mobility, security, quality of service. Although many details of the IPv6 needs further improvement, its numerous characteristics which more suit for IoT will make it become the basis network technology in the future.

(2) Sensing technology

Data generation, access, transmission, processing and application are the important components of IoT. The data acquisition is one of important links; otherwise, IoT is nothing but vain words. In the IoT, based on sensing devices including RFID, sensors, infrared devices, global positioning system devices, the real-time data are acquired to terminal. Sensor can detect external environmental signals, including heat, power, light, electricity, sound and others, they can provide the raw data which for data transmission, processing and application in IoT. It achieved the dynamic information access of things, so that "things" have the ability to sense the external world. Therefore, we can regard RFID, IPv6 technology as the "eyes" of people and sensors can be considered "skin", RFID, IPv6 technology can solve the "Who", that is to achieve recognition of things; Sensors can solve the "How", that is to achieve sensing of things.

The data collection process of IoT mainly through the control of various sensing devices to collect information on the surrounding environment, and transfer the data to the nearby sink node through the corresponding WSN network protocols, at last, delivered to the users of application layer through the Internet. Therefore, the research of the WSN network protocol is a core technology in IoT. The goal of design network protocol is to meet the application requirements while minimizing network overhead, improving system throughput and improving the overall utilization of resources. At present, most research of WSN network protocol focuses on the routing layer and MAC layer.

WSN is a multi-disciplinary overlapping domain [8], in addition to basic network protocols, there should be a wide range of supporting technologies to achieve a variety of applications better in IoT. WSN supporting technologies have the time synchronization, node localization, data fusion, quality of service assurance and network management. In view of the different application scenes, we will set the different request to these support technologies, for example, the multi-sensor collaborative sensing, data compression and integration is established on the basis of time synchronization, localization is mainly used in distance positioning, materials tracking and other fields.

Because of the broadcast nature of WSN in the wireless channel and the characteristics of self-organizing network, node easy to suffer each kind of active threat or the passive attack, then obtain the privacy information which stored in the node. In the future, different applications will have different security needs, for example, in the remote medical environment, users usually don't hope that their own case information is seen by the third party, in the open country environmental monitoring, must guarantee that the node will not come under the deceit attack and collect the false information. Security objectives at this stage mainly depend on the key management, authentication and data encryption. Sensing technology will be a hot spot in the future research of IoT. Because the IoT has its own characteristic which different with traditional network, correlation technique's research must aim at the specific application scene, meets the different design need. In addition, human- based will become a major characteristic in the data sensing of IoT, the human-based sensing will take human participate in the process of information sensing. The human is not only the information gainer (consumer), but also the information participant (provider). Its role's change will cause the new transformation in the future networking deployment and sensing technology.

(3) Communication and network integration technology

The transmission of sensing data in IoT mainly rely on network and communication technology, and the communication may divide into the short distance wireless communication and wide-area network according to the transmission type.

Network integration technology makes full use of different network communication resources, according to different application environment and local conditions, providing a richer network services for users through flexible and efficient networking ways. The future network level of IoT will not be limited to traditional and single network structure. We will eventually realize the seamless and transparent integration for different types of network, such as the Internet, 2G/3G mobile communications network and Broadcasting and Television network. It involves wired, wireless, mobile and other means of access, the unification of heterogeneous network address, conversion, packet format, routing options and other issues. We believe that network convergence should follow the principle of functional separation and hierarchical network, making different terminals in different access modes can share the same network platform, isolating the upper application and underlying

control, shielding the complexity of heterogeneous network. The initial stage of network convergence is build a unified service platform which provides the corresponding interface for each network, gradually forms the network architecture which take the IP Internet as the core, mobile communication network and cable television network coexistent. The ultimate goal of networking is to build a truly unified and open platform which different network boundaries will no longer exists, it will provide broadband, narrowband, mobile, wireless and other access methods, to achieve any time, any place and any network interconnection.

D. Intelligent information processing technology

In the Internet of Things, in order to sense an event, it requires the deployment of many types of different sensing devices to monitor different attributes of the event, and then determine whether the incident occurred through the integration of sensing data. The key technology is how to transform the physical sensing data into the logic data which easy to understand by man and machine. Intelligent information processing technology integrates the intelligent computation, data mining, optimized algorithm, machine learning and so on, we can process and analyze the sensing data through smart technology and deliver the results to the user finally. For example, when we pick up a product in the supermarket, it can back to us some interest information such as the origin of products, structural components which help us better understand the product through intelligent information processing technology. The revolution of IoT is thought injected into the things, so they can communicate with people directly and form an intelligent network finally. How to make "things" have thought, we believe that the key is the introduction of a variety of smart technology. In addition, cloud computing can take full advantage of network computing power to achieve the sharing of resources and services, there are many advantages of cloud computing, for example, virtualization, customization flexibility, high reliability, security, and powerful computing power and storage capacity [12]. Cloud computing can be effective management of huge amounts of data to improve resource utilization and quality of service.

In addition, there are many other key technologies, such as security privacy, service discovery and search, fault- tolerant mechanisms need further study and discussion. Currently, the research for the Internet of things is just beginning, as many problems yet to be resolved, so there is much room for future research.

5. CONCLUSION

Internet of Things brings us a great opportunity, but there also exist many problems at same time, we believe that hinder the development of future IoT will no longer be technical details, but how to realize large-scale application. First is the architecture, protocols and standards. How to coordinate various aspects to formulate a set of standards is urgently.

Second is the industry plan, any good technology, if there is no reasonable planning and business model to support the operation, it is difficult to sustainable development.

Finally is the trade integration, the application of future IoT will no longer be limited to a specific area, it will be a cross-product which between different industry and different disciplines. Only breaking down the regions barriers, and carrying on better communication and integration, Internet of Things will finally succeed.

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Analysis on The way of College Students' Legal Education

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Abstract: College students are the backbone of promoting social civilization and progress and building a socialist country ruled by law. How to strengthen the legal education of college students and explore the effective mechanism of legal education in colleges and universities is an important issue for college educators. The article analyzes the way of college students' legal education from the following four aspects: to effectively change the concept of legal education, to improve university legal educational content, to improve the construction of teachers, to optimize the whole legal educational environment and construct the joint force system of legal education.
Keywords: way; college students; legal education

1. EFFECTIVELY CHANGE THE CONCEPT OF LEGAL EDUCATION

College students are the backbone of promoting social civilization and progress and building a socialist country ruled by law. In the process of carrying out ideological and political education and moral education in universities, colleges and universities have been purposely, systematically and systematically imparting and educating college students with basic legal knowledge, to cultivate a complex type of law talent with legal awareness and legal qualifications that meets the requirements of a modern society ruled by law, which is the main content of college students' legal education. How to strengthen the legal education of college students and explore the effective mechanism of legal education in colleges and universities is an important issue for college educators.

First, university administrators should fully understand the importance and urgency of legal education. Colleges and universities should attach importance to legal education from the strategic height of improving the quality of personnel training. To understand the positioning of legal education of college students correctly, colleges and universities can use the combination of “legal education” and “ideological and moral education” to change the status quo that "legal education" is subordinate to "ideological and moral education" and build a complete and status-independent Legal education system.

Second, one of the main tasks of legal education in colleges and universities is to create a sense of legal awareness and legal system that students should act according to law. Legal education should aim at the characteristics of college students, strengthen the legal awareness of the students, guide students to respect and advocate the law, and guide them to think about the legal issues. In the process of the society going to the rule of law, every college student has the responsibility and obligation to improve his legal quality and improve his ability to defend one's own rights. It is also an important part of raising the law awareness of the entire nation. Legal belief should be the core of university legal education. To enhance the effectiveness of legal education, we should start from changing our concept, and liberate from the simple idea of abiding by the law as the original intention and the end-of-life concept model in the past, and change into cultivating students' ultimate belief in law and training students Legal consciousness as the destination, which is a deeper level of quality education and building a country ruled by law in response.

Third, the legal education and moral education of college students belong to the content of quality education. Therefore, the relevant departments should put the legal education on the same level as moral education and pay more attention to the legal education of college students. First of all, the administrative department of education should separate the basic knowledge of law from "ideological and moral cultivation and legal basis", set up the basic legal courses, and combine them with the courses of ideological and political theory as compulsory courses for college students to set clear educational goals and content to form a more systematic course system. Second, the educational administration should step up its supervision over the legal education implemented in colleges and universities to form educational concepts that affect each other and complement each other in schools, families, and society. In addition, colleges and universities should form an educational concept of mutual influence and cooperation among schools, families and communities. Through the mass media, it has infiltrated all levels and formed the resultant force of cultivating the

legal quality of college students. Actively guiding college students to carry out legal practice activities can effectively cooperate with the theory of legal curriculum teaching, but also allows students to join an open teaching method. Through practical and practical activities, students can experience the law through their personal hands-on experience, deepen the essence of the law and form a true feeling of the law.

2.IMPROVE UNIVERSITY LEGAL EDUCATIONAL CONTENT

First, give full play to the main channel of classroom teaching. To do a good job of legal education for college students, we need our college educators to do a good job in legal classroom teaching. The course of "Ideological and Moral Cultivation and Law Basis" is the main channel for college students to carry out legal education in universities and is the main front for cultivating college students' legal awareness. Therefore, in order to enhance the effectiveness of legal education for college students, we must reform the teaching contents and teaching methods of "Moral Cultivation and Law Basics" and strive to improve the effectiveness of classroom teaching. It is necessary for colleges and universities to revise the teaching content based on "How to Enhance the Legal Consciousness of College Students". While refining the content of the course, teachers must make the main legal knowledge thoroughly explained to the students, enrich the content of classroom teaching, and better mobilize the enthusiasm and initiative of students to learn legal knowledge so as to further enhance the socialist legal awareness of college students.

Second, improve teaching methods and improve classroom teaching effectiveness. In order to improve the teaching effect of the basic course of law, teachers should pay attention to the reform of teaching methods, instruct teaching by changing from one-way infusion of teaching to the method of instilling teaching, give full play to the position and function of the teacher-led and the main body of students, and cultivate the students' learning consciousness. Teachers can use cases teaching, seminars, lectures, class discussions and other colorful, lively forms of teaching, to mobilize the enthusiasm of students and enhance the effectiveness of classroom teaching. In addition, making full use of modern technology, paying attention to the leading role of educators and the main role of educators, arousing the enthusiasm of students, giving play to their subjective initiative and enhancing the appeal and attractiveness of the classroom so as to constantly improve college students' use of jurisprudence to analyze problems and ability to solve problems. But also to increase the interaction between teachers and students in the classroom teaching should give full play to the leading role of teachers and the role of the students to change the "full house" teaching methods, to strengthen the interaction between teachers and students, and change from the boring legal framework to a vivid knowledge of the students, easy to be accepted by students, thus continuing to improve students' interest in learning legal knowledge.

Third, legal education should be combined with moral education and mental health education. Legal quality is an important part of ideological and moral qualities. In quality education, we shouldn’t only strengthen moral education, give play to the educational and guiding functions of morality on human thoughts and actions, but also strengthen the legal education and give play to the mandatory norms of law on human behavior effect. People have strengthened the concept of the rule of law and will accordingly raise moral standards. Therefore, we should not regard the legal basic class as a course of knowledge, and simply teach the students legal knowledge. Instead, we should regard it as a course of ideological and moral education and infiltrate the moral education in imparting legal knowledge. In addition, a large number of facts show that the lack of legal concept and healthy psychology is an important reason why young college students get lost and go astray. This requires that we must organically combine legal education and healthy psychology education. We extensively develop psychological counseling services to college students, and actively carry out psychological counseling activities to develop students' healthy psychology. Psychological counseling is an effective auxiliary form of legal education, which is a deep and scientific work of moral education. The psychology of college students is not yet mature, which easily leads to psychological disorder after being frustrated in study, life and love, and even leads to mental illness or crime. Through psychological counseling, students can effectively get rid of mental difficulties, to avoid unfortunate incidents, and promote their physical and mental health development.

Fourth, combine between legal education and social practice education. Carrying out purposeful legal practice activities is an important part of improving legal education for college students. The effectiveness test of legal education for college students can be reflected in this aspect. It is the most important aspect of legal education to use legal practice to consolidate the knowledge of

books and improve the ability to solve specific problems by legal means. We should combine legal education with social practice education. For example, we can organize students to conduct social surveys, legal knowledge contests, essay writing, establishment of "legal counseling and service" mailboxes, websites, participation in public security and other activities in schools, and enrichment of legal education two classes. Setting up the base of legal practice in practice base has a subtle influence on improving the legal quality of college students. The activities of court investigation, court debates and public hearings in a regulated place are surely more effective than demonstrations or explanations in a common classroom. Students educate by themselves and learn by themself through theory with practice and learning to apply knowledge, which not only increases the learning time, but also actives student ideas, enriches the content, and thereby enhances the effectiveness of legal education.

3.IMPROVE THE CONSTRUCTION OF TEACHERS

Optimizing the teaching staff is the key to legal education. The quality of teachers is directly related to the effectiveness of legal education. Therefore, continuously improving the teaching level of teachers, improving the professional quality of teachers themselves, and strengthening the construction of teachers has become the key to improving the legal education system. The legal education of college students is a comprehensive education of political, ideological, theoretical, informative and practical nature. There must be a contingent of teachers who have received formal training and have a certain theoretical level and practical experience. Colleges and universities may optimize the structure of teachers according to the specific conditions of schools, increase the proportion of middle-aged and young teachers, increase funding and welfare protection, maintain the stability of the contingent, and increase the proportion of highly educated teachers so that the teaching staff will develop toward specialization.

First, improve teachers' training mechanism. Colleges and universities should continue to improve the system of teacher training. On the one hand, colleges and universities should provide certain conditions for teachers' learning and development. On the other hand, colleges and universities should also urge teachers to continuously study and improve their teaching standards. In addition, colleges and universities should enrich teachers' training methods. Through various means such as pre-job training, regular rotation training, taking part in advanced studies and other means, as well as visits, expeditions, exchanges and seminars, teachers can grasp the law of college students' growth, grasp the knowledge and skills of comparatively systematic legal disciplines, update their knowledge structures, improve the legal quality of teachers and legal education, and set a good example for students. Furthermore, colleges and universities can encourage teachers to participate in legal practice and practice their abilities. Schools can establish contacts with courts, law firms, legal aid centers and other institutions, to arrange for teachers to go to these institutions to participate in practice, and continuously improve teachers' practical ability.

Second, continue to improve the teaching quality of teachers. From the teachers' resource, to improve the quality of legal teachers' team is the fundamental guarantee of cultivating the quality of law students. The quality of teachers not only directly affects the effectiveness of classroom teaching of legal education. For college teachers, one is to improve their teaching quality. Law teachers should not only be proficient in legal professional knowledge, but also have a more comprehensive education, teaching and research capabilities, and understand the art of teaching. Only by constantly improving their ability to organize teaching and implementing teaching and improving their ability to use modern educational technologies, can students' interest in learning legal knowledge be stimulated, their enthusiasm and initiative be mobilized, which continuously improves the teaching effectiveness of legal courses. The second is to improve their legal quality. Law teachers in colleges and universities should have comparatively systematic knowledge of legal disciplines and higher legal literacy. Educational administrators also have to consciously learn the law and understand the law. They must become law-abiding officials in all aspects of their work in schools. In day-to-day management, educators should play a leading and exemplary role, conscientiously abide by and strictly implement the laws and regulations of the country and the school's rules and regulations.

Third, optimize teachers' introduction mechanism and evaluation mechanism. Attracting outstanding legal education professionals to the ranks of teachers is a necessary requirement for enhancing the level of teachers. When schools introduce talented people, they can examine the ability of teachers in many aspects. They should not only include knowledge held by teachers, but also teachers' ability to teach and practice. Colleges and universities can also introduce personnel engaged in legal affairs for many years, such as judicial

personnel and lawyers who are engaged in law-related matters all year round. They are familiar with legal knowledge and have strong legal practice, which is conducive to the development of legal education for college students. In addition, the evaluation of legal teachers in colleges and universities is basically based on the test scores of legal basic courses taught by teachers as the main evaluation criteria. Reasonable teacher evaluation mechanism should not only focus on the level of student achievement, but should pay attention to the actual effect of teaching. Students' test scores as a standard to assess the teaching quality of teachers, but also the teachers' scientific research results and practical results can also be into them. Besides, the number of times and results of the teachers' leading students to practice can also be as one of the evaluation indicators, which guide teachers to improve teaching way, and pay attention to the legal practice teaching.

4.OPTIMIZE THE WHOLE LEGAL EDUCATIONAL ENVIRONMENT AND CONSTRUCT THE JOINT FORCE SYSTEM OF LEGAL EDUCATION

First, create a good campus culture of legal environment. College campus is the main place for college students to live and study. The law environment of campus plays an important role in cultivating college students' legal awareness and legal belief. School management according to law is the main means to create a good campus environment. Schools should incorporate the concept of the rule of law and the spirit of the rule of law into daily management. Through the establishment of a sound regulatory system, the management of teachers 'norms, respecting students' right to information and establishing appeal mechanisms and so on, schools should embody the concept of managing schools according to law and create a system of legal educational surroundings.

First of all, according to the law, schools should establish and improve school rules and regulations. Establishing a school-based school discipline that is consistent with the legal requirements is in fact a matter of cultivating students' awareness of discipline. Second, all the work of the school should be handled in strict accordance with the law. The key to the construction of law environment lies in "rule", that is, implementing the system, managing according to law, and acting in accordance with the laws so as to truly achieve "law enforcement and strict enforcement of laws." Furthermore, schools should make the education of legal system run through the campus culture, making the education of legal system normalized, visualized, institutionalized, standardized and rationalized so as to form a conscious, natural and strong culture of campus legal system. Colleges and universities should make full use of the second classroom and social practical activities, to carry out rich campus cultural activities, vivid and intuitive legal education for students. Schools can organize debating contests related to legal issues, conduct legal educational class sessions, legal knowledge contests, moot courtrooms, etc., to actively carry out ideological, knowledge-based and fun activities, publicize legal knowledge, promote the idea of the rule of law, and continuously deepen college students' Legal concept.

Second, purify the social environment of legal education. First of all, it is necessary to intensify the efforts to comprehensively control the surrounding environment of the campus. Schools can be associated with the local police station, start regular patrols around the campus, and set up security pavilions, to strictly control the flow of non-school personnel to the school so as to ensure the personal and property safety of the students. We will resolutely ban illegal books, games halls, dance halls, bars, chess and card room and other places that are not conducive to the physical and mental health of students at home and abroad to provide a good environment for the study and life of college students.

Third, purify the network educational environment. Under the premise of respecting the laws and regulations, colleges and universities should strengthen the supervision of the school network, purify the cyberspace and strengthen the education of laws and regulations on the Internet so as to enable students to have less access to bad information while surfing the Internet, receive more correct guidance, promote civilized and science surfing, and resolutely abandon the use of the Internet for criminal activities. Colleges and universities should set up a special network monitoring team to screen the network information to help students resist the intrusion of bad information. Colleges and universities should also use information technology to create a new platform of legal education, which uses the Internet to provide services for college students to live and study. In addition, the construction of campus network environment should follow the rules of network communication, correctly guide the online public opinion, make bigger and stronger positive publicity, and guide the students with correct public opinion to form the online mainstream public opinion with high spirits.

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Research on Optimal Game Map Path Based on Heuristic Search Algorithm

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Abstract: The algorithm used most frequently in map routing is the heuristic A* algorithm, but the standard A* algorithm has shortcomings in the optimization of data structure. In this paper, A* algorithm is improved. Firstly, according to the characteristics of the game map, the improved method of A* algorithm added direction factors. The method reduces the searching time and the number of traversing nodes. Secondly, the OPEN table storage structure is optimized using the least binary heap, improving the efficiency of the algorithm. Finally, the method is feasible and effective comparing the standard A algorithm and improved A* algorithm.
Keywords: A* algorithm, OPEN Table, Direction factors

1. INTRODUCTION

Path search has always been the most practical and core application in artificial intelligence games. For example, in all kinds of games, players must control their own direction to be able to pass all kinds of terrain, avoid obstacles, find players and play against them. There are many examples of such games. The search for the map path is the status space search. The common methods include blind search and heuristic search, and blind search includes two methods, depth priority and breadth priority, which represent algorithm Dijkstra algorithm and Floyd algorithm. Heuristic search has gradually become the mainstream path search algorithm. The heuristic search is the search in the state space to evaluate each search location, get the best position, and then search from this location until the target ignoring a lot of useless search paths and improving efficiency. The typical heuristic search algorithm is A* and IDA *, which are considered to be the two main path search algorithm in game artificial intelligence[1]. Because A* algorithm takes up less memory, this paper chooses A* algorithm as the main path search algorithm. The main problem in this paper is how to avoid obstacles and find the shortest path in the shortest time.

2. IMPROVED A* ALGORITHM

The evaluation function is the core of A* algorithm, and the proper valuation function will allow the path search process to traverse fewer nodes, save the space of the node storage, and also reduce the search process indirectly. In the valuation function, G(n) which represents the cost of the starting node to the current node is certain, thus the main weight in the evaluation function is the heuristic function H(n). There are many ways to evaluate the value function H(n) including Manhatta Distance, Diagonal Distance and Euclidean Distance and so on. Because of Euclidean Distance <Diagonal Distance < Manhatta Distance, the Manhatta Distance is the longest[2][3]. In the experiment map with square grid, the direction of the square grid map is not arbitrary, and the calculation cost of Euclidean distance is the highest. Therefore, the reference heuristic function is chosen as Diagonal Distance, and improved and verified.

(1) THE HEURISTIC FUNCTION WITH DIRECTION

In the heuristic function, the more advantageous the choice of optimal path with the more constraining information. In the standard heuristic function, only the heuristic information about the distance of the destination node is emphasized. However, the angle is also very enlightening to the approach. The path away from the origin can not be optimal. The calculation of the introduction angle must consider the inspiration information of the parent node. Therefore, this paper proposes to increase the enlightenment information of the angle of search, as follows:

$$F(n) = G(n) + Hd(n) + k\theta \quad (1)$$

$$H_d(n) = \sqrt{2}|x_s - x_m| + |x_m - x_d| + |y_m - y_d| \quad (2)$$

$$\theta = \arctan\left|\frac{k1-k2}{1+k1.k2}\right| \quad (3)$$

$$k1 = \frac{y-y_s}{x-x_s} \quad (4)$$

$$k2 = \frac{y_d-y_s}{x_d-x_s} \quad (5)$$

If the starting node is S (x_s, y_s), the destination node is D (x_d, y_d), node M(x, y).In formula (2), Hd(n) is the Diagonal distance between the current node M and D node.In formula (3), Θ between MA and MD is generally a smaller value. In order to effectively increase the weight of the Angle heuristic information in the evaluation function, and increase the amplification factor k, the value is designed according to the real map grid size and the length of the path distance.

(2) OPTIMIZE THE OPEN TABLE STORAGE STRUCTURE

The most time cost in A* algorithm is to find the node with the smallest value of F(n) in the OPEN table[4]. The solution is to sort out the nodes in the OPEN table based on the value of the F(n), so that the OPEN table is kept in an orderly fashion and the search

efficiency is high because of a large number of nodes in the game map, while at the same time it takes more time to plug in the node because of inserting a new node which is put it in the right place to ensure that the OPEN table is in order[5]. In the A* algorithm, the minimum node of F(n) in the OPEN table is searched every time[6]. The binary heap will to be stored as a one-dimensional array, as shown in Fig.1. An array open L [x,y] is created, and the top node of the minimum binary heap is stored in open L [0]. All nodes are stored in this order. It will be continued to add new nodes to the OPEN table in search of the path. when a new node n is inserted into the heap, first a null node will be created in the next idle position in the heap. If the i is placed in the hole without destroying the sequence, the insert operation is completed. Otherwise, the node which is the parent of the hole elements is moved to the hole, thus the hole will be a step in the direction of the node until i can be into the hole and do not destroy the stack sequence.The process of removing the node and adding the node is the reverse.

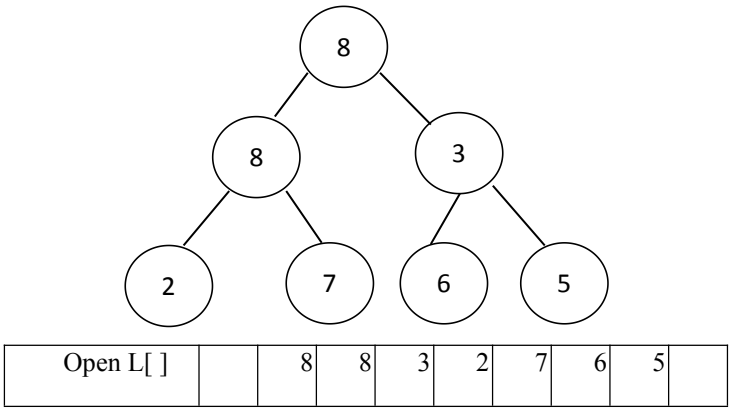

Figure 1 Storage structure of the minimum binary heap

(3) ALGORITHM IMPLEMENTATION

The specific algorithm is as follows:

(1) 200 nodes will be input the datebase.

(2) A simulation experiment map of 200 nodes randomly is generated.

(3) The nodes coordinate and the connections between nodes are randomly generated.

(4) Put the starting node S into the OPEN list, and the connection between S and destination D is marked as SD.

(5) The node S is removed from the OPEN table and put in the CLOSE table. Use the minimum binary heap to rearrange the OPEN table.

(6)The node A and B near node S are put into the OPEN table. The angle of SA and SD markesαand the angle of SB and SD Angle areβ.

(7) $F(n)_1$ and $F(n)_2$ will be calculated respectively by puttingαand β into equation (1).

(8) Compared $F(n)_1$ and $F(n)_2$, the smaller F(n) is used as the next iteration node.

(9) The distance of path and the time of each algorithm are recorded.

(10) If the number and condition of the experiment are satisfied, the data is counted, otherwise the data will be returned.

3. EXPERIMENTAL RESULTS

The A* algorithm has made two improvements in the paper. The improved valuation function can increase the information of heuristic constraints, reduce the number of traversing nodes, and improve the utilization of memory.

According to the 7 groups data, the standard A* algorithm and improved A *algorithm are compared in time and the number of traverse nodes. The experimental results are as follows:

It can be seen that heuristic information with the angle can significantly reduce the number of traversing nodes, and when the search is more complex, the extent of node traversing decreases. The same search efficiency has also been greatly improved. The most cost part of A* algorithm is to find the min F(n) in the OPEN table. The OPEN table is stored with a minimum binary heap optimization structure in this paper. The node is removed from the top of the heap efficiency and the insertion node in the binary heap structure is higher than the other efficiency. The experimental results are shown using the minimum binary heap to optimize the OPEN table storage structure in table 2.

TABLE I
EXPERIMENTAL DATA OF TWO PATH SEARCH ALGORITHM

Group No	Standard A* algorithm		Heuristic information with angle
	Time(ms)	Number of traversing nodes	Number of traversing nodes

1	0.654	411	368
2	0.453	345	299
3	0.123	234	211
4	0.234	276	236
5	0.678	456	379
6	0.345	301	278
7	0.565	434	378

TABLE II
EXPERIMENTAL DATA

Group No	Standard A* algorithm (Time：ms)	Optimization of OPEN table the minimum binary heap (Time：ms)
1	0.654	0.443
2	0.453	0.325
3	0.123	0.078
4	0.234	0.101
5	0.678	0.534
6	0.345	0.200
7	0.565	0.401

It can be seen from the Table2 that the improved A* algorithm can not only effectively reduce the number of nodes, but also improve the efficiency of the path search. The optimization of OPEN table can reduce the average length of searching time. The experiment verifies the feasibility of this method in the game finding path. On the other hand, the disadvantage of this method is that the result might not be the optimal path.

4. CONCLUSION

Evaluation function of the improved A* algorithm with the angle can reduce the map traverse nodes and optimizing the storage structure of OPEN table toimprove the algorithm efficiency. In the application aspect, according to the characteristics of the game map, the improved A* algorithm is designed after analyzing theoretical feasibility drastically reducing the length of the search. However, the experimental map of this paper only has flat ground and obstacles in addition to increasing topographic loss. The cost of moving in real game development is different. For example, the swamps, hills, and dungeons are supposed to require higher mobile costs than flat and open spaces. The research of the algorithm will be improved better in the future.

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A Brief Analysis of Construction of China-Northeast Asia Geo-channel Pattern

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Abstract: In the 21st century, northeast Asia has become an eye-catching development area in the world.China, which is located at the core of northeast Asia, is full of opportunities and challenges. The construction of China-Northeast Asia Geo-channel pattern is a crucial approach to seize the opportunity of development and confront challenges. The good Geo-channel pattern is the basis of superior status in the northeast Asia geographical pattern. The paper starts from the connotation of geographical pattern and makes an analysis of China-Northeast Asia Geo-channel pattern from two aspects including the construction of port system and channel system, aiming to provide some references for China to enjoy a good status in the northeast geographical pattern.

1. THE CONNOTATION OF GEOGRAPHICAL PATTERN

Geographical pattern is the situation and prospect in which Geo-entities (countries or regions adjoining in space or relatively related in space) form relatively stable interrelationship, restrain each other, compete with each
other and cooperate and collaborate with each other within certain temporal and spacial dimension, based on national interests and long-term development strategy.

The improvement of Geo-channel pattern will influence the formulation and implementation of domestic and diplomatic policies, the approach and means they adopt for foreign-related activities, and result in the new Geo-political and Geo-economic relationship pattern.

China is a great power in Asia with both land and marine territory, with 20 neighboring countries, including 14 neighboring countries on the land, and 6 neighboring countries on the sea. These countries vary in state system, military force, development extent and religious belief, and some countries have obvious grudge and dispute over territory and history and conflict and confrontation brought about by various factors. The four areas of the five acknowledged geographical regions with potential conflict, including Taiwan Strait, North Korean Peninsula, Central Asia and South Asia subcontinent which are all located around China, besides the Persian Gulf in the Middle East; China is also bordered with great powers such as Japan, Russia, India , America and Association of Southeast Asian Nations, enclosed by island chains on the sea. These factors contribute to the special geographical location of China. Among great powers in the world, China is considered to be one of the countries with the most complex geographical environment. Therefore, it is of great theoretical and practical significance to study Geo-channel pattern.

2. THE SYSTEM OF BORDER PORT

There are 73 foreign border ports in China open to the surrounding countries and they function as bridges and geographical channels connecting China and surrounding countries, thus creating the relative mechanism of geographical cooperation between China and surrounding countries.

There are 27 border ports connecting China and the neighboring countries, including 6 Sino-Russian ports, which are Hunchun Port, Heihe Port, Suifenhe Port, Manzhouli Port, Heishantou Port, Shiwei Port; 6 Sino-North Korean ports, which are Dandong Port, Tumen Port, Kaishantun Port, Sanhe Port, Nanping Port and Linjiang Port; 15 Sino-Mongolian ports, including Erenhot Port, Arihashate Port, Zhuengadabuqi Port, Ganqimaodu Port, etc., to name just a few, as is seen in Diagram 1-1.

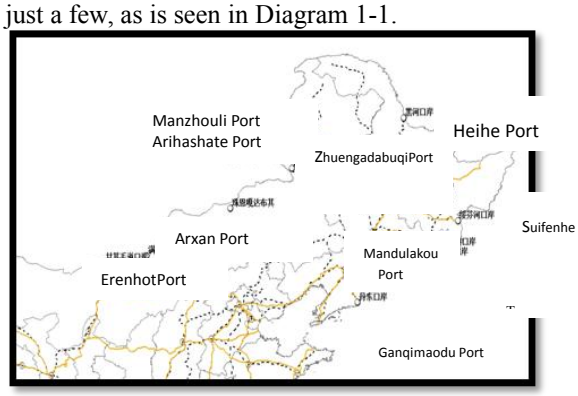

Figure 1 Diagram 1-1 Distribution Diagram of China-Northeast Asia Border Ports

A. China-Russia Border Ports

The trade volume of China-Russia border ports including Hunchun Port, Heihe Port, Suifenhe Port, Manzhouli Port make up a relatively large portion, playing a crucial role in the six border ports.

Hunchun Port, also named Changlingzi Port, belongs to the first-class port of China. 15 km away from Hunchun City, it is the only land border port open to Russia in Jilin Province. It is 42 km away from Russian Posyet Port, 71 km away from Russian Zarubino Port, 170 km away from Vladivostok Port.

The exports are mainly food, mechanical and electrical products, timber, textile products, construction materials, light industrial products, while the imports are mainly mechanical and electrical products, timber, steel, chemical fertilizers, sea food. With the improvement of infrastructure in the port, people enjoy more smooth and convenient entry and exit channels, creating a situation of large-volume import and export.

Heihe Port is also the first-class port of China. It is located in Heihe City, facing Blagoveshchensk City (provincial capital of Amurskaya Oblast Russia) across the river. As is seen from the annual structure of imports and exports, the exports are mainly garments, mechanical and electrical products, agricultural products and spin-off products, plastic products, steel products, high-tech products, ceramics for decoration, etc. The imports are mainly crude oil, fertilizers, refined petroleum, timber, iron ore, converted timber, paper pulp, synthetic rubber, coal, craft paper, plastics in primary shape, etc.. The trade volume of the port is increasing steadily in recent years, in which the imports play a prominent role.

Manzhouli Port is located in the west of HulunBuir Prairie Inner Mongolia, at the triangle zone of China-Russia-Mongolia with Russia in the north and Mongolia in the west. It is the transportation hub of the first Eurasia Land Bridge, the vital international pathway connecting China and the Commonwealth of Independent States and European countries, the largest land border port of China. The volume of the freight in the port ranks the first among other ports of the same type.

Through years of development, the mode of foreign trade in Manzhouli Port has become diversified, with petty border trade accounting for a large proportion, various modes of trade such as general trade, processing trade, tourism trade side by side. As for commodity structure, the imports of Manzhouli Port has turned from waste and old materials in 1991 to the resource-based commodities at present such as timber, paper pulp, chemical fertilizers, base oil and iron ore, etc.

B. China-North Korea Border Ports

Dandong Port is located in Liaoning Province, southeast of the open economic zone of Liaodong peninsula and central area of northeast Asia. The exports from Dandong are mainly mechanical equipment, textile raw materials and shell fabrics, cereals, chemical products, mineral construction materials, timber. The imports cover coal, metallic mineral, crude oil, minerals, aquatic products, dried vegetables and nuts, timber. The trade volume of the port is going up rapidly. Compared with Dandong Port, the trade volume of Tumen port is relatively small. The exports are mainly mechanical and electrical products, refined petroleum, spinning yarn, steel, daily necessities and cereals. The imports are mainly timber, billet, aquatic products and mineral products. Changbaishan Port is also the first-class port of China. The category of exports and imports are similar to that of Tumenjiang Port. Kaishantun Port is located in Kaishantun Town which is 38 km from the east of Longjing City, facing Sanfeng District, Onsong County, Hamgyeongbukdo North Korea across the river. The annual freight amounts to 100,000 tons and annual passengers amounting to 50,000 persons. Moreover, there are Sanhe Port, Quanhe Port- Yuanting Port and Guchengli Port.

C. China-Mongolia Border Ports

China-Mongolia border ports are mainly Erenhot Port, Arihashate Port, Zhuengadabuqi Port, Ganqimaodu Port and Takeshiken Port. These crucial ports mainly import bulk cargo such as copper ore powder, timber, iron ore, base oil, zinc ore powder and containers and export construction materials, mechanical and electrical products, chemical products, agricultural products and spin-off products, etc. The trade volume is mounting up in recent years.

3. The Construction of Channel System

The Northeast Asia Corridor is the longest of the Four Corridors, lasting 32,500 km, connecting Europe and Pacific Ocean. It starts from Germany, through Poland, the Republic of Belarus, Russia, Kazakhstan, Mongolia, China, stretching to the East End--- North Korea. The Siebra Railway lasting 9,200 km can carry large quantities of goods from northeast Asia through Moscow to Europe. China is located at the crucial part of the corridor and the good construction of Geo-channel will not only contribute to the development of China, but also drive the joint development of the region.

A. The Channel of Sea of Japan

In 19th century, China lost the access to the port leading to the Sea of Japan. The provinces of northeast China, Jilin and Heilongjiang Province which enjoy abundant resources and strategic positions lost the exporting port. Renting the Rajin Port further presents that China would like to develop it into a crucial trade portal connecting Northeast Asia Geo-entities including Russia, North Korea, South Korea and Japan.

For years, Jilin Province has persistently pursued the strategy of “Renting Port for Shipping” Continuously promoted the practical cooperation with surrounding countries, and fastened the pace to the world by the ports of Russia, North Korea, South Korea and Japan. Yanbian prefecture has a borderline of over 700 km, along which there are 11 border ports open to Russia or North Korea and one international airport. 10 ports of Russia and North Korea have been dotted in the section (with Hunchun City which is the only border city of China along the Sea of Japan as the center and a radius of 200 km). Therefore, Yanbian Prefecture plays a particular role in Chinese coastal pattern of opening to the outside world and is located at the center of northeast Asia. At present, with advancing of the channel construction step by step, the

hinterland “Changbaishan-Jilin-Tumen” increasingly plays its supporting role. The exports from Hunchun City will be transported to South Korea and Japan through Russia (Zarubino Port, Vladivostok Port andPosyet Port) or North Korea (Rajin Port, Chongjin Port). The distance between the ports are within 500 nautical miles. Hunchun is not only the only channel for China to access the Sea of Japan and the closest approach to reach Russia, eastern coast of North Korea, western coast of Japan, or even to North America or Northern Europe.

Renting port is not a new approach. China has committed to it for over 20 years. What matters is not whether to open the channel of the Sea of Japan, but to open it as fast as possible. Jilin Province is carrying out the development project of Tumenjiang Region, with the prerequisite of opening the channel of the Sea of Japan, trying to turn the closed Yanbian Prefecture in to the frontier open to the outside world so as to create a situation of interaction among Japan, South Korea, North Korea and Russia. According to the media of North Korea, if one takes the railway (with Rajin Port at the starting point) from Kobe Port or Niigata Port of Japan to Rotterdam in Europe, it will take him three days less by traveling the west Siberia Railway from Vladivostok Port, nine days less by taking marine transportation through marine transportation through Suez Canalz Canal and eighteen days less by taking marine transportation through Capetown.

B. Hunchun-South Korea Geo-channel

The transportation channel from Hunchun City to North Korea is mainly the secondary road from Quanhe Port China to Rajin Port North Korea, lasting 53.35 km, taking 45 min. There are three railways connecting China, Russia and North Korea, including Tumen- Nanyang North Korea- Tumen River-Hasan Russia, lasing 127 km; Tumen- Huining North Korea- Chongjin North Korea, lasting 171.1 km; Tumen- Nangyang North Korea- Rajin North Korea, lasting 158.8 km. Moreover, the cross-border bridge (Quanhe Port Hunchun China- Yuantingli Port North Korea) has been consolidated and the QuanheHunchun- Rajin Port North Korea road has been put into use.

C. Russia-North Korea Channel along Sea of Japan

In recent years, Rajin North Korea- Hasan Russia railway has been put into operation. The connection of North Korea and Russia railway meets the mutual development and benefit, sets an example for large-scale bilateral cooperation, and will become the reliable transportation portal for friendship and for connecting Europe and Asia. Russia has carried out the specific reform of track width of high standard in order to meet the requirements of the railways in both countries, costing 260 million US Dollars for railway of 54 km. In return, North Korea gives Russia 49 years’ right to use the railway. The railway connects the North Korean Peninsula, and it is helpful for improvement of relationship between South Korea and North Korea, consolidating peace and stability of North Korean Peninsula.

D. China-North Korea Yalu River Channel

In February 25th2010, China and North Korea has signed the Agreement of Joint Construction, Management and Maintenance of Yalujiang Boundary River Road Bridge. Sino-Korean Yalujiang Boundary River Road Bridge is located in the new urban district of Dandong, with four lanes to and fro, costing China over 1 billion RMB, and it is of great significance for the economic and trade breakthrough. At least 70% of the trade volume between China and North Korea rely on the transportation network which connects Dandong China and Xinyi North Korea. It has been one of the most important projects to invest in construction of infrastructure. Undoubtedly, the construction of Yalujiang Bridge is closely related with the development of Dandong in the project of rejuvenating Northeast China.

Geographical position is the relation between geographical factors and the relative space, in which the channels function as the bond and the ports are the nodes of relation. Therefore, the channels and ports are the basis of Geo-channel pattern, the adhesive for Geo-entities. Different parts of Geo-entities rely on each other through Geo-channel and interconnect in time and space. In a word, the unique Geo-channel pattern, the geographical location contribute to Geo-China.

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An Empirical Study on the Relationship between Equity Structure and R&D of GEM Listed Companies in China

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Abstract: In this thesis, theoretical analysis and empirical research methods were taken to explore the impact of ownership structure on corporate R&D investment in GEM. Firstly, from the theory of the relationship between the two to sort out and discuss in order to putting forward relevant assumptions, then we take the methods of descriptive statistics, correlation analysis and regression analysis to empirical testing. Finally, the study found: (1) the GEM high overall level of R&D investment; (2) When in a relatively controlled state, the ratio of the largest shareholder and corporate R&D investment showed a significant negative correlation; (3) the development of state-owned enterprises investment intensity is slightly stronger than the non-state-owned enterprises; (4) the ratio of R&D investment executives shareholding relationship was not significant. Based on these conclusions, we propose to incentive R&D investment of the enterprises.
Keywords: GEM; Equity Structure; R&D; Empirical Study

1. INTRODUCTION

Since the two separations of powers [1], the ownership structure has become an important factor affecting the efficiency of corporate governance. And many scholars begin to pay close attention to equity structure will affect and how to influence corporate R&D behaviors, but whether it is from the point of theoretical deduction and empirical test results, equity structure and is not a single linear relationship between R&D, but more complex curve relationship [2].Appear this kind of fuzzy relations may have two reasons: one is the theoretical framework of build problems, most scholars pay more attention to when demonstrate the relationship between the variables between the mechanism of action of [3] [4], such as equity concentration produced by the balance between private income and supervision cost mechanism [5], the state-owned holding company on R&R investment decision-making problem of low efficiency [6][7].However, these studies ignore the matching relation between variables and ignore the strategic implications of the ownership structure. For example, if it is proved to be a low-efficiency equity concentration and state-owned shareholding, will it be effective if combined? That is to say, the three dimensions of the equity structure: the matching of equity concentration, equity nature and ownership balance can affect the relationship between variables. And that research is now being ignored. Is the empirical research on the other hand, most of the research sample selection focus on a-share listed companies, and because of the influence of R&D disclosure and corporate strategy comparison between R&D activities. The reason is mainly because: (1) The evaluation index is different. For example, in the selection of ownership concentration, some will give priority to the shareholding ratio of the largest shareholder, while some will choose the shareholding ratio of the top five shareholders. (2) The selection of samples is different. The size and industry of the company will affect the analysis results and draw different conclusions. (3) Different research methods. Including case analysis, regression analysis with least squares method, principal component analysis, etc. The selection of these methods also affects the research conclusions. The better treatment of the above problems is to select the sample of the GEM listed companies that are more active in R&D activity [8][9].Combining above two points, this article selects the GEM listed companies as research samples, discusses the relationship between ownership structure and company R&D, this undoubtedly can supplement relevant research literature from theory, and more important to give the company on R&D strategic guidance.

2. THEORETICAL BASIS AND RESEARCH HYPOTHESIS

Relationship between ownership concentration and R&D investment

The principal-agent theory proposed by Jansen and Macklin [10] suggests that, in the case of highly decentralized ownership, individual shareholders hold few shares and lack the motivation to supervise operators. In this way, the operator of the

company loses effective supervision and becomes the actual controller of the company. On the other hand, for managers, they are not the real owners of the enterprise, but are entrusted by shareholders to operate. Because of the asymmetry of information, even when he does his best, he will be questioned by shareholders because of poor business performance. In addition, managers are term limits, in order to improving the management of their tenure performance, in exchange for its higher reputation in the talent market, they will be more inclined to choose to short-term profits and it's easy to quantify. Research and development investment as an enterprise is difficult to quantify and is difficult to profit in the short term, not easy to be favored by managers. Therefore, when the enterprise equity is highly dispersed, the R&D investment level of the enterprise is low [11].

At the same time, entrust theory, with the further increase of the first big shareholder shareholding, the second principal-agent problems began to emerge, namely big shareholders infringe on the interests of small shareholders. Because master quite a proportion of shares of major shareholders have enough strength and power to control the company's management, managers to a certain extent, are subject to the will of the majority shareholder, other small shareholders because shares are too scattered, cannot unite contend with major shareholders. At this time, due to lack of enough, due to the higher pursuit of self-interest, big shareholders to use their right to carry on some beneficial for their own rights and interests, this kind of activity is often damage the interests of small shareholders or the company's premises. In this case, the positive incentive to ownership is overwhelmed by the negative incentive to be stolen. Research and development investment will also decrease with the increasing degree of ownership concentration.

Based on the above analysis, the following hypotheses are proposed:

H1: When other conditions are equal, the shareholding ratio of the largest shareholder is negatively correlated with the R&D investment in the enterprise when the equity is more concentrated.

The relationship between equity property and R&D investment

Coase[12]believes that the property owner of the private enterprise enjoys the surplus profit and the right of the owner. The property owner has a strong incentive to constantly improve the efficiency of the enterprise. But for the state-owned holding company, not only to profit as the goal, they and their management affects the local economic, social, employment, and many other social aspects, finally to achieve other goals may sacrifice profits maximization of financial goals, corporate R&D activities have become relatively minor. In addition, according to the principal-agent theory, the emergence of large shareholders can restrain the behavior of managers and promote R&D investment. However, when the majority shareholder is a state-owned legal person, due to the objective reasons, there will be a situation of insufficient supervision of the effective shareholding of state-owned shares[13][14].On the contrary, it is different for non-state-owned listed companies. In most non-state-controlled listed companies, the business objectives are for profit and long-term development. In order to achieve this goal, operators and managers are more willing to invest more in R&D.

Based on the above analysis, the following hypotheses are proposed:

H2: Under the same conditions, non-state equity is more likely to promote R&D investment than state-owned shares.

The relationship between executive ownership and R&D investment

According to agency theory, as the owner of the company, shareholders tend to maximize the long-term value of company, willing to take risks in order to obtain the corresponding high returns, so they are willing to accept the R&D. On the contrary, managers tend to be conservative in their attitudes to risk, because they care about the safety of their personal work and their reputation in the workplace, in addition to their interests. For managers, research and development is a high-risk activity. Because the company involved a lot of research and development expenses and resources in the process of R&D activities, the short-term profit and cash flow were reduced, and the manager could not account to the shareholders on paper. The most important point is that when the project is successful, the benefits are owned by the shareholders, but once the R&D activity fails the manager has to bear the consequences, including the possibility of being fired. As a result, the manager for its own sake tends to increase the profit of the current period direction, and ignores the R&D activities can bring long-term profitability, reduce the current R&D[15]. Managers to overcome the short-term oriented, agency theory put forward by design risk incentive mechanism to motivate managers, agency theory is that the executives shareholding is the internal incentive mechanism to solve the problem of principal-agent. Executives shareholding interests can be unified with the wealth of shareholders and

company, making it more actively pay attention to the long-term interest of the company, to a certain extent, can reduce the opportunism behaviors in R&D investment manager. Therefore, the shareholding of senior executives can lead to the initiative to pay attention to and increase the R&D investment which is beneficial to the long-term development of the company. The higher the shareholding ratio, the larger the R&D expenditure of the company will be.

Based on the above analysis, the following hypotheses are proposed:

H3: In the same circumstances, the proportion of senior executives' ownership is positively correlated with R&D expenditure.

3. RESEARCH DESIGN

A. Sample selection and data source

Sample selection. In this paper, the company that disclosed R&D investment from 2011 to 2012 in China's Shenzhen stock exchange is a research sample. Select samples, in turn, take the following methods: first of all, selected in 2010 during the listing and can provide two years from 2011 to 2012, the company's annual financial report GEM listed companies, and on this basis, according to the following standard sample for the screening of: (1) excluding data of listed companies;(2) and a listed company that has been issued a reserved opinion or negative opinion audit report;(3) exclude ST and * ST. Finally, through the above screening, there are 143 listed companies listed in Shenzhen with 286 sample data.

Data sources. In this paper, the data of GEM listed companies used in the research are collected by hand, mainly from the annual financial report disclosed by the listed companies on the Shenzhen stock exchange website. Other data were obtained through the giant tidal information network and confirmed with data from the Shenzhen stock exchange startup board to minimize the error.

B. Selection of variables

In the selection of variables, this paper is based on the experience of Zhao Liwei et al.[16]

Selection of dependent variables. R&D: in this paper, the selection of corporate R&D intensity (R&D/revenue) and R&D investment in the two measures as indicators of R&D spending, relative and absolute value from the R&D input is to enterprise's R&D activity, expressed in RD1, RD2, respectively.

Selection of independent variables. Concentration degree of equity: select the proportion of shareholding ratio of the largest shareholder as a measure, and use C; Equity attribute: this paper focuses on the influence of the first major shareholder on R&D investment, which is expressed by GQXZ. If the last controlling shareholder class of the largest shareholder of the enterprise is a state-owned stock, it is assigned 1, otherwise it is 0; Executive ownership: the ratio of the shareholding of senior managers to the total number of shares in the company, which is represented by GGCG.

Select the control variables. Enterprise scale: the natural logarithm of business revenue is measured by the natural logarithm of the enterprise, and the SIZE is expressed; Liability ratio: the ratio of total liabilities of the company to the total assets of the ending assets is measured in LEV.

The variables of this paper are defined as follows (table 1):

TABLE 1 VARIABLE DEFINITION

Variable Types	Variables	Code	Variable Definition and Measurement
Dependent Variables	R&D Investment Intensity	RD1	R&D Investment/Operating Income
	R&D Investment Scale	RD2	R&D Investment Amount
Independent Variables	Equity Concentration	C	Shareholding Ratio of First Major Shareholder
	Equity Attributes	GQXZ	The Actual Controller is 1 When it is State-owned, Otherwise it is 0
	Executives at Stake	GGCG	Executive Share/Total Number of Shares
Control Variables	Enterprise Scale	SIZE	Natural Log of Revenue
	Debt Ratio	LEV	Total Liabilities/Total End Assets

Data Source: According to the Relevant Data of Zhao Liwei[16].

C. Empirical model design

The empirical model is as follows:

In order to examine the impact of ownership concentration on the investment intensity of enterprise R&D, model (1) is adopted.

$$RD1 = \alpha_0 + \alpha_1 C + \alpha_2 LEV + \alpha_3 SIZE + \varepsilon$$

In order to check the influence of ownership concentration on the scale of enterprise R&D investment, model (2) is adopted.

$$RD2 = \alpha_0 + \alpha_1 C + \alpha_2 LEV + \alpha_3 SIZE + \varepsilon$$

In order to examine the impact of equity nature on

enterprise R&D investment intensity, model (3) is adopted.

$$RD1 = \alpha_0 + \alpha_1 GQXZ + \alpha_2 LEV + \alpha_3 SIZE + \varepsilon$$

In order to examine the impact of equity nature on enterprise R&D investment scale, model (4) is adopted.

$$RD2 = \alpha_0 + \alpha_1 GQXZ + \alpha_2 LEV + \alpha_3 SIZE + \varepsilon$$

Mode l(5) is used to test the influence of executive shareholding ratio on enterprise R&D investment intensity.

$$RD1 = \alpha_0 + \alpha_1 GGCG + \alpha_2 LEV + \alpha_3 SIZE + \varepsilon$$

In order to test the influence of the proportion of senior executives on the scale of R&D investment, the model (6) is adopted.

$$RD2 = \alpha_0 + \alpha_1 GGCG + \alpha_2 LEV + \alpha_3 SIZE + \varepsilon$$

4. EMPIRIVAL TEST AND ANALYSIS

A. Descriptive statistical analysis

Table 2 is a sample of the distribution of the controlling shareholder properties, can be seen from the table, there are 93% of the sample company belongs to the non-state-owned holding listed companies, in Shenzhen GEM listed companies in our country are private companies

.TABLE 2 SAMPLE DATA DISTRIBUTION （N=286）

	Frequency	Ratio	Effective Ratio	Cumulative Ratio
0	266	93.0	93.0	93.0
1	20	7.0	7.0	100.0
Total	286	100.0	100.0	

Table 3 is a sample of each variable descriptive statistical results, including (RD1) to enterprise's R&D strength, enterprise R&D investment in the (RD2), the first big shareholder's stake, executives shareholding rate, equity attributes, enterprise, enterprise size of maximum, minimum, mean and standard poor indicators of statistics. It can be seen from the tables that there are differences between the various variables of the enterprise, indicating that the samples we selected can fully reflect the situation of high-tech enterprises in different levels in the market.

TABLE 3 DESCRIPTIVE RESULTS OF THE SAMPLE

	N	Minimum	Maximum	Mean	Standard Deviation
RD1	286	.65%	44.86%	7.25%	7.02%
RD2	286	276766573	23766373507	3346524046	3480274168
C	286	8.50%	61.50%	33.27%	12.42%
GGCG	286	.00%	89.73%	37.70%	21.88%
GQXZ	286	0.00%	1.00%	.07%	.26%
LEV	286	1.39%	64.85%	18.98%	13.28%
SIZE	286	17.97	21.86	19.89	0.68
Valid N(List State)	286				

B. Correlation analysis of variables

Before the regression analysis, this article first, correlation analysis to a preliminary understanding of the relationship between variables close degree and the change trend, at the same time can also be a simple judgment whether there is a serious collinearity among the independent variables, regression analysis lays the foundation for later. In this paper, Pearson correlation analysis is used to analyze the correlation between the variables in the model. Table 4 is the test result.

TABLE 4 PEARSON DOUBLE-TAIL TEST BETWEEN EACH VARIABLE

		RD1	RD2	C	GQXZ	GGCG	LEV	SIZE
RD1	Pearson Correlation	1	.577**	-.147*	.042	.054	-.239**	-.278**
	Significance(Bilateral)		.000	.013	.481	.362	.000	.000
	N	286	286	286	286	286	286	286
RD2	Pearson Correlation	.577**	1	-.115	.117*	-.048	.045	.428**
	Significance(Bilateral)	.000		.051	.048	.419	.449	.000
	N	286	286	286	286	286	286	286
C	Pearson Correlation	-.147*	-.115	1	.016	-.114	.109	.031
	Significance(Bilateral)	.013	.051		.784	.055	.067	.597
	N	286	286	286	286	286	286	286

GQXZ	Pearson Correlation	.042	.117*	.016	1	-.395**	-.053	.087
	Significance(Bilateral)	.481	.048	.784		.000	.376	.144
	N	286	286	286	286	286	286	286
GGCG	Pearson Correlation	.054	-.048	-.114	-.395**	1	-.064	-.146*
	Significance(Bilateral)	.362	.419	.055	.000		.281	.013
	N	286	286	286	286	286	286	286
LEV	Pearson Correlation	-.239**	.045	.109	-.053	-.064	1	.435**
	Significance(Bilateral)	.000	.449	.067	.376	.281		.000
	N	286	286	286	286	286	286	286
SIZE	Pearson Correlation	-.278**	.428**	.031	.087	-.146*	.435**	1
	Significance(Bilateral)	.000	.000	.597	.144	.013	.000	
	N	286	286	286	286	286	286	286

Notes: ** it is significantly related to the.01 level (bilateral).*. Significant correlation was found at the 0.05 level (bilateral).

C. Multiple collinear analysis

Before we can see through the correlation analysis between variables and independent variables and correlation, the correlation can affect later regression analysis, so we want to each index variables multicollinearity analysis, the results in table 5.

As we can see in table 5, so tolerance is far greater than 0.1, and the variance inflation factor (2 VIF is based) far less than 10, shows correlation between independent variables and control variables in the range of acceptable, regression analysis.

TABLE 5 TOTAL LINEAR STATISTICS

	Linear Statistics	
Variable	Tolerance	VIF
C	0.97	1.03
GQXZ	0.88	1.14
GGCG	0.86	1.16
LEV	0.79	1.26
SIZE	0.80	1.25

D. Regression analysis of the model

According to the result of the previous descriptive statistical analysis and correlation analysis, combined with the theoretical analysis and research of this paper assume that, in this section, we will set up linear regression equation, and Uses SPSS17.0 software R&D investment in the equity structure and the interpretation of the regression analysis between the variables. Considering the above explanation variables in the correlation analysis and explain the relationship between the variables are significantly different, so the control of other factors that could be explained variable, on the basis of interpretation of various variables and explain the relationship between the regression analysis. Table 6 shows the results of regression analysis. Analysis and discovery:

Model 1 is a test of ownership concentration, corporate debt ratio influence on R&D strength, enterprise scale, as you can see, the model is significant at the 0.01 level, explain model fitting is good, the adjusted R2 is 0.101, goodness of fit is small, but is acceptable in the empirical analysis, show that the selected indicators for enterprise R&D intensity is influential, but can only explain 10.1% of the information, there are other variables affect corporate investment intensity. And expected the same theory, the first largest shareholder ownership is negatively related to the intensity of R&D, shows that the controlling shareholder's stake in the company they inhibit the greater the enterprise research and development activities.

Model 2 is a test of ownership concentration, corporate debt ratio, the influence of R&D investment in the enterprise scale, equation adjusted R2 is 0.213, the goodness of fit is relatively high, and the equation by significance test. The proportion of the shareholding ratio of the largest shareholder is negative, indicating that the shareholding ratio of the controlling shareholders will weaken the R&D expenditure of the enterprise. Model 1 and 2 support hypothesis 1.

Model 3 and 4, respectively to study the equity property, corporate debt, corporate size on R&D strength and the impact of R&D investment scale, although equation overall passed the test of significance, but in both model 3 and model 4, the coefficient of equity attribute has not been through the test of significance. Referred to in the above analysis of the related R&D investment in equity property and has significant positive correlation, that is not a simple linear correlation between the two, the result can't effectively support hypothesis 2.This may be related to the fact that state-owned capital has more resources and choices, and that

state capital is easier and willing to go to high-tech R&D than private capital.

Model 5 and 6 respectively studied the executives shareholding, corporate debt, corporate size on R&D strength and the impact of R&D investment scale, the equation of the whole through the test of significance, the executives shareholding regression coefficient is 0.014, 0.015, respectively, and not through the test of significance, shows executives shareholding has little influence on corporate R&D activities. Contrary to assumption 3.This is probably related to the sample selected. We know that the GEM listed company executives are the founder of the company, and they have some technical background, tolerance for risk than the average company executives is strong, even in many cases they are a company's innovation advocate, so through the equity incentive to change their likes and dislikes of R&D risk attitude effect is not obvious. In order to verify this view, we will discuss the relationship between executive shareholding and R&D investment scale and R&D investment intensity in the next section.

In addition, look from all models of corporate leverage on R&D strength and scale effect, found that leverage the regression coefficients were negative, and through the test of significance, shows that enterprise's debt ratio is higher, will tie the enterprise research and development activities. The realistic experience, when the enterprise's external debt pressure is bigger, the enterprise did not high-risk R&D innovation power of long-term investment, on the contrary when the enterprise debt burden is relatively easily nowadays, enterprises will be able to have more money into research and development activities.

In model 1, 3, 5, enterprise scale symbol regression coefficients of all negative, and the regression coefficients in the model 2, 4, 6, symbols are positive, that the scale of the enterprise has a negative impact on R&D strength, R&D investment in to have a negative impact. The scale of enterprise is opposite to the regression coefficient symbol of R&D investment intensity and R&D investment scale. In fact, in the process of enterprise development, enterprises will invest more funds for research, but because of the accumulation of early and enterprise in the allocation of resources tend to be more ample funds use last time in the other side of the enterprise, so there will be a R&D spending is bigger and the intensity of R&D investment is the result of the decline.

TABLE 6 REGRESSION ANALYSIS RESULTS

Dependent Variable	RD1	RD2	RD1	RD2	RD1	RD2
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	55.488	-4.585	54.089	-4.623	52.189	-4.735
C	-0.126** (-4.403)	-0.114** （-2.151）				
GQXZ			0.054 （-0.941）	0.065 （-1.228）		
GGCG					0.014 （-0.239）	0.015 (-0.280)
LEV	-0.131** (-2.082)	-0.161** （-2.743）	-0.139** （-2.207）	-0.167*** （-2.832）	-0.145** （-2.31）	-0.174*** (-2.963)
SIZE	-0.217*** (-3.482)	0.502*** (-8.598)	-0.222*** （-3.508）	0.495*** （-8.376）	-0.213*** （-3.352）	0.506*** (-8.530)
F Value	11.624 ***	26.651 ***	10.126 ***	25.338 ***	9.82 ***	24.736 ***
Adjust R2	0.101	0.213	0.097	0.204	0.085	0.208

Note: (1) *** is significant at 0.01 level, and ** represents significant at the 0.05 level;(2) the value of t in brackets.

5.CONCLUSIONS AND RECOMMENDATIONS

Based on combing the existing literature and empirical research results under the premise of to complete data from 2011 to 2012, disclosure of Shenzhen GEM companies as research samples, the ownership structure affect the R&D GEM listed companies made a theoretical analysis and empirical test. This part will summarize the conclusions based on the empirical research, and make Suggestions from the perspective of the company's shareholding structure and external governance.

A. Major conclusions

(1) the R&D investment of GEM enterprises is high overall. In terms of the descriptive results, the overall high level of R&D input of GEM

enterprises is in line with the expectation, which reflects the importance of the enterprise to R&D activities. As a dynamic organic component of China's stock market, the experience of GEM enterprise in innovation is worth promoting. (2) when the state is in relative control, the increase of the shareholding ratio of the largest shareholder is not conducive to the R&D and innovation activities of the enterprise. Descriptive results show that GEM enterprises are in relative holding situation. In this situation, a regression analysis of the impact of the shareholding ratio of the largest shareholder on R&D investment has found that the increase of the shareholding ratio of the largest shareholder will suppress the research and development activities of the enterprise. (3) the R&D investment intensity of state-controlled enterprises is slightly stronger than that of non-state-controlled enterprises. This may be related to the selection effect of state-owned capital and the degree of R&D resources enjoyed. (4) the proportion of senior executives does not affect R&D investment. From the above correlation and regression analysis, there is no evidence to support the proportion of senior executives in the research and development activities. This may have something to do with the attitude of innovation executives to risk and the professional pursuit of individuals.

B．Policies and Suggestions

Based on the research conclusions of this paper, it is proposed that: (1) to reduce the shareholding proportion of controlling shareholders appropriately. According to the research conclusion, the shareholding ratio of the largest shareholder is significantly negatively correlated with the R&D investment, and the concentration of ownership is too high for the enterprise to innovate. From the perspective of the ownership structure of the enterprise, therefore, appropriate to reduce the proportion of controlling shareholders, on the one hand, can alleviate the big shareholder control enterprises and managers, violate the interests of enterprises, on the other hand, is beneficial to improve the level of corporate investment;(2) promote the entry of state-owned capital into high-tech start-ups and appropriate holding, and promote enterprise innovation. According to the research conclusion, the R&D investment intensity of state-owned enterprises is slightly stronger than that of non-state holding enterprises. In view of the state-owned capital has the abundant resources and have the strength to bear risks, this article advocates the state-owned capital into the high-tech start-ups and appropriate control, leading the development of the enterprise innovation, but also suggest that state-owned legal person should be supervision in place, avoid state-owned legal person and managers of the enterprise the situation of insufficient regulation; (3) the incentive effect of rational treatment of executive stock ownership to enterprise R&D activities. It is concluded from the research that there is no significant relationship between the proportion of senior executives and the R&D activities of enterprises in high-tech innovation enterprises. Therefore, this paper suggests a rational view of the incentive effect of executive stock ownership on enterprise R&D activities. Companies can encourage or support executives in other ways to pursue innovation rather than single equity incentives.

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Fall Recognition Based On Wavelet Packet Energy Feature And Multiple Classifiers Fusion

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Abstract: Fall accidents have become the main cause endangering personal safety in the elderly, a quick and accurate fall detection can ensure a quick response with effective medical aid. In order to improve the accuracy for fall detection, this paper introduced the ideas of the ensemble learning of multiple classifiers into the elderly fall detection, building the multiple classifier system by using the diversity measure on each base classifier. Firstly, utilizing wavelet packet decomposition method to partition acceleration signals bands of different actions obtaining each action's signal energy distribution of acceleration in each frequency band, based on the fact that the energy distribution of acceleration signal of each action has its specificity, we proposed that the wavelet packet energy entropy was proposed as the feature of fall detection; then multiple classifier systems theory was used to select and evaluate the performance of classifier which was trained by wavelet packet energy entropy, so as to realize the complement advantage between each classifier; at last, a weighted voting method was used to fuse the results of each classifier in the decision level to get the recognition results. This method showed a good performance on accuracy in the experiment including fall and other activities of daily livings, the results showed that the average recognition rates of fall reached 92.1%, the average recognition rates of activities of daily livings reached 86.7%, which is higher than the recognition results of single classifier model.

Keywords: fall detection; wavelet packet decomposition; ensemble learning; multiple classifiers fusion; pattern recognition

1. INTRODUCTION

In the 21st century, China has entered an aging society. Due to the gradual increase of aging people in the population of society, the proportion of empty nesters also increases year by year. Fall has become one of the risks of threatening health of the old. Studies have shown that about 1/3 of the elderly people who are over 65 had an experience of fall [1]. At present, more and more people put attention on the detection methods of fall, domestic and foreign scholars have put forward their own methods to predict and detect the fall. In general, the methods of fall detection can be broadly classified into three categories, including visual-based approaches, wearable devices based methods, and environment-based approaches [2].

Visual-based method is often used to classify the daily activities and abnormal behavior of the old by sending the extracted video and image features into the classifier to achieve the purpose of effective identification. M. Behzad et al. [3] extracted the relevant characteristics of the subject image profile and sent to the design of a multi-classifier system for fall detection, get a good effect. X. Ma et al. [4] obtained the three-dimensional coordinate data of activities by kinect and used computer technology to extract curvature scale space, human body shape and skeleton point trajectory as the characteristic, then used the improved limit learning machine to detect the fall.

Visual-based detection method has the disadvantage that the system is more complex, computationally intensive and costly, besides it is easy to expose personal privacy. Wearable device based method is more competitive compared with visual-based method because the device price is relatively cheap and easy to use. P. Paola et al. [5] placed a three-axis accelerometer, a gyroscope and a magnetometer device on the waist of the subjects and tested whether the subject had fallen by comparing the value with the thresholds of the various human falls, However, most of the thresholds in this approach are subjective through the experiment, and are less robust when dealing with different types of falls. Compared with the threshold method, the method of machine learning has obviously improved the effect of the fall recognition, which includes the method including hidden Markov model [6], random forest algorithm [7] and support vector machine [8], limit learning machine [4].

However, the above-mentioned device-based fall detection method often uses a single feature or multi-feature combination to construct a single classifier to detect the fall. As each classification method has some limitations, a simple use of single classifier to detect fall often can't get a very satisfactory results. At present in the field of machine

learning, to deal with complex identification and detection problems, multi-classifier systems are often used [9]. Multi-classifier system can establish different base classifier for different detection problems based on the performance of each classifier and take certain rules and algorithms to filter and integrate them to increase robustness and achieve better performance. Therefore, this paper proposes a fall detection model which combines multiple classifiers in order to improve the fall detection rate.

2. THE WAVELET FEATURE

The acceleration signal has been widely used in human abnormal activity recognition. Wavelet transform is one of the tools that can combine the time domain and frequency domain and extract the feature of the signal[10]-[11]. Wavelet packet decomposition can describe the acceleration characteristics of different activities in a detail way, which is helpful to identify the activities.

In this paper, wavelet feature is extracted with the acceleration signal G, the formula is:

$$G=\sqrt{X^2+Y^2+Z^2} \tag{1}$$

Where, X, Y, Z stands for the acceleration value on the x, y, z three axes.

Wavelet packet energy spectrum is a way that the signal is decomposed by wavelet to express the signal characteristics in different frequency bands. The energy of the wavelet signal can be defined as:

$$E_f=\int_{-\infty}^{+\infty} f^2(t)dt \tag{2}$$

The energy on the i_{th} band can be expressed as:

$$E_i=\int\left|f_i(t)\right|^2 dt=\sum_{n=1}^{N}\left|d_l^{j,n}\right|^2 \tag{3}$$

Where: $d_l^{j,n}$ represents the amplitude of the reconstructed signal discrete point, N is the original signal length, L=1, 2,…, 2^j. All E_i constitute the wavelet energy spectrum vector:

$$E=[E_1,E_2\cdots E_{2^j}] \tag{4}$$

The eigenvector E is normalized by the formula (5):

$$T=\left(\sum_{l=1}^{2^j}\left|E_l\right|^2\right)^{1/2} \tag{5}$$

3. MULTI-CLASSIFIER FUSION SYSTEM

This paper builds a strong classifier to detect the fall through the integration of different attributes of the basic classifier. On the basis of classifier's excellent performance, the designed ensemble learning system for fall detection measures the differences between each classifier and uses fusion rules to combine them. Figure 1 is a schematic diagram for the multi-classifier fusion system.

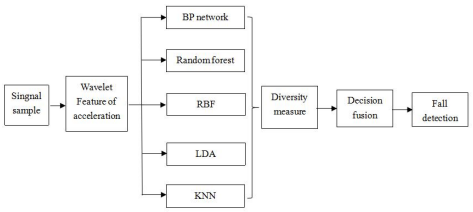

Fig. 1 Schematic diagram of the multi-classifier frame

A. Base classifier selection

In the selection of the base classifier, BP neural network, RBF neural network, LDA algorithm, random forest algorithm and KNN algorithm are selected as the base classifier respectively.

B. The principle of difference measurement of classifier

The difference between two different base classifiers is measured by Q statistic [12]-[13]. For the two base classifiers Q_1 and Q_2, N_{11} and N_{00} represents that the two classifiers make the correct recognition of the sample proportion of the with the wrong recognition to the total sample.

N_{ij} represents the proportion of samples that are identified accurately in Q_i and identify errors in Q_j. The Q statistic can be expressed as a formula:

$$Q_{ij}=\frac{N^{11}N^{00}-N^{01}N^{10}}{N^{11}N^{00}+N^{01}N^{10}} \tag{6}$$

Where Q_{ij} is at the value range [-1, 1]. When the Q_{ij} statistic is 0, the two classifiers are independent.

If an integrated learning system consists of L single classifiers, the pairwise difference of the whole system is obtained by averaging all pairs of pairs in this system:

$$Q_{av}=\frac{2}{L(L-1)}\sum_{i=1}^{L-1}\sum_{j=i+1}^{L}Q_{ij} \tag{7}$$

The whole performance of the ensemble classifier is measured by the difficulty metric method. First, the distribution of the random variable X is calculated, and X is the ratio of the base classifier that is correctly classified by the input sample pixel x, $X \in \{0,1/L,2/L,\ldots,1\}$. Difficulty measures the variance of X as in equation (8):

$$\theta = \mathrm{var}(X) \tag{8}$$

In equation (8): the size of θ is inversely proportional to the difference in the performance of the integrated classifier.

C. Multi-classifier decision-level fusion

In this paper, the weighted voting method is used to fuse the identification information of different base categories. The calculation of the weight of the classifier is determined according to their accuracy in the training set. The formula is shown as equation (9)

$$\alpha_i=\frac{Rate_i}{\sum_{n=1}^{L}Rate_i} \tag{9}$$

4. EXPERIMENT AND RESULTS

A. Experimental systems and data

The experimental system consists of two parts: one is the acceleration sensor part and the other is the receiving part interacting with the computer. The acceleration sensor section includes the ADXL-345 acceleration sensor, the Arduino Pro micro controller module and the nRF24L transceiver module (Figure 2a). The receiving part of the computer interaction consists of the Arduino Pro micro controller module and the nRF24L transceiver module (Figure 2b). The receiver uses the UART interface to connect to the personal computer. The setting parameters are as following: data bit 8, baud rate 115200, parity no, stop bit 1. In this study, we collected the acceleration signals from the five subjects and the daily life activities. All subjects were wearing the acceleration sensor at the same part of the waist, as shown in Figure 2c.

(a)ADXL345 sensor section (b) computer receiving section (c) the placement of accelerometer

Fig. 2 Schematic diagram of the multi-classifier frame

Taking into account the safety of the experiment, all subjects were from healthy students in the laboratory. Acceleration signals of fall and some other daily activities from each participant were collected. Each participants did every daily activity 20 groups and fall 80 groups. The collected data samples are divided into training samples and test samples according to the ratio of 6: 4.

B. Analysis of the base classifier

In this paper, we use the wavelet characteristics extracted from the acceleration signal to train the five selected classifiers respectively. The accuracy of the training set of each classifier is shown in Table I:

TABLE 1. RECOGNITION RESULTS OF BASE CLASSIFIER

Classifier	Walking	Jump	Sit down	Stand up	Fall
BP	87.6%	72.6%	85.3%	82.1%	84.3%
RBF	83.2%	80.6%	76.3%	73.3%	77.8%
LDA	78.2%	81.7%	85.3%	86.4%	87.9%
Random forest	87.1%	79.3%	76.2%	85.4%	78.6%
KNN	68.5%	72.4%	73.5%	69.6%	78.3%

According to the diversity measure principle in the chapter of the principle of difference measurement of classifier, three classifiers are selected from the five base classifiers for detection system. For the sake of convenience, the BPN neural network, the RBA neural network, the LDA algorithm, the random forest algorithm and the KNN classification algorithm are labeled as 1 to 5 classifiers respectively for the diversity measure between the two classes. According to the recognition result of the single classifier, formula (6) was used to calculate the Q_{ij}, formula (7) was used to calculate the Q_{av} and formula (8) was used to calculate the θ. The results are shown in Table II-Table IV.

TABLE 2. Q STATISTIC BETWEEN TWO CLASSIFIERS

Q_{12}	Q_{13}	Q_{14}	Q_{15}	Q_{23}	Q_{24}	Q_{25}	Q_{34}	Q_{35}	Q_{45}
0.786	0.843	0.734	0.863	0.932	0.549	0.671	0.814	0.657	0.583

TABLE 3. Q STATISTIC BETWEEN THREE CLASSIFIERS

Q_{123}	Q_{124}	Q_{125}	Q_{134}	Q_{135}	Q_{145}	Q_{234}	Q_{235}	Q_{245}	Q_{345}
0.653	0.737	0.822	0.854	0.682	0.734	0.782	0.684	0.753	0.673

TABLE 4. OVERALL PERFORMANCE INDEX θ BETWEEN THREE CLASSIFIERS

θ_{123}	θ_{124}	θ_{125}	θ_{134}	θ_{135}	θ_{145}	θ_{234}	θ_{235}	θ_{245}	θ_{345}
0.172	0.087	0.058	0.042	0.147	0.094	0.062	0.072	0.089	0.126

Based on the above results and the principle of classifiers' selection, a multi-classifier integrated system for fall detection based on BP neural network, LDA classifier and random forest is built.

C. Multi-classifier fusion and result analysis

On the basis of Table II, formula (9) was used to calculate the weights of each classifier, and then merge the classifiers by weighted voting method. The converged multi-classifier system can be expressed as:

$$classify = \alpha_1 classify_1 + \alpha_2 classify_2 + \alpha_3 classify_3 \quad (10)$$

Where $classify_i$ represents the individual classifiers (i= 1, 2, 3), α_i is the corresponding weight for the

classifier, and the final fusion classifier is represented by classify. The results obtained by using the fusion classifier are shown in Table V.

TABLE 5. COMPARISON OF DIFFERENT MODEL RECOGNITION ACCURACY

Algorithm	Recognition rate (%)	
	Fall	ADL
BP	84.3%	81.9%
RBF	77.8%	78.4%
LDA	87.9%	82.9%
Random forest	78.6%	82%
KNN	78.3%	71%
Multi-classifier fusion voting method	89.2%	84.3%
Multi - classifier fusion weighted voting method	92.1%	86.7%

It can be seen from Table V that the performance of the base classifier on the fall detection is different. The recognition rate of the ensemble learning system constructed by this method is 92.1% and the recognition rate of ADL is 86.7%. Compared with the single classifier model, the highest recognition rate is 87.9%, and the highest recognition rate of daily activities is 82.9%. It can be seen that the ensemble learning achieves better detection performance relative to the single classifier. In this paper, the feasibility of the proposed method and the higher recognition rate are proved by considering the respective weights of base classifiers, which obtains the better effect than the unweighted fusion method.

5. CONCLUSION

The acceleration signal can reflect the corresponding motion pattern. Because of the single classification algorithm has its shortcomings, recognition result has a high error rate. Therefore, the multi-classifier ensemble learning method was proposed. In this paper, the wavelet packet energy spectrum of acceleration was used as the eigenvector to construct the ensemble learning system by means of diversity measure. The experimental results show that the proposed method can improve the detection ability of the fall and make up the deficiency of the single classifier model. This paper provides a new way of thinking for improving the recognition rate of fall.

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Industrial Policy and Private Enterprises Investment Efficiency-Empirical evidence from private listed company in China

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Abstract: Based on the special system situation in China, This paper empirically tested the influence of industrial policy on private enterprises investment behavior and investment efficiency. The research found that business capital investment level of enterprises might significantly raise due to the support by industrial policy, but investment efficiency of this kind of enterprises decreased obviously. The research of this paper not only revealed the influence path of industrial policy on the enterprise investment, but also had theoretical guidance significance for private enterprises to take advantage of industrial policy to improve investment efficiency.
Key words: Industrial policy, private enterprises, Investment behavior, Investment efficiency

1. INTRODUCTION

Under the situation of special system in our country, as the "visible hand" for government to adjust the market economy, the promulgation and implementation of industrial policy profoundly effects on the development of the macro-economic and microeconomic entity, but for the research of industrial policy also becomes a widely focused issue in academic and practice world. Existing research shows that enterprises supported by industrial policy usually have a better development opportunity, and may be supported by the government when investment opportunities appear (Zhengfei Lu and Feichi Han, 2013, Lidong Zheng, etc., 2015), it embodies that both of financing level (Donghua Chen, etc., 2010) and the investment level (Wenjing Li and Yaotao Li, 2014) significantly increase. But when the industrial policy transfers the extreme even wrong policy signal (Xiaofang Bi, etc., 2015), it also may cause the excessive investment behavior of the enterprises, and then damage enterprise value. Under the background of special property system in our country, as an important engine of economic development, the development of private enterprises will also be influenced by government policy. Then what influences will be produced for industrial policy on private enterprises financial behavior, especially the investment behavior? Whether investment behavior of private enterprises has significant differences under the different industrial policies or not? For the answers of above questions, it could not only reveal conduction paths from the industrial policy to micro enterprise in the micro level, but also has a strong theoretical and practical significance for how to use industry policy to improve the investment efficiency of the micro enterprises.

2. METHODS

2.1 hypothesis

Government may normally adjust macro economy and microeconomic entity by setting monetary policy, fiscal policy, industrial policy and other economic policies, and conduct by credit channel and monetary channel, etc.(Yingzhang Zhou and Zhensheng Jiang, 2002, Zhaohui Sheng, 2006) , and guide investment direction of micro enterprises, and then affect the investment and financing decisions of enterprises. But improvement of investment level may lead to the decline of the investment efficiency. Xiaofang Bi, etc. (2015) thought that private enterprises supported by the industrial policy could get more attention by the media and industrial policy had the larger promotion effect on enterprise performance in the short term, thus leading to too optimistic judgment of capital market for enterprises, it intensified overconfidence of management level, ignored the potential risks of investment to do low efficiency investment (Guoliu Hu and Shaohua Li, 2013)。On the other hand, due to the growth of the resources endowment brought by industrial policy, the enterprises encouraged by states get more credit funds by preferential policy measures and credit support in the process of investment, management level makes more investment depending on the beneficial industry environment from their own interests, resulting in the decline of investment efficiency. In addition, the signals transferred by industrial policy may become the cover for management to realize the private behavior, thus exacerbate agency conflicts and cause the moral hazard and adverse selection problem, and even become the channel for big shareholders to grab benefit, further exacerbate the decline of investment efficiency. Based on the above analysis, put forward the research hypothesis as following:

H: In comparison, investment spending level of private enterprises supported by industrial policy increases and the investment efficiency declines.

2.2 Sample Selection

This paper selected 2005-2014 Shanghai and Shenzhen A shares mainboard non-financial private listed companies as the research object. Research data was mainly from Tai'an (CSMAR) database. On this basis, this paper handled research samples as following: (1)Delete companies of PT and ST Class.(2)Delete companies that ownership interest is less than 0. (3)Delete the company of incomplete data. After the screening, there are 3992 samples in total in this paper.

2.3 Research Variables

Industrial Policy(ENC)

Reference the method of Donghua Chen (2010), Jigao Zhu, etc. (2012) to measure the industrial policy (ENC). According to industry development planning in five-year plan in China, this paper defines the enterprises encouraged by states and key support enterprises from sample enterprises as 1, otherwise as 0.

Investment level (INV)

This paper defines investment level as new increased investment of enterprises the same year, references the research of Qingquan Xin, etc. (2007), and defines new increased investment of enterprises the same year for cash items paid by fixed assets, intangible assets and other long-term assets in the cash flow statement, and divides by the initial total assets to eliminate scale effect.

Investment efficiency (EFF)

Reference the method of Richardson (2006), this paper firstly estimates the normal capital investment levels of enterprises, then measure over-investment and under-investment by fitting out regression residuals.

Control variables

Based on the existing research, this paper adopts firm Size (Size), free cash flow (FCF), asset-liability ratio (Lev) and Growth opportunities (Growth), investment opportunities (Tobin's Q) as control variables, and control the industrial effect (Ind) and the annual effect (Year).

Table 1 variable declaration

types of variables	name of variable	variable symbol	variable definition
dependent variable	capital investment	INV	Cash/ year-end total assets paid by fixed assets, intangible assets and other long-term assets
	investment efficiency	EFF	absolute value of residual value fitted by Model 1
Independent variable	industrial policy	ENC	The paper shall define industrials for enterprises states encouragement and key support of sample companies as 1, otherwise as 0.
control variable	scale of company	Size	The natural logarithm of company year-end total assets
	free cash flow	FCF	（operating cash flow - Depreciation and amortization - anticipativet year new investment）/ year-end total assets, during them, t year new investment is anticipative capital investment estimated by Model 1.
	Debt-to-assets ratio	Lev	End-year gross liability / End-year total assets
	growth opportunity	Growth	sales growth rate
	investment opportunity	Tobin’s Q	(common stock * current value of closing price+(total number of stocks- common stock)* end-of-period value of ownership interest/ end-of-period value of paicl-up capital + end-of-period value of current period of liabilities)/ End-year total assets

3. RESULTS

Reference the method of Richardson (2006), this paper firstly estimates the normal capital investment levels of enterprises, then measure over-investment and under-investment by fitting out regression residuals. Estimation model for the normal capital investment levels of enterprises is as following:

$$INV_{it} = \alpha_0 + \alpha_1 Growth_{it-1} + \alpha_2 Lev_{it-1} + \alpha_3 Cash_{it-1} + \alpha_4 Age_{it-1} + \alpha_6 Ret_{it-1} + \alpha_7 INV_{it-1} + \sum Ind + \sum Year + \varepsilon_{it} \quad (1)$$

This paper expresses investment efficiency of enterprises with the absolute value of residual value fitted out from Model 1, the greater its value, the greater for the degree of investment level of enterprise actual investment deviation theory, the lower investment efficiency. Further, sort out the residual value, the value that is more than 0 is defined as over-investment (Over INV), the value that is less than 0 is defined as under-investment (Under INV).

By constructing Model 2, this paper observes the influence of industrial policy support on the enterprises investment level and investment efficiency. The details are as following.

$$INV_{it} / EFF_{it} = \alpha_0 + \alpha_1 ENC + \sum \alpha_i Controls_{it} + \sum Ind + \sum Year + \varepsilon_{it} \quad (2)$$

4. DISCUSSION

4.1 Descriptive Statistics

The paper showed the single variable inspection results for influence of industrial policy on the investment of private enterprises, as Table 2. It could be found in the table that industrial policy support had larger influence on the investment spending (INV) of private enterprises, the results both of single variable mean value test and nonparametric rank sum test showed that investment level of enterprises supported by industrial policy is more than the enterprises not supported by industrial policy, it indicates that industrial policy support could promote private enterprises to improve the investment level. But both of single variable mean value test and nonparametric rank sum test showed that investment level (EFF) of enterprises supported by industrial policy was low. Test results of other control variables showed that the size (Size) of enterprises supported by industrial policies is smaller, Debt-to-assets ratio (Lev) is lower, and growth (Tobin's Q) is higher.

Table 2 difference test of major variables in different industrial policies

variable	univariate test (mean value)		differences between mean values	t statistic	non-parametric test (median)		differences between medians	z statistics
	ENV=0	ENV=1			ENV=0	ENV=1		
INV	0.062	0.075	-0.011	-5.542***	0.046	0.059	-0.013	-7.083***
EFF	0.027	0.032	-0.004	-3.623***	0.020	0.023	-0.003	-3.772***
Size	21.38	21.212	0.168	5.170***	21.313	21.112	0.199	5.341***
FCF	-0.041	-0.044	0.003	1.219	-0.041	-0.043	0.002	1.99**
Lev	0.423	0.369	0.056	7.969***	0.420	0.352	0.065	8.062***
Growth	0.203	0.204	-0.001	-0.074	0.138	0.164	-0.025	-2.338**
Tobin's Q	1.802	2.280	-0.476	-8.922***	1.424	1.801	-0.377	-10.418***

4.2 Investment efficiency test of industrial policy and private enterprises

Table 4 listed the empirical test result of influence of industrial policies on the investment level and investment efficiency of private enterprises. We found in the results of influence of industrial policy on the investment level that coefficient of ENC was 0.0104, , t value in the level of 1% was significantly positive; it indicates investment level of enterprises supported by industrial policies is higher, it indicates that the industrial policy could really promote to increase the investment amount of private enterprises. We found in the results of influence of industrial policies on the investment efficiency that coefficient of ENC was 0.0023, t value in the level of 5% was significantly positive; it indicates investment efficiency of enterprises supported by industrial policies is lower, i.e. the industrial policy promote the increase of investment level of private enterprises, but it lead to occur the low investment efficiency. Further, investment efficiency was divided into two subsamples of over-investment and under-investment in this paper, in order to deeply reveal the influence mechanism of industrial policy on the investment efficiency of private enterprises. Results shows that in the over-investment group, coefficient of ENC is significantly positive (T value is1.67, and significant in the level of 10%), but in the under-investment group, coefficient of ENC is non-significant in the statistical sense. It indicates that private enterprises supported by industrial policies more easily lead to over-investment problems, thereby lower the investment efficiency of enterprises.

Table 3 investment level and investment efficiency of private enterprises under the support of different industrial policies

variable	INV		EFF		OverINV		UnderINV	
	Coefficient	T value	Coefficient	T value	Coefficient	T value	Coefficient	T value
Constant	0.0160	0.80	0.0127	8.26***	0.1929	6.38***	-0.0534	-5.15***
ENC	0.0104	5.92***	0.0023	2.24**	0.0041	1.67*	-0.0003	-0.41
Size	0.0031	3.58***	-0.0031	-5.43***	-0.0066	-5.14***	0.0012	2.53**
FCF	-0.0963	-9.18***	-0.0351	-5.93***	-0.0091	-0.61	0.0523	8.50***

Lev	-0.0462	-9.25***	-0.0142	-3.81***	-0.0133	-1.58	0.0138	6.22***
Growth	0.0081	3.43***	0.0008	0.60	0.0022	0.60	-0.0001	-0.12
Tobin's Q	0.0001	0.15	0.0003	0.72	-0.0001	-0.09	-0.0008	-2.35**
Industry	Control		Control		Control		Control	
Year	Control		Control		Control		Control	
Sample size	3992		3992		1480		2512	
F value	20.92***		13.79***		5.40***		14.67***	
R2	0.074		0.040		0.047		0.093	

5. Conclusion

The research found that: (1)Industrial policies had positive effects to promote the investment for private enterprises; Specific performance was that investment level of private enterprises supported by industrial policy might significantly increase. (2)Investment efficiency of private enterprises supported by industrial policy was low and mainly caused by over-investment.

As the process of market moves forward, how to correctly guide investment direction of enterprises by macro-policy under the "new normalcy" of economy to realize adjustment and optimization of industrial structure, and constantly promote the stable sustainable development of regional economy and employment growth, they are the issues that need special attention when the present government is formulating economic policy. Meanwhile, for the private enterprises as the important engine of economic development in our country, how to adapt and effectively use industrial policy to achieve its own development also becomes the main problems faced by private enterprises in the production and management, if enterprises want to achieve long-term sustainable development, they should rationally and effectively make use of policy opportunity brought by the positive industrial policy, at the same time, by constantly improving their own enterprise governance mechanism, and creating a good business environment for the enterprise development, consequently realize the target for optimal allocation of resources and maximization of enterprise value.

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Research on the Risk of Stock Price Collapse in China's GEM: Cause of Formation and Governance Mechanism

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Abstract: Gem is an important component of China's multi-level capital market .the It has positive significance to promote the development of high-tech industry in China ,but the collapse of the stock price risk has long plagued the healthy development of China's growth enterprise market, and gradually become the focus of attention of the academic community. Therefore, based on the institutional background of China's capital market, this paper analyzes the causes and governance mechanism of the stock price crash risk of the listed companies on the gem. This study not only for improving the risk management ability of GEM listed companies, maintaining the GEM market price stability has a certain guiding significance, but also provide the basis for government departments to formulate market supervision policies and regulations.
Keywords: stock price crash risk; growth enterprise market; information asymmetry; agency problem

1. INTRODUCTION

Gem is an important component of China's multi-level capital market . It is a special equity financing platform for high-tech enterprises .It plays an important role in promoting the development of China's high-tech industry. However, the GEM market in high-speed development has also exposed some problems, such as lack of innovation, resource allocation weakened, IPO premium, stock crash risk, especially the risk of collapse in stock prices has increasingly become a hot topic in academic circles.

The stock price plummeted or stock price collapse or collapse, usually refers to without any warning, stock prices suddenly fell sharply phenomenon. Data show that the first week of 2016, the gem index plummeted 17%, refresh the historical record single week decline; in December 12, 2016, the gem index plunged 5%, nearly 200 stocks daily limit, compared to more than the total number of 1/3.Compared with the main board listed companies, listed companies on the gem stock price volatility is more intense, and presents the characteristics of short time slump which easily lead to systemic financial risk. Therefore, this paper analyzes the impact factors of stock crash risk, causes and governance mechanisms. This paper studies for improving GEM listed companies risk management, maintenance of the GEM market price stability has a certain guiding significance.At the same time, it provides a theoretical basis for the formulation and market supervision to the government policies and regulations.

2. THE REASONS FOR THE COLLAPSE RISK OF LISTED COMPANIES ON GEM

The supervision mechanism of the growth enterprise market is not perfect

China's growth enterprise market adopts a government led regulatory model, and the GEM listed companies have strong motivation to establish political connections, but the political connection is an important incentive for GEM companies to change their performance after listing.[14] The GEM market supervision mechanism is not perfect mainly reflected in four aspects: first, Chinese gem market information disclosure system is the same with the motherboard market, while Europe and the United States capital market is based on the scale of listed companies to make a difference of information disclosure system. The design defects of the information disclosure system, leading to the GEM listed companies mandatory information disclosure, voluntary disclosure, whitewash statements or even illegal The disclosure of the situation have occurred. Second, the internal control of GEM listed companies adopts the rule oriented supervision mode , due to the internal control attestation report specification is not standardized, the internal control system of listed companies on the gem of the operation and pertinence is not strong .[15] Third, the Chinese sponsor system of GEM market, because of the double identity of sponsors "both referees and athletes', and the service level is not high, the moral self-discipline and other reasons, led to the regulatory role of the sponsor system has not been fully play.[16-17] Fourth, the gem funds of Listed Companies in small scale, high investment risk, in the gem city

Field establishment of exit mechanism of survival of the fittest "is necessary, but the exit mechanism of GEM market lack of accountability and compensation mechanism and exit mechanism did not play the expected" restriction and punishment ".

2.2 The information asymmetry of the growth enterprise market is serious

The information asymmetry in the capital market is reflected in two aspects: on the one hand, the existence of information heterogeneity between the securities trader, private information once informed traders were released, uninformed traders follow up to deal with, to increase the risk of future stock price collapse. On the other hand, in the low information transparency in the company, the company's management easy to conceal bad news and negative news is accumulated and released instantaneously, which increases the risk of the future collapse of the stock price .[5] China capital market is weak form efficient, information quality differences between investors, coupled with the information transparency of GEM listed companies with low price, "up or down" phenomenon is serious, the GEM listed companies face greater risk of stock crash.[18] In addition , the securities analyst for "Commission pressure" and the management of the company will choose the "conspiracy", sponsors for motivation of excessive packaging of listed companies, institutional investors in order to safeguard the personal reputation and interests of "herding investment, investors and intermediaries benefit behavior increased the market information asymmetry, and indirectly increase the risk the company's future stock price collapse .

2.3 GEM listed companies serious agency problem

Under the modern enterprise system of "separation of two powers", due to the inconsistent function between shareholders and management, the management has the motivation to conceal the negative information of enterprises because of the option incentive, on-the-job consumption and political factors. There are three reasons for the agency problem of listed companies on GEM :First, the GEM market has established the mandatory information disclosure system, but the management of the company to disclose information content and the time still has a certain "discretion", this benefit provides a prerequisite for the management of the company to seek. Second, there are some institutional defects in the regulation of the GEM market, especially the lack of accountability and punishment, resulting in illegal transactions such as "related transactions", "excessive capital abuse", "sponsor corruption" and so on .Third, The GEM market investors "speculation themes, fried hot" and "village investment" phenomenon, strong market speculation mood to a certain extent, weakened the regulatory role of the capital market. The management of the company to seek a variety of interests and they will use a variety of means, excessive investment, aggressive tax avoidance means misappropriation of the interests of the company, the implementation of social responsibility the enterprise characteristics also reflects the management of "self-interest tools".

3.THE GOVERNANCE MECHANISM OF STOCK PRICE CRASH RISK OF GEM LISTED COMPANIES

3.1 Building a diversified supervision system for the growth enterprise market

The so-called multiple regulatory system refers to the organization and system of the regulation of the growth enterprise market, which is composed of government departments, stock exchanges and securities intermediaries .The construction of multiple regulatory system should focus on three aspects: First, the Commission will strengthen macro regulation function, promote the gem issuance system change from approval system to registration system, the Commission issuance examination committee is only responsible for the promulgation and implementation of the necessary conditions for the listing of the company compliance review form. Second, strengthen the stock exchange regulatory functions, granted stock issuing and listing the essence of the right to audit, increase the companies listed on GEM information disclosure supervision, explore the transformation path of government led, "stock exchange supervision mode. Third, sponsors and securities analysts are important intermediaries in the GEM market to improve the market trading rules to prevent sponsors, securities analysts and executives of listed companies" collusion ", and to crack down on corrupt practices of securities intermediaries. The purpose of establishing the multiple supervision system of the growth enterprise market is to define the macro supervision of the CSRC and the function of the micro supervision of the stock exchange and to play the role of securities intermediary "information link", so as to achieve the purpose of reducing market information asymmetry and restricting the interest behavior of executives of listed companies.

3.2 Reforming the pricing mechanism of IPO in the growth enterprise market

China gem sponsor system and adopt the inquiry mechanism, but the implementation of the sponsor system caused by IPO oversupply, government regulation and inquiry mechanism leads to a level two, the market information asymmetry, the formation of IPO pricing and the "three high" the

coexistence of the new shares issued new system the Commission had the three revision of the GEM market unfortunately, has not been able to improve this situation, so we must vigorously promote the reform of the pricing mechanism of IPO. First, investors in the GEM market dominated by individual investors, but only institutional investors participating in the market inquiry, the need to improve the GEM market proportion of institutional investors, at the same time A collection of network inquiry improve individual investor participation. Second, give full play to the role of securities analysts and sponsors of the "information link", "lower level market" and "two" market information asymmetry, alleviate the "secondary market" and "the new two level market issuance price difference is too large contradictions. Third, we should further relax the administrative regulation of IPO pricing in the GEM market, speed up the transformation of the IPO audit system to the registration system and establish the leading role of the market mechanism in the IPO pricing.

3.3 Specification of the GEM market information disclosure system

Information disclosure is an important regulatory mechanism of capital market, the high quality information disclosure can improve information transparency, reduce the information asymmetry of the GEM market. Specification of the GEM market information disclosure system should proceed from the following aspects: First, the information disclosure system must rely on the legal responsibility and punishment measures and should establish the corresponding civil compensation system, strengthen the illegal acts of punishment responsibility efforts and give full play to the supervisory role of the market mechanism. Second, reform the current information disclosure system, disclose the financial information and non-financial information separately, and strengthen the supervision of intangible assets information disclosure. Third, The reputation mechanism of information disclosure in the growth enterprise market should be established to guide the listed companies to actively disclose the information, and the companies with high quality of information disclosure should be given moderate incentives, while of the company information disclosure of poor quality in the "black list" publicity. Fourth, Fourth, sponsors, securities analysts as the GEM market intermediary agencies, plays an important role in the establishment of "information link", sponsors, securities analysis responsibility investigation system, vigorously punish corruption intermediary institutions, give full play to the sponsor, information security analysts disclosure. Fifth, strengthen public supervision, increase the illegal behavior of the media exposure, guarantee "Independent, objective and impartial" investigation report. Sixth, increase the education and training of individual investors, cultivate the ability of information disclosure of individual investors and restrain the GEM market irrational speculative sentiment.

3.4 Improve the entry and exit mechanism of the gem

Improving the market access mechanism of gem is beneficial to protect the rights of investors, maintain the security of the growth enterprise market and improve the allocation efficiency of the market resources. The Shenzhen Stock Exchange issued the access policy of the growth enterprise market in April 2010, but the market access policy still faces many difficulties. It the need to further improve the market access system. First, strengthen the supervision of the sponsor, establish the "occupation career file system" to ensure the authenticity and reliability of information disclosure. Second, the information disclosure of listed companies need to accept external oversight, regulatory agencies through legal and economic means to strengthen the responsibility of false disclosure and punishment .Third, the government regulation gradually liberalized market access, establish linkage mechanism of a market "and" two markets ", play the market supply and demand mechanism of gem regulation IPO, unreasonable governance IPO break and the" three high "coexist. Delisting system is an important regulatory mechanism of capital market, on the one hand, the establishment of the GEM market supporting accountability and compensation mechanism, on the other hand, dynamic adjustment of the GEM market exit criteria, in order to improve the delisting system operability and binding.

Ⅳ Conclusion

The establishment of China's growth enterprise market has promoted the development of high-tech industry, but the stock price crash risk has plagued the healthy development of the GEM market. Based on the literature review and practical observation, from the government supervision mechanism, market information asymmetry and agency problem perspective analyze the cause of price collapse risk of GEM listed companies, and put forward the construction of multiple regulatory system reform of IPO pricing mechanism, information disclosure system, improve market access and exit mechanism of governance measures. The conclusion of this paper has significant policy implications ,such as guiding the government's functional departments to strengthen the market supervision of the gem market and maintaining the stock price stability of the gem market and so on. In addition, the collapse of the

stock price is at the micro enterprise level, but the influence factors include government intervention, supervision mechanism, the degree of capital market development, economic and legal environment, and many other macro factors . Therefore, simply increase the intrinsic value of gem's and risk prevention ability is not enough to solve the problem of price collapse .Comprehensively promoting the reform of the institutional mechanism of the GEM market, making up the system short board of the development of the GEM market, and playing the leading role of the market mechanism in the allocation of resources is a fundamental way to solve the stock crash risk of GEM listed companies.

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Analysis of Water Usage Efficiency in Beijing based on Stochastic Frontier Function Model

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ABSTRACT: The Stochastic Frontier Function is a widely used model, which is used in various disciplines, especially in the application of economics. In this paper, this model is used to measure the utilization efficiency of metropolis water resources. The metropolitan system consists of economic system and water environmental system. To study the relationship between economic system and water environmental system in metropolis, this article brought in the concept of "system coupling", and calculated their coupling degree using coordinate coefficient model. Then the stochastic production frontier approach is used to obtain the input-output function of water usage efficiency taking Beijing as an example. Finally we reached the following conclusions: Many factors could have an impact on water usage efficiency in a metropolis setting because of the complex interactions between economic system and water environmental system in them. And the coupling degree between economic system and water environmental system exerts the most influence.

Keywords: Stochastic Frontier Function; Economic-Water environmental System; Water Usage Efficiency; Coupling Theory

1. INTRODUCTION

As urbanization accelerates in China, large scale expansion and huge economic growth occur in metropolis. At the same time, however, enormous pressure has been placed on ecology and particularly, on the utilization of water resources environment. Metropolis is a natural outcome of urbanization and an advanced stage of city development. In China, urbanization accelerates as the industrialization speeds up, resulting in many metropolises and metropolitan areas. Economic system and water environmental system are very important components of a metropolitan system. On one hand, well-functioned economic system facilitates socioeconomic development, powers the water environmental system, and brings about water pollution; on the other, water environmental system provides the water resources necessary for industry production and daily life, faces the pressure from water pollution, and is responsible for water purification and decontamination[1-4]. And in whole system, water usage efficiency is an important indicator of how water resources are utilized.

Figure 1 Distribution of water system in Beijing

In this paper, Beijing is the research area, it is the largest city in the north China. Beijing is located in the north of the North China Plain (E 115.7 ° -117.4 °, N 39.4 ° -41.6 °), it has jurisdiction over 16 counties, with a total area of 16410.54km2 and the total population of 2170.5 million (2015). Beijing is a typical temperate continental climate with an average annual precipitation of 585 mm, about 76% being concentrated in the summer (June, July and August) (Figure 1). The total water resources is 2.676 billion m3 (2015), per capita water resources is only 123m3. Apparently, there is a certain contradiction between economic development and water resources supply.

methods

2. COUPLING COORDINATION MODEL

To study the coupling degree between economic system and water environmental system, we first divided these systems into four subsystems, each of which consists of several components. The economic system consists of population and economic development subsystems, in which the population subsystem consists of gross population, natural population growth rate and urbanization rate; the economic development subsystem consists of GDP, water supply investment and water consumption per ten thousand yuan GDP. The population subsystem provides the labor force

capital necessary for the well function of economic development subsystem, while the well-functioned economic development subsystem will in turn benefit the population subsystem. The water environment system consists of water supply and water environment carrying capacity subsystems, in which the water supply subsystem consists of total amount of water supply for the whole year, water consumption for industry and water consumption for daily life; the water environment carrying capacity subsystem consists of centralized processing rate of sewage, daily sewage treatment capacity and quantity of waste water effluent[5-7]. The water supply subsystem provides the water resources necessary for the functioning of the social economy, and the water environment carrying capacity subsystem absorbs the waste water and sewage from the economic activities.

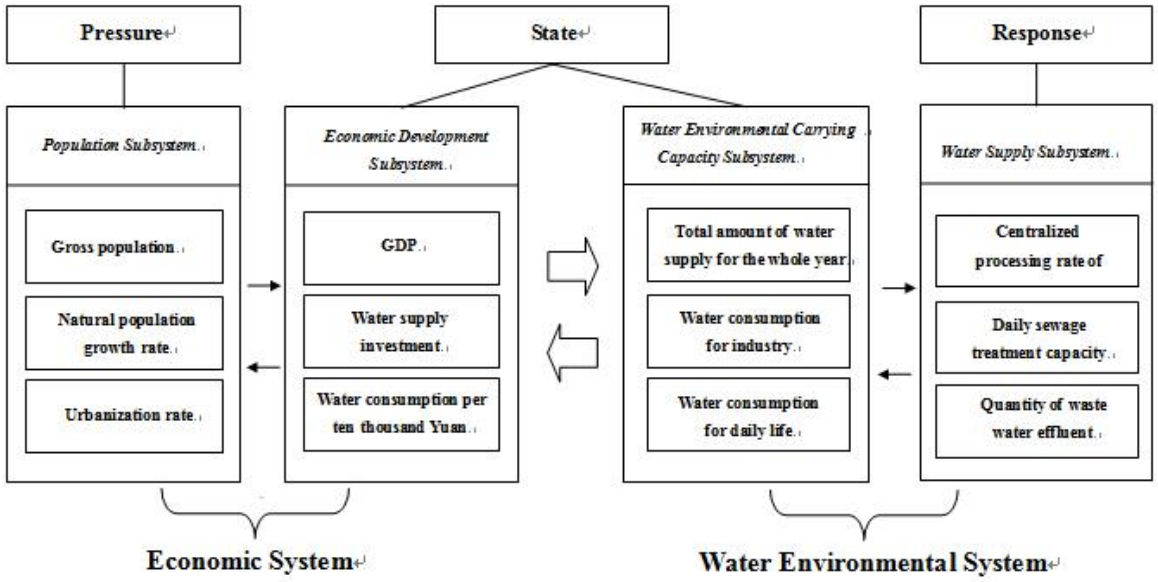

Figure 2 The illustration of economic & water environmental system in Beijing

3. DATA PRE-PROCESSING

Data were processed using the maximum difference normalization method. Evaluation indexes include: output index (Equation (1)), input index (Equation (2))

$$X'_{ij} = \frac{X_{ij} - \min(X_j)}{\max(X_j) - \min(X_j)} \tag{1}$$

$$X'_{ij} = \frac{\max(X_j) - X_{ij}}{\max(X_j) - \min(X_j)} \tag{2}$$

Where i = 1, 2, …, N refers to years, j = 1, 2, …, N refers to parameters, X_{ij} represents original values of the parameters, X'_{ij} represents the value after standardization, $\max(X_j)$ and $\min(X_j)$ are the maximum value and minimum value of the parameter, respectively.

Determine index weight using mean square deviation method

The coefficient of variation CV_j was introduced into the mean square deviation method to determine index weight,

$$CV_j = \frac{\sigma_j}{\bar{X}_j} \tag{3}$$

$$W_j = \frac{CV_j}{\sum_{j=1}^{n} CV_j} \tag{4}$$

Where CV_j represents the coefficient of variation, σ_j represents the standard deviation of the jth parameter, $\bar{X}_j$ and W_j represent mean value and weighted value, respectively.

Calculating comprehensive index between economic system and water environment system

The comprehensive indexes of economic system f(x) and water environmental system g(y) were obtained by multiplying the standardized value of parameters and their corresponding weights.

$$f(x) = \sum_{i=1}^{m} X'_{ij} W_x \tag{5}$$

$$g(y) = \sum_{i=1}^{n} Y'_{ij} W_y \tag{6}$$

Coordination degree analysis

The coordination degree reflects how uniform are the development of different components within a system, which is described by

$$C=\left\{\frac{f(x)\times g(y)}{\left[\frac{f(x)+g(y)}{2}\right]^2}\right\}^k \tag{7}$$

$$T=\alpha f(x)+\beta g(y) \tag{8}$$

$$D=\sqrt{C\times T} \tag{9}$$

Where C represents the coordination degree, k represents accommodation coefficient (let k = 2 in this study), T represents comprehensive evaluation index of economic system and water environmental system. α and β are undetermined coefficients, in this study, let α=β=0.5 as they are equally important. D is the coordinated development coefficient[8-9].

Building stochastic frontier model using translog cost function

4. MODEL FORM

In this study, the stochastic frontier model was built to study the water usage efficiency in Beijing, using the translog cost function. The model was first introduced in 1973 by Christensen, Jorgenson and La, who studied the efficiency of economic operations based on maximum profits (output) and minimum cost (input). In our study, water usage could be treated as an economic practice, in which the labor force, capital investment and resource supply are the input variables and the gross earnings are output variable in the coupling system. Specifically, the employed population, investment in fixed assets and total amount of water supply for the whole year corresponded with labor force, capital investment and resource supply, respectively, and the regional GDP corresponded with gross earnings.

Let water usage efficiency be described by the following stochastic production frontier function:

$$LnY_{it}=\beta_0+\beta_1 LnK_{it}+\beta_2 LnL_{it}+\beta_3 LnW_{it}+\beta_4(LnK_{it})(LnL_{it})$$
$$+\beta_6(LnL_{it})(LnW_{it})+\beta_7 Ln^2(K_{it})+\beta_8 Ln^2(L_{it})+\beta_9 Ln^2(W_{it}) \tag{10}$$

Where i = 1, 2, …, N refers to cities, t = 1, 2, …, N refers to time points.

Y_{it} represents local GDP, L_{it} represents employed population, K_{it} represents investment in fixed assets, W_{it} represents total amount of water supply for the whole year, u_{it} represents water usage efficiency, which follows non-negative tail normal distribution. $u_{it}\sim N(m_{it},\sigma_u^2)$ (m_{it} and σ_u^2 are the average and variance of u_{it}, respectively)，i.e. $u_{it}\geq 0$

$$m_{it}=\delta_0+\delta_1 Z_{1_{it}}+\delta_2 Z_{2_{it}}+\delta_3 Z_{3_{it}} \tag{11}$$

In formula(11), Z1,Z2,Z3 represent factors influencing water usage efficiency, specifically, Z1 represents the coupling degree between economic system and water environment system, Z2 represents drop rate of water consumption per ten thousand yuan GDP, Z3 represents water pollution treatment rate, and δ_0, δ_1, δ_2, δ_3 are the vectors of parameters to be estimated. γ_{it} represents stochastic error term, in this study, representing the uncontrolled factors, which follows normal distribution, i.e. $\gamma_{it}\sim N(0,\sigma_\gamma^2)$.

Let TEit the metropolis water usage efficiency, be described by

$$TE_{it}=\frac{E\left(Y_{it}/\mu_{it},X_{it}\right)}{E\left(Y_{it}/\mu_{it}=0,X_{it}\right)} \tag{12}$$

Where, $X_{it}=\left(K_{it},L_{it}\right)$ is the corresponding input vector..

Assumptions

In this study, the model to calculate metropolis water usage efficiency was built under the following assumptions:

i.The relationship between in-output components in the model follows the basic form of translog production function;

ii.The stochastic error of technical efficiency v_{it} follows normal distribution, i.e. $v_{it}\sim N(0,\sigma_V^2)$;

iii.The corresponding non-efficiency factor u_{it} follows $u_{it}\sim N(0,\sigma_u^2)$;

iv. $u_{it}=\{\exp[-\eta\cdot(t-T)]\}\cdot u_i$.

5. DATA SOURCE

Taking Beijing as a case study, all data were obtained from the "Beijing Statistical Yearbook 1997-2013" and related bulletins[10-12].

Results

Based on the coupling coordination degree model built above, we plugged the related data from 1997 to 2003 into formula (1) to (9) to obtain the coupling degree. Based on the logistic cost function of stochastic frontier model, the Beijing water usage efficiency was calculated by solving (10) to (12).

Hypothesis testing of the model

Statistical test result of maximum likelihood

$$\text{Let } \gamma=\sigma_u^2/(\sigma_u^2+\sigma_v^2) \tag{13}$$

H0: γ = 0 (water usage technologies in metropolis is effective), H1: γ > 0 (water usage technologies in metropolis is ineffective)

Following the maximum likelihood statistical test using Frontier 4.1, we obtained γ =0.99 and the corresponding standard error 0.22, t ratio 4.5, indicating that γ is not equal to 0 at 5% level of significance. Thus the null hypothesis is rejected, the analyses of metropolis water usage efficiency has its practical meaning.

The maximum likelihood function is

$$LR=-2\{\ln[L(H_0)/L(H_1)]\}=-2\{\ln[L(H_0)]-\ln[L(H_1)]\} \quad (14)$$

Where L(H0) represents the maximum likelihood statistical value under null hypothesis, L(H1) represents maximum likelihood statistical value under alternative hypothesis. LR value follows the mixed distribution of $\chi^2(\cdot)$. Using related table and Frontier 4.1 software, we obtained that under 5% level of significance, $\chi^2(2\alpha)=9.236$, LR=38.47 with unilateral standard error 9.4. Since $LR>\chi^2(2\alpha)$ the null hypothesis is rejected.

Analysis of translog production function

$$H_0:\beta_0=\beta_1=\beta_2=\beta_3=\beta_4=\beta_5=\beta_6=\beta_7=\beta_8=\beta_9=0$$

Using software Frontier 4.1, the estimated values of the corresponding parameters of stochastic frontier production function are calculated, results showing:

$\beta_0=504.9233$, $\beta_1=-173.3999$, $\beta_2=50.6221$, $\beta_3=-66.2332$, $\beta_4=-8.2528$, $\beta_5=5.6573$, $\beta_6=-2.6363$, $\beta_7=16.2708$, $\beta_8=0.9682$, $\beta_9=6.8445$

None of the parameter above equal to zero, indicating the null hypothesis should be rejected and the analyses match actual situation, no specification bias in the description[13-14].

Stochastic frontier analysis of water usage efficiency in Beijing

Parameter estimation

We plugged in the data from 1997 to 2013 mentioned above into Frontier 4.1, and obtained the stochastic frontier estimation results.

δ_1, δ_2, δ_3 represents the coupling degree between economic system and water environment system, decrease in water consumption rate per ten thousand GDP, and sewage treatment rate. When using SFA to calculate technical efficiency factors, a positive parameter estimate suggests a negative correlation between that factor and the technical efficiency, i.e. with the factor increases, the technical inefficiency increases and technical inefficiency decreases, vice versa.

$\delta_1=$ -0.3740, indicates a positive correlation between the coupling degree (between economic system and water environment system) and water usage efficiency, the higher the coupling degree, the lower the corresponding technical inefficiency.

$\delta_2=$ -0.0071 indicates a positive correlation between decrease rate in water consumption per ten thousand yuan GDP and water usage efficiency, the higher the decrease rate in water consumption, the lower the technical inefficiency. $\delta_3=$ -0.0012 indicates a positive correlation between sewage treatment rate water usage efficiency, the stronger the capacity to treat sewage, the higher the water usage efficiency.

From the estimated value of δ_1、δ_2、δ_3, it is easy to reach the conclusion that the coupling degree between the economy system and water environment system has the highest impact on the water usage efficiency, followed by decrease rate of water consumption per ten thousand yuan GDP and sewage treatment rate. Optimizing the functions of economy and water environment, improving sewage treating capacity and especially improving the coupling degree will all increase the water usage efficiency.

Analysis of technical efficiency

The water usage efficiency of Beijing was obtained using data from 1997 to 2013 operated by Frontier 4.1. Compare the system coupling degree and water usage efficiency, we obtained results shown in Figure 3.

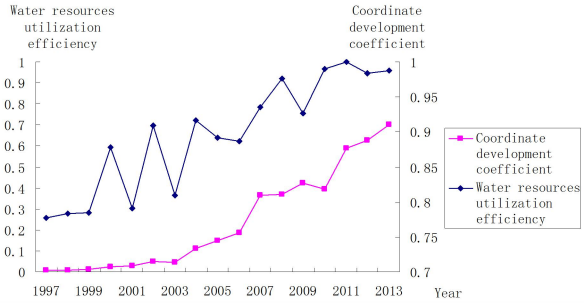

Figure 3 Diagram of water use efficiency and coupling degree in Beijing from 1997 to 2013

From Figure 3, the system coupling degree and water usage efficiency followed a similar trend from 1997 to 2013. Generally, water usage efficiency increases with the increase in system coupling degree. More fluctuation is observed in the water usage efficiency, as from 1997 to 2006, it experienced two times of decreases at a large scale, occurring in 2001 and 2003, respectively. During these times, the system was not well coupled, thus having limited influence on the water usage efficiency. Besides, even if there were decreases in the coupling degree, it would not be obvious as the coupling degree had been very low during that

time. By contrast, after 2007, the trend between the coupling degree and water usage efficiency became more uniform, especially in 2011 when the coupling degree reached 0.5894 (approximately at the extreme), the water usage efficiency reached 0.9998, the highest among all 17 years, indicating a positive relationship between the two.

6. CONCLUSIONS

Many factors could have an impact on water usage efficiency in a metropolis setting because of the complex interactions between economic system and water environmental system in them. And the coupling degree between economic system and water environmental system exerts the most influence.

Water usage efficiency in metropolis is related to regional GDP, employed population, fixed asset investment and whole year water input, and is also influenced by coupling degree, water consumption per ten thousand yuan GDP and sewage treatment rate. The coupling degree correlates with the water usage efficiency, a higher coupling degree indicates a lower technical inefficiency of water usage, and a better functioned society. Increasing the coupling degree will improve the functioning of both systems as it exerts the most influence on the water usage efficiency. At the early development stage of metropolis, more emphasis was placed on the increase in economy, leading to unbalanced development with heavy pollution and higher energy consumption, causing great pollution to the ecology, especially to water environment. In this stage, the economic system and water environment system had lower coupling degree. With the optimizing of the economic structure and the development of energy saving economy, development in a scientific and sustainable way is more and more valued, coupling degree is getting higher and the development is getting more balanced.

ACKNOWLEDGMENTS

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Research On The Development and Prospect Of Memristor

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Abstract：The origin and development of memristor are reviewed. The related characteristics of memristor and the research status of memristor model are analyzed. Some outstanding researches are analyzed. This paper Introduces the main application direction of the memristor. Through correlation analysis and points out some obstacles for further development of the memristor. Finally, it emphasizes how to overcome the limitations of memristor development, and gives a reasonable prospect for memristor development.
Keywords: memeristor; application; Development Strategy; prospect for memristor

1. INTRODUCTION

In order to further reduce the size of semiconductor devices, the international academic and industrial circles have turned the research focus to the new principle of nano information devices[1-2]. The memristor is a great development prospects in the new nano devices[3]. It is a new type of passive nano information device. Its resistance is determined by the amount of its charge and remains constant and nonvolatile[4] after power cut. At the same time, memristor has the advantages of high integration density, high read and write speed[5], low power consumption, multi valued computing potential, and so on. It is one of the research frontiers and focuses in the international academia and industry. At present, the memristor is in non-volatile memory[6], logic operation, new computing storage convergence architecture computing and new neural morphology calculation etc. has broad application prospects[7], the memristor model also will continue to increase.

2. RESEARCH OF MEMRISTOR

In 1971, Leon O. Chua published a landmark paper on nonlinear circuit research. From the point of symmetry and completeness of circuit theory, the author predicts and proves the existence of fourth basic passive devices mathematically, and named it memristor[3], as shown in Figure 1

In 2008, the HP laboratory issued a document in the famous magazine Nature, claiming that it had created the world's first nano size memristor[8], which proved the existence of memristor, as shown in figure 2,The successful preparation of the actual memristor marks[9] the relevant research from the theoretical stage to the practical stage, attracting extensive and intense attention, which has made great contributions to the development of memristor.

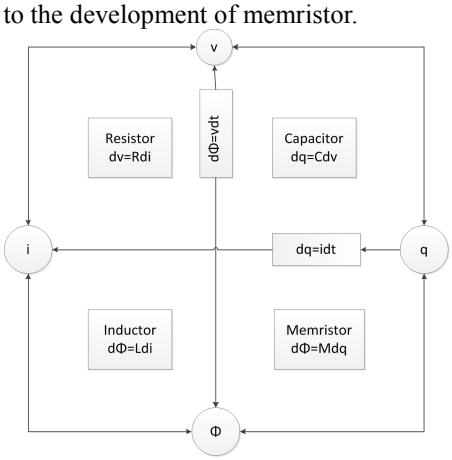

Figure 1 Four basic source relation diagrams

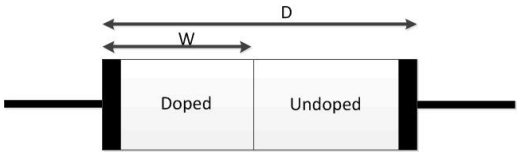

Figure 2 Memristor model built by HP laboratory

(1)Characteristics of memristor

Professor Cai pointed out that there are four basic variables in circuit theory: voltage, current, electric charge and magnetic flux, their combination can be said resistance, inductance and capacitance, the memristor is the basic element of fourth circuit. In the theoretical[10] describing the macroscopic electromagnetic phenomena, the differential form reference[11] of the extended ampere loop law is expressed as equation (1).

$$\nabla \times H = J + \frac{\partial D}{\partial t} \tag{1}$$

In formula (1), the left value represents the strength of the magnetic field rotation[12].The right represents the density of the current and the vector of the displacement current respectively. The differential form of Faraday's law is shown in equation (2).

$$\nabla \times E = -\frac{\partial B}{\partial t} \tag{2}$$

Taking into account the current continuity relation with the charge, such as equation (3) is shown.

$$\nabla \times J = -\frac{\partial \rho}{\partial t} \tag{3}$$

From the previous 3 formulas, the definition of memristor is shown in equation (4).

$$M(x)=\frac{d_{\phi}}{d_{q}}=\frac{v}{t} \tag{4}$$

Moreover, the integration, power consumption and read/write speed of memristor based memristor are superior to the traditional random access memory, which is a charge controlled memristor and its value expression is shown in the equation (5).

$$M(q)=R_{OFF}-K_{H}.q(t) \tag{5}$$

The basic principles of the model design of magnetically controlled memristor circuits are shown in equation (6) and (7).

$$i(t)=W(\varphi(t))v(t) \tag{6}$$

$$W(\varphi)=\frac{dq(\varphi)}{d\varphi} \tag{7}$$

If the Periodic sinusoidal signals of arbitrary amplitude A and angular frequency is applied to the ideal memristor, The voltage and current Li Saru pattern of memristor exhibits 8 character hysteresis phenomenon. The 8 character hysteresis phenomenon is a hysteresis effect with memory characteristics. As shown in Figure 3, if the observed hysteresis phenomenon is starting from the t0 moment, the figure shows that the memristor memory M and Q resistance state is monotonically increasing,

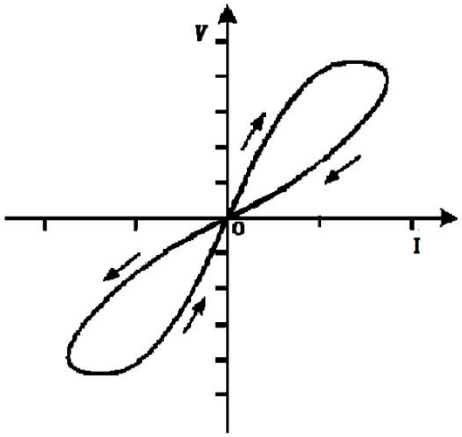

Figure 3 An ideal memristor voltage and current Li Saru figure example

(2)Memrisor model research

After the memristor model of HP was published, memristor has become the focus of scholars. The dynamic characteristics of various types of memristor are discussed and studied in detail, It is proved that memristor has important application value in storage, simulation, neural network and so on. The memory properties of memristor are demonstrated. It is found that the memristor may have the same dynamics as ferromagnetic properties. It is concluded that the memristor system will gradually enter the state of damping from the damping state, and eventually lose its elasticity (resistance change capability) and become a fixed value resistor under constant excitation. A new memristor modeling method based on controlled current source is proposed in SPICE environment. This model shows the dynamic characteristics of memristor inherent and basic functions, and this method can be used to build a memristor magnetron. The simulation results demonstrate the possibility of applying the model to other multiple memristor circuits. A magnetic controlled memristor is proposed by using photosensitive resistor, in this model, three TL084ACD operational amplifier built integral circuit and subtraction circuit to calculate the response signal of system flux changes, The response signal can control the input current indirectly through resistance control on the LDR, that is to say, it can be simplified as a control circuit to control a variable resistor, so that the whole circuit has the characteristics of magnetic controlled memristor. Finally, the feasibility of the model is verified by experiments.

With the development of memristor research, scientific community discusses the special case that the HP memristor model has no physical definition of the boundary value. It believes that HP migration velocity model in the entire doped region and non doped regions are different, more close to the boundary, the slower migration, that is to say, the closer the boundary is, the smaller the charge accumulation affects the resistance value. Finally the charge tends to infinity, the memristor also close to the infinite boundary value, which finished the physical definition of boundary value of the model in HP by this mean.

after the memristor model was proposed, Researchers have successfully constructed the model of memristor by means of memristor and memristor converter. a detailed analysis of the pattern of Li Sharu and frequency responses of the model, combined with simulation in SPICE environment, show the nonlinear hysteresis loop meminductor circuit model, finally in two typical sine wave and triangular wave voltage signal excitation, using experimental methods to get the dynamic characteristics after the meminductor circuit and resistor capacitor in series, and proved the feasibility of meminductor is used to filter circuit

(3)Application of memristor

The application development based on memristor is mainly focused on the development of a new computing system using memristor's nonvolatile memory and logic computing capabilities. The most popular directions are: Artificial intelligence field, new non-volatile memory, new neural morphological computing system and so on. Details are as follows:

①Artificial intelligence field

Most of the traditional synapses are simulated by transistors, which makes the density of artificial

synapses much lower than the density of biological synapses in biological nerves, resulting in the defects of artificial neural networks and difficult to be applied in the field of artificial intelligence. In order to solve this problem, some scientists put forward the use of memristor to achieve neural synapses, because the characteristics of memristor and biological synapses are very similar, and the volume can reach nanometer level, which opens up a new path for the simulation of artificial neural synapse.

②A computing system based on memristor

Yang and others of Duke University have studied the memory structure of the memristor, and proposed the structure of Mem CAM and Mem TCAM based on the memristor. In 2010, HP laboratory Borghetti et al. Implemented the implication logic based on memristor cross circuits. This study shows that memristor has the ability to fuse logic operations and storage for the first time. Subsequently, Lethtonen et al. The oretically proved that two memristor can complete all 16 Boolean logic functions. Peking University proposed a "I Mem Comp" non von Neumann computing architecture, it uses both a storage and calculation function of memristor core module to perform the task. This module has the capability of parallel computing, learning and user-defined logic functions.The nonvolatile memory characteristic of memristor makes it have the ability of data storage, the ability of the state to be continuously adjusted so that it can have numerical calculations, The combination of the two can make the memristor achieve the fusion of computation and storage in the same location, which can completely break through the limitations of the traditional Von Neumann computing architecture.

③Simulation of synapse structure

In 2010, the University of Michigan Wei Lu confirmed the memristor can simulate long term synaptic plasticity, peak dependent plasticity. A new memristor was prepared by the Pan Feng research group at Tsinghua University, and the short term plasticity of the memristor synapse was studied. Memristor not only can realize nonvolatile memory, but also can simulate the working characteristics of brain synapses under external excitation. With the advantages of high integration density and low programming power consumption, memristor has become a new physical basis of artificial neural morphological computing system, and it is the most popular direction of current research. In 2010, Pershin et al successfully constructed memristor neural network with memristor simulator to realize Pavlov associative memory, which showed that memristor neural network could realize the function of traditional network. In 2012, the Howard network structure will be a variety of different types of memristor is applied to adaptive connection. Combined with genetic algorithm, the navigation optimization problem is solved from hardware, and the practical value of memristor neural network is verified. In 2013, Fabien realized the pattern recognition of letters T and X by using the basic memristor crossed array, and verified the feasibility of memristor neural network in physical. In 2015, Prezioso published an article in Nature, they use passive memristor cross array real realized single layer perceptron, and realizes the classification of black and white graphics 3*3, which verifies the feasibility of realizing complex neural networks with physical objects.

④Application in analog circuit

Memristor can be applied to all kinds of signal processing, such as signal rectification and signal delay. It can also be applied to waveform generator. At the same time, memristor can also be applied to filter circuit, and the cut-off frequency of band can be adjusted by changing the resistance of memristor. Pershin and Ventra et al. Put forward a way to implement analog circuits using a "programmable" memristor. They use the digital potentiometer and micro controller to construct memristor model, and design two circuits composed of memristor, capacitor and operational amplifier. The simulation shows that the circuit has the characteristics of recall and memory.

3. PROSPECTS OF MEMRISTOR

From the first generation of electronic vacuum tubes to the present, electronic devices have experienced five times: transistor, small and medium scale integrated circuits, large-scale integrated circuits, large scale integrated circuit. Which devices can become the next generation electronic devices, although after more than 20 years of exploration (such as superconducting devices, etc.), but it is not clear. Memristor is the most promising candidate for the sixth generation of electronic devices, at least, it will certainly be an excellent complement to the existing electronic devices and part of the optimized alternative products. To become the next generation of electronic devices, at least should have these advantages: faster, lower power consumption, higher density, smaller size, more powerful, lower cost, more environmentally friendly, can achieve a wide range of alternatives. Memristor is expected to have almost all of the above characteristics, but there are also some shortcomings, affecting memristor eventually achieved success: The performance and cost of the device itself; the structural system, design theory and development tools of the related circuits and systems; the speed and acceptance of the market; and the specific deficiencies are as follows:

① The principle of the memristor is not completely clear. There exist many coexistence and interconversion of conductive mechanisms in memristor devices, so the observation of the conductive process is very complicated.The observation of the conductive process is very complicated. Therefore, the research on the physical

conduction mechanism of memristor is not clear, which restricts the design, processing and application of the device to a certain extent.

②the application of memristor is difficult. Although memristor is a hot research topic at present, it has a great prospect, but it is still difficult to apply in industrial production, and there is still a long way to go.

Through the analysis of some problems in the development of memristor, we can know that once the scientific community can overcome these technical problems, the development of memristor will open a new milestone. As a new type of passive electronic components, the appearance of memristor provides new modulation and new functions for electronic circuit behavior. With the lack of in-depth research, the model and mechanism for the realization of memristor behavior are being put forward. So far, this component has been emerging in the field of model analysis, basic circuit design, electronic device and integrated circuit design, and biological neural system simulation. It is expected that the memristor device will be expected to be applied in the electronic circuit system and will become a new opportunity for the further development of electronic information technology.

4. CONCLUSION

Memristor has become a hot spot in the field of materials science, circuit science and other fields. Its appearance can fundamentally change the pattern of traditional circuits. However, the research for modeling of memristive as a basic application is not perfect, the development of the memristor also has some limitations: device performance and cost; improve the system structure, circuit and system design theory and development tools; market forward speed and the acceptance of the effects of defects. However, the research at home and abroad lays the foundation for the further development of memristor.

ACKNOWLEDGMENT

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Research on the Price Fluctuation of Pepper in Beijing

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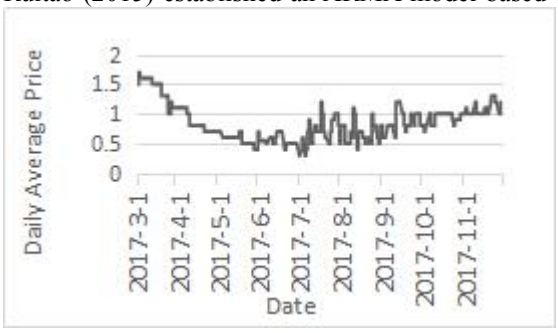
Abstract：In recent years, the fluctuation of vegetable prices has drawn wide attention from all walks of life. Scholars have devoted themselves to the research of vegetable price fluctuation and have achieved certain results. Through literature research, we find that the majority of scholars' studies focus on the long-term fluctuation of vegetable prices, which has a weak guiding effect on the production activities of vegetable suppliers and consumer behavior. Based on the previous studies, this paper establishes the price ARMA-GARCH joint model by using the price of pepper in Beijing Xinfa Di from March 1 to November 28, 2017 as sample data. And predicted the price of the pepper and the variance of its conditions in the future 31 days, in order to provide some reference for the short-term decision-making of vegetable suppliers and resident consumers.
Keywords: Pepper; Price Volatility; ARMA Model; GARCH Model

1. INTRODUCTION

Vegetables are an important part of residents' daily consumption. The fluctuation of vegetable prices is closely related to the production and life of residents. In recent years, the vegetable industry in our country has been developing rapidly. However, the price of vegetables is more volatile, and the phenomenon of market instability is significant, which has a greater impact on the lives of residents. The impact has been widespread concern in the community. Therefore, the research on the fluctuation of vegetable prices and the effective prediction of the future fluctuation of vegetable prices are of great significance for guiding the consumption behavior of residents and the production activities of vegetable producers.

2. LITERATURE REVIEW

In recent years, scholars have devoted themselves to the research on the trend of vegetable price volatility and have achieved some results. According to the current research results, previous studies on vegetable price volatility mainly focus on two aspects: (1) Decompose vegetable prices and explore their volatility. Sun Qian and Mu Yueying (2011) used the VAR model to analyze the fluctuation of vegetable prices since 2008 and found that the vegetable prices have long-term trends, seasonal fluctuations and extraordinary fluctuations [16].Guo Liye (2014) analyzed the price fluctuation of main vegetable varieties in China from 2004 to 2013 by adopting HP filter method and BP filter method. The results showed that the price of vegetables in our country showed a linear trend of overall growth with obvious seasonal variation and no obvious random fluctuation [13]. Tang Yong and Rong Yuting (2016) applied the X-12-ARIMA seasonal adjustment model and the H-P filter decomposition to analyze the prices of five kinds of bulk vegetables in Hubei Province. The stochastic volatility of the five kinds of vegetables in the province varied in varying degrees every year [7]. Liu Lihong and Li Jin (2016) applied the time series decomposition method and H-P filter method to analyze the fluctuation characteristics of Beijing vegetable prices [9]. Xu Yiting and Mu Yueying (2017) decompose vegetable price series in Beijing into seasonal fluctuations, long-term trends, cyclical fluctuations and stochastic volatility to explore the specific characteristics of price changes[4].(2) Analyze the vegetable price fluctuations and establish a model to predict the future development trend. Using the AR (1) model, Qiu Shuqin (2013) made a predictive analysis of the short-term trend of ginger prices and put forward corresponding policy recommendations [15]. Zhou Mingming and Zhang Ruitao (2015) established an ARMA model based on



time series analysis. The prices of Chinese cabbage, cucumber and tomato were analyzed and predicted. The forecast results show that the future price will show an upward trend [12]. Xing Congcong (2016) established the ARMA-GARCH model to forecast the price of Shouguang vegetable, and the result shows that the model predicts good results [8]. Tang Zhaobiao and Wang Bingwen (2016) used the principle of multiplication to seasonal decomposition of the original vegetable price series. The ARIMA model was established for the seasonally adjusted average price of vegetables and the overall average price of each month was predicte. The prediction effect was good [10]. Based on the seasonal index, Zhang Biao and Zhang Lingxian (2017) analyzed the trend of vegetable prices and the listing volume, and

built a forecasting model of 15 vegetable prices from 2005 to 2016 to predict the price fluctuation trend in the next two years [5]. Liu Zhiwei and Duan Dajuan (2017), who separated the long-term trend that vegetable prices do not contain seasonal cycle fluctuations, then calculated the seasonal index and established a price forecasting model to predict 2017 vegetable prices in Midu County [3].

To sum up, most of previous researches focus on the long-term fluctuation of vegetable prices, which has a weak guidance on the production of vegetable suppliers and the consumer behavior. Based on the previous studies, ARMA-GARCH joint model of short-term price volatility was established based on the sample price of pepper in Beijing Xinfa Di from March 1, 2017 to November 28, 2017. And predicted the price of the pepper and the variance of its conditions in the future 31 days.

3.EMPIRICAL STUDY ON THE PRICE FLUCTUATION OF PEPPER

3.1 DATA SOURCES

Considering that the January and February which before and after the Spring Festival, vegetable prices affected by the holiday factor larger, belong to the abnormal price volatility, so this article selected from March 1,2017 to November 28, 2017,a total of 270 days average daily price of pepper As a sample, the data comes from Beijing Xinfa Di official website. The data sequence diagram is shown in figure 1.

Figure 1.Sample Data Timing Diagram

As can be seen from figure 1, the average daily price of pepper during the sample period fluctuates around the mean value, and the sequence shows a relatively stable trend of fluctuation.

3.2STATIONARITY AND HETEROSKEDASTICITY TEST

Using the ADF test to test the data stationarity, the test results show that the value of t statistic is -2.83, the P value is less than 0.1, reject the null hypothesis at 90% confidence level, and the sequence satisfies the stationarity requirement.

In order to test the existence of ARCH effect in the model, an autoregressive moving average model of the sequence is established. Here, the optimal model is selected according to AIC and SC criteria. The comparison results of AIC and SC values of different models are shown in table 1.

Table 1 The AIC, SC value comparison of ARMA model

Model Type	AIC	SC
AR(1)	-1.493	-1.466
AR(2)	-1.482	-1.442
ARMA(1,1)	-1.486	-1.446
ARMA(1,2)	-1.616	-1.562
ARMA(2,1)	-1.485	-1.432

As can be seen from table 1, ARMA (1, 2) is the smallest compared with the values of AIC and SC in different models. Therefore, the ARMA (1,2) model of the sequence is established here and the residuals of the model estimation results are tested for autocorrelation from the test results, it can be seen that the autocorrelation coefficient of residuals falls within the confidence interval at the eighth period, and the P value is greater than 0.1. The original hypothesis is not rejected, and the residual sequence is irrelevant.

The LM test is used to test the residuals. The AIC and SC criteria are used to determine the test lag. When choosing different lags, the AIC and SC values of the LM test are shown in table 2.

Table 2 The AIC, SC value comparison of different lags LM test

Lags	AIC	SC
1	-1.622	-1.555
2	-1.620	-1.540
3	-1.614	-1.520
4	-1.607	-1.500
5	-1.592	-1.470
6	-1.596	-1.460
7	-1.590	-1.442
8	-1.585	-1.423

According to table 2, we can see that when the lag is 1, the value of AIC and SC is the smallest, so the one LM test is used here. According to the test results, the chi square value is 3.628, the P value is 0.057 and less than 0.1, and reject the null hypothesis at 90% Confidence level, ARCH sequence effect exist.

3.3 CONSTRUCTION OF ARMA-GARCH JOINT MODEL

Construct ARMA (1,2)-GARCH (1,1), ARMA (1,2)GARCH(1,2),ARMA(1,2)GARCH(2,1)ARMA (1,2)-GARCH (2,2) model, the values of AIC and SC of each model are shown in table 3.

Table 3 The AIC, SC value of ARMA-GARCH joint model

Model	AIC	SC
ARMA(1,2)-GARCH(1,1)	-1.794	-1.700
ARMA(1,2)-GARCH(1,2)	-1.686	-1.578
ARMA(1,2)-GARCH(2,1)	-1.788	-1.680
ARMA(1,2)-GARCH(2,2)	-1.786	-1.664

According to table 3, ARMA (1, 2) -GARCH (1, 1) has the smallest value of AIC and SC, so ARMA (1,2) -GARCH (1,1) is the most suitable model. Through comparative analysis, the error distribution function adopts the generalized error distribution. When the distribution parameter is 1.8, the AIC and SC values of the model are smaller and the parameters are tested. The parameter estimation results are shown in table

4.

According to the results of parameter estimation in table 4, the model can be expressed as:

Mean Equation:

$$p_t = 0.977p_{t-1} + 0.933 - 0.125a_{t-1} - 0.238a_{t-2} \quad (1)$$

Variance Equation:

$$a_t|\varphi_{t-1} = h_t\delta_t \quad (2)$$

$$h_t^2 = 0.000153 + 0.074a_{t-1}^2 + 0.913h_{t-1}^2 \quad (3)$$

$$\delta_t \sim iidN(0,1) \quad (4)$$

Among them, p_t represents the average daily price of pepper.

3.4 MODEL TEST

(1) Test of mean equation

According to table 4, P values of the t-test of each coefficient of the mean equation are less than 0.1, AR, MA eigenvalue are less than 1. According to the test results, the autocorrelation coefficient of the residuals fall into the confidence interval from the fifth period, the P value is greater than 0.1, the original hypothesis is not rejected, and the residual sequence is irrelevant , The model fully extracted the information.

(2) Test of variance equation

According to table 4, each factor of the variance equation is greater than 0, and the sum of the coefficients is less than 1. The t-test of the coefficient of P values are less than 1, the test passed.

3.5 MODEL PREDICTION AND RESULT ANALYSIS

(1) Model prediction

Using the fitted ARMA (1, 2)-GARCH (1, 1) model, the multi-period predictive value of the pepper price and the conditional variance can be obtained. The variance of the conditions for price fluctuation of the sample pepper is shown in figure 2.

period

Figure 2 The condition variance of sample sequence

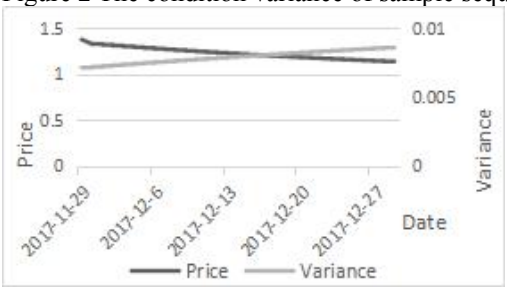


Figure 3 The Price and Variance of Forecast Period

Forecast the price of the pepper from November 29, 2017 to December 29, 2017. The forecast results is shown in figure 3.

Table 4 The parameter estimation of ARMA (1,2) -GARCH (1,1) model

Mean Equation		
	Coefficient	P value
C	0.933	0.000
AR(1)	0.977	0.000
MA(1)	-0.125	0.088
MA(2)	-0.283	0.000
Variance Equation		
C	0.000153	0.072
RESID(-1)^2	0.074	0.001
GARCH(-1)^2	0.913	0.000
R^2	0.889	
Inverted AR Roots	0.980	
Inverted MA Roots	0.600	

(2)Result analysis

The variance of the condition estimated from the model shows that the fluctuation of pepper price during the sample period has the following characteristics:

①Time-variant

As can be seen from figure 2, the conditional variance sequence of the price of pepper fluctuates with time. The maximum of variance on September 9 is 0.038 and the variance is the smallest of 0.003 on May 12. In July 2017 to September 2017, the variance fluctuated a lot, with obvious time-varying.

②Aggregation

As can be seen from figure 2, the conditional variance of the price of the jerky fluctuates greatly between July 2017 and September 2017, and the large fluctuations tend to follow a large fluctuation, while the small fluctuations tend to follow a small one Fluctuation. In the rest of the period the volatility is relatively small. Showing a more obvious aggregation effect.

As can be seen from figure 3, the small fluctuation of variance will bring about a relatively large price fluctuation. The conditional variance in the forecast period shows a slight upward trend, but the price of pepper shows a significant downward trend.

4. SUGGESTION

Based on the above analysis, the following suggestions are made:

(1) For residential consumers. According to the price forecast, the price of pepper may show a more drastic downward trend in the next 31 days. Therefore, consumers can use pepper as a substitute for some vegetables and appropriately increase the purchase of pepper.

(2) For vegetable suppliers. For vegetable producers, since the prices of pepper can show a significant downward trend in the next 31 days, it is possible to reduce pepper production and increase the production

of other types of vegetables in the short term under the premise of ensuring internal demand. However, In satisfying their own interests at the same time can also promote the stability of the vegetable market. The vegetable supply intermediary can also reduce the high-volume purchases of pepper, reduce the market supply.

(3) For regulators. As the price of pepper will appear more significant fluctuations in the short term, so vegetable market regulators can take a limited supply of pepper and other measures in advance to cope with future price fluctuations on market stability.

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Low-velocity Impact and Flexural Properties of Composite Laminates

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Abstract:In this work, the analysis of the impactor mass effect on the behaviour of carbon/epoxy woven laminates under low velocity impact is carried out. To this end experimental test were performed by means of a drop weigh tower in a range of energies varying from 10 to 110 J, and using three different impactor masses. Two different laminate thicknesses were considered in order to take into account its possible influence. An analysis of the impact tests is performed using the Composite Structure Impact Performance Assessment Program, in order to observe the influence of impactor mass. Once impacted, the laminates were inspected by means of a C-Scan (to quantify the delamination extension) and a phased array ultrasonic system (to analyse the failure through the thickness); this non-destructive analysis will determine the influence of the impactor mass on the laminate failure.
Keywords: A. Woven carbon/epoxy; B. Drop weight tower; C. Low velocity; D. Impactor mass

1. INTRODUCTION

The use of composite laminates by the aeronautic industry has increased significantly in the last years. One example of this increase is the use of these materials in the recent developments performed by the two largest civil aircraft company manufactures, where the use of composite laminates in the structure has achieved 50% in terms of weight. In addition to this field, recently the automotive industry has started to use this type of materials in the vehicle structures, in order to reduce the energy consumption in the new generation of electric cars.

In an attempt to clarify the influence of impactor mass in woven laminates, this work presents the analysis of low velocity impact test using three different impactor masses in a wider energy range than previous works, where both delamination and fibre failure are presented. The influence of impactor mass is also studied in two different laminate thicknesses. In order to perform the analysis of the influence of impactor mass, a systematic study of the impact has been carried out using the Composite Structure Impact Performance Assessment Program (CSIPAP) proposed by Feraboli and Kedward [1]. Since it is expected that the impactor mass effect on the failure mechanism for equienergetic impacts could be small, a detailed damage inspection has been performed in the current work using conventional C-Scan and a detailed C-Scan using a phased array ultrasonic system to obtain the in-plane and through thickness delamination shape.

2. EXPERIMENTAL

Fig. 2summarises the experimental tests performed with each impactor mass, detailing the impact velocity and the kinetic energy.Impact test were record by means of a high speed camera (Photron SA-Z 2100 K), configured at 20000 fps and with a resolution of 1024×1024 pixels. Using a mirror placed under the specimen with an inclination of 45°, it was possible to visualise at the same time the impactor movement and the back face of the laminate, allowing to observe the initiation of the fibre failure and the propagation of it. A sketch of the experimental set-up used to record the impact process can be observed in Fig. 1. It also includes a frame obtained by the high speed camera; the central region of the back face of the laminate has been painted in white allowing a better identification of the fibre failure.

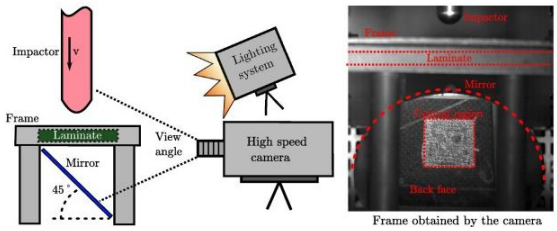


Fig. 1. Sketch of the experimental set-up used for the recording of the impact process, and a frame obtained with it.

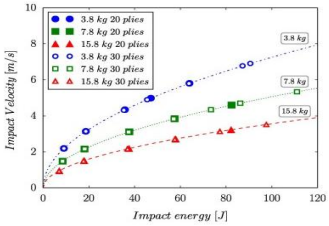


Fig. 2. Summary of impact test performed in this study.

As aforementioned the force vs. time curves were directly obtained from the instrumented striker of the drop weigh tower. It has to be mentioned that the force time history curve has not been filtered according to the ASTM standard test D7136 [2]. Fig. 3 shows an example of these curves, one subcritical (10 J) in which no damage is induced, and the other supercritical (50 J) which produces damage.

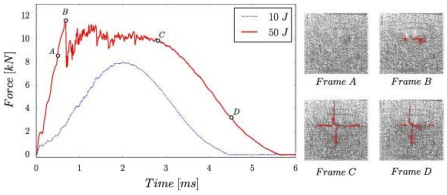


Fig. 3. Representative force time curve patterns for subcritical (10 J), supercritical (50 J) and images of the centre of the back face of a 30 plies laminate at different times impacted at 50 J.

The peak force as a function of the impact energy for all the impactor masses and laminate thicknesses considered is shown in Fig. 4. It could be observed that for the thinner laminates the peak force slightly increases with the impact energy. For thicker laminates, two different slopes are observed; from an impact energy of around 20 J onwards, the peak force increases in a similar manner as it does in the thinner laminates, whereas below 20 J the peak force is sensible smaller. This change in the slope is due to the fact that no delamination or fibre failure was induced at 10 J in the thicker laminates (confirmed with C-Scan) while at 20 J both delamination and fibre failure have already appeared causing the peak force to have a soft growing trend, almost constant, as shown in the work of Feraboli et al. [1] and Zabala et al. [3]. For the thinner laminates no slope change is observed, since for the minimum energy considered (10 J), delamination and fibre failure is already induced. It is possible to state that no influence on the impactor mass is found for the two studied laminates attending to the peak force.

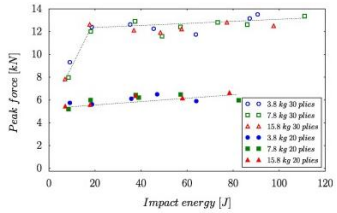
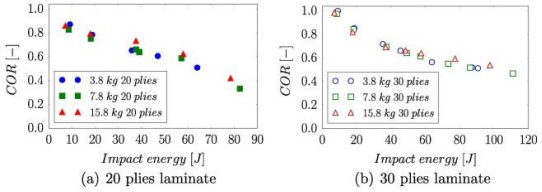


Fig. 4. Peak force as a function of impact energy for both laminate thicknesses.

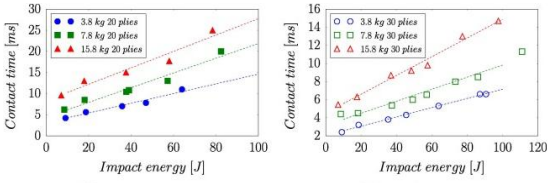
In order to study the response of the laminates in terms of energy, the COR [1] is depicted for all the cases considered in Fig. 5.



(a) 20 plies laminate (b) 30 plies laminate

Fig. 5. COR evolution vs. impact energy for both laminate thicknesses.

Fig. 6 shows the total time of contact between the impactor and the laminate as a function of the impact energy for the different impactor masses and laminate thicknesses considered. It is observed that as the impact energy increases, the contact time also increases; this happens because the damage in the laminate becomes larger, making the specimen more compliant. Regarding the thickness of the laminates, the total contact duration for the thicker laminates is around 2 times smaller than for the thin laminates due to the higher stiffness of the first ones.



(a) 20 plies laminate (b) 30 plies laminate

Fig. 6. Contact time vs. impact energy for both laminate thicknesses.

It can also be observed a clear influence of impactor mass in such a way that for a given impact energy the heavier impactor, and therefore slower, remains a longer time in contact with the laminate. The differences are similar to the differences in the initial impact velocity, which could indicate that this parameter have scaled in time the overall process of impact. Nevertheless, to have a better understanding of the phenomenon, the final displacement among the different masses impacted is plotted, Fig. 7. The results confirm the previous explanation, since no influence of impactor mass can be observed. It has to be mentioned also that, as expected, the final displacement is smaller for the thicker laminates.

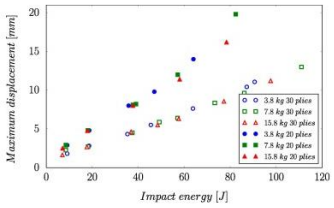
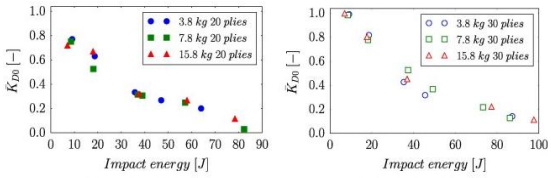


Fig. 7. Maximum displacement as a function of the impact energy for different impactor mass and two laminate thicknesses.

Fig. 8 shows the normalised residual transverse stiffness for both analysed thicknesses, as function of the impact energy. It could be observed that it diminishes as the impact energy increases due to the rising of the damage induced in the laminate. As happened in the COR plots, the normalised residual transverse stiffness curves do not show a clear trend regarding the influence of the impactor mass for this particular range of impact energies. Finally, as expected, the normalised residual transverse stiffness for the thicker laminates is slightly bigger than for the thinner laminates.



(a) 20 plies laminate (b) 30 plies laminate

Fig. 8. Normalised residual transverse stiffness vs. impact energy for 20 and 30 plies laminate thicknesses.

3. DAMAGE ANALYSIS

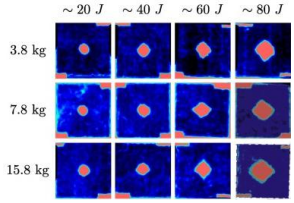


Fig. 9. Comparison of the C-Scan results for a 30 plies laminate, impacted at different energies with different impactor masses.

The conventional C-Scan procedure was used to obtain the shape and extension of the delamination. The C-Scan inspections for the 30 plies laminates are presented in Fig. 9. The images show the projected damage areas of the laminates impacted from 20 to 80 J for the three impactor masses studied; the laminates impacted at 10 J are not included since no damage was found. The shape of the

damaged area is circular for the impacts performed at 20 J, and as the impact energy increases it tends to a diamond pattern. This evolution is the same for the three impactor mass analysed.

Fig. 10 shows the C-Scan for the 20 plies laminates. In this case the shape of the projected delaminated area is a diamond (or cruciform) from the lowest impact energy. As for the thicker laminates, both the shape and the size are very similar no matter of the impactor mass used.

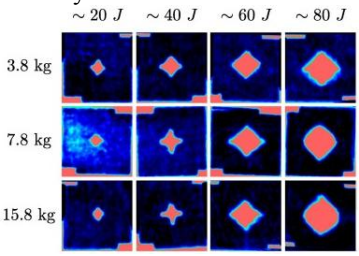
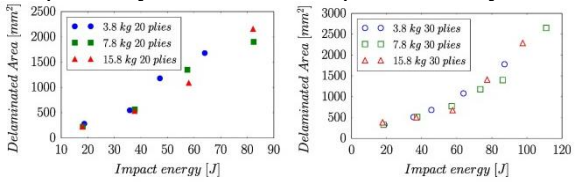


Fig. 10. Comparison of the C-Scan results for a 20 plies laminate impacted at different energies with different impactor masses.

As a summary of the damaged areas, Fig. 11 shows a graph with the delaminated area vs. the impact energy for all impact cases with damage. As the impact energy increases the extension of the damage grows, independently of the mass or impactor velocity.



(a) 20 plies laminate (b) 30 plies laminate

Fig. 11. Delaminated area vs. impact energy for both laminates thicknesses.

An Olympus Omniscan-SX phased array ultrasonic system is used to analyse the location of the delaminations through the thickness of the laminate. Fig. 12 shows the in-depth C-Scan of the thicker laminate impacted at 20 J for the different impactor masses. The colour (please referred to the online version of the paper) indicates the depth of the first delamination found by the scan. It can be seen how the delamination area increases with the depth, producing a frustum-cone shaped delamination, that it is better depicted in Fig. 13where the B-scan is presented for the same laminate thickness for an impact of 40 J. This is a very well known effect, firstly reported by Cantwell et al. [4].

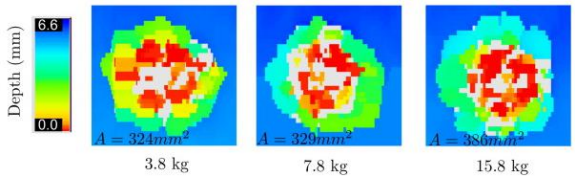


Fig. 12. Detailed C-Scan for the laminate of 30 plies impacted at 20 J for the three different impactor masses.

Analysing Fig. 12 ; Fig. 13, it is possible to conclude that no influence of impactor mass is found. A very similar result is obtained for the 20 plies laminates. It can be concluded, after the damage analysis, that the delaminated area, the in-plane delaminated shape and the through thickness delaminated shape does not show impactor mass influence for equienergetic impacts, reinforcing the idea that in this range of energy, mass influence on the behaviour of carbon/epoxy woven laminates is negligible.

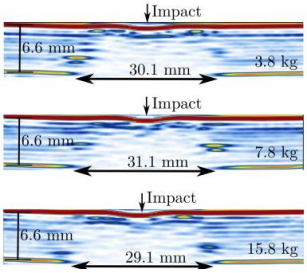


Fig. 13. Phased array B-Scan performed for impacts at 40 J for the laminate of 30 plies with the three different impactor masses.

4. CONCLUTIONS

Low velocity impact test have been performed with different impactor masses in order to analyse its influence on the induced impact damage. Thanks to the CSIPAP methodology, it can be said that no influence of this parameter has been observed in the behaviour of composites laminates at this energy range where fibre damage and delamination occurred. Peak force, COR, maximum displacement and residual stiffness plots are function of impact energy alone and not velocity impact or impactor mass separately. Total contact duration shows a difference trends for each impactor mass. This is not caused by a different behaviour of the impacted laminated, but it is explained due to the different initial velocity in equienergetic impacts. As it is expected, differences regarding laminate thickness has been observed in the previous parameters, resulting for the thicker one in higher peak force, higher COR, lower contact duration, lower final displacement and higher residual stiffness at the same impact energy.

ACKNOWLEDGEMENTS

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Damage Resistance of A Preloaded Composite Plate to Low-Velocity Impact

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Abstract: The purpose of this work is to study the resistance to low velocity impact of woven hemp/epoxy matrix composites and the influence of impact damage on their residual quasi-static tensile and cyclic fatigue strengths. Impact characteristic parameters were evaluated and critically compared to those found in the literature for other similar composites. Damage mechanisms were analysed by using AE monitoring and microscopic observations. An analytical model is used to predict the fatigue lifetime of impacted specimens. Moreover a damage scenario is proposed, reduced to two phases in post-impacted fatigue behaviour, instead of three phases for non impacted specimens.
Keywords: Fabrics/textiles; Impact behaviour; Fatigue; Acoustic emission

1. INTRODUCTION

In recent years, as a result of environmental and economical concerns, there has been a growing scientific and economic interest in natural fibres because of their sustainable and eco-friendly production processes and disposal[1-2], accompanied by good mechanical properties [3]. Bast fibres (hemp, flax and jute) and leaf fibres (sisal) have been considered very promising candidates in terms of specific mechanical properties for semi-structural applications as viable replacement of synthetic reinforcing materials, such as glass and aramid fibres, in polymer based composites[3-4]. In service conditions, low-velocity impacts and related damage are unavoidable and are often undetectable by human eye inspections. Various research programs have been conducted in order to obtain a better understanding of the behaviour of composite materials under impact [5]. However, there is still a very limited scientific literature on the impact response of natural fibre (woven) composites [6].

In the scientific literature, data on the post-impact fatigue behaviour of composites reinforced with woven natural fibres are not yet reported and this study aims to fulfil this gap by providing experimental data and modelling tools to enable a good estimation of them. The purpose of this work is to study the resistance to low velocity impact of woven hemp/epoxy matrix composites and the influence of impact damage on their residual quasi-static tensile and cyclic fatigue strengths. Drop weight impact tests were performed on woven hemp/epoxy composite specimens to analyse their impact behaviour and damage modes. Impacted samples were tested in quasi-static and cyclic fatigue tensile loading and compared with results from non-impacted ones. Finally, an analytical model was used to predict S–N curves after impact.

2. MATERIALS AND METHODS

The studied composite materials have already been used in previous studies[7-10] and are characterised by a lay-up of 7 plies of a plain woven hemp fabric impregnated with epoxy resin. The hemp fabric (produced by Lin et L'Autre – France) has non-treated surface, a weight of 267 ± 1 g/m2 and a thread count of 2362 × 1575 (warp and weft per metre) with three hemp yarns in each warp and weft strand. Hemp fibres in yarns have an average diameter of 13 ± 5 μm and are produced with a twist level of 324 tpm (yarn surface twist angle of 11°) and a linear density of 83 tex. Besides the irregular cross-section, the hemp yarns have an apparent diameter of 300 ± 60 μm [7]. The epoxy resin is an EPOLAM 2020 from Axson Technologies (France) with density of 1.10 g/cm3 after curing (according to the manufacturer's datasheet). The composite plates were manufactured at Valagro(France), by the vacuum infusion technique (vacuum of 30 mbar, absolute pressure). The hemp fabric was pre-dried at 40 °C for 24 h before use. The laminates were cured by using the following cycle: 24 h at ambient temperature, 3 h at 40 °C, 2 h at 60 °C, 2 h at 80 °C and 4 h at 100 °C. The resulting composite plates are characterised by a density of 1.2 ± 0.1 g/cm3, a fibre volume fraction of 0.31 ± 0.04, a maximum void content of around 6% by volume and a thickness of 4.5 ± 0.2 mm. The composite plates have the warp direction of each ply oriented at 0° from the tensile axis (X axis).

3. RESULTS AND DISCUSSION

Fig. 1a presents the contact force–deflection curve of specimens impacted at 2.5 J, 5 J and 10 J. In this curve, contact force is the load undergone by the specimen and deflection is the indentation of the falling dart through the specimen's surface. These plots show a closed loop, which is peculiar to specimens having rebound. As schematized in Fig. 1b, the area under the curve is the deformation energy that is initially transferred from the dart to the specimen and then returned from the specimen to the (rebounding) dart (i.e. recovered energy). From this curve, also other characteristic parameters were obtained, like peak load and linear stiffness, to characterise the laminate

resistance to impacts and to allow comparisons between different materials.

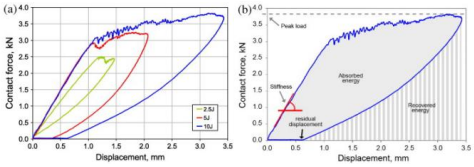

Fig. 1. (a) Impact load–displacement curves for hemp/epoxy composite specimens impacted at 2.5 J, 5 J and 10 J. (b) Schematic representation of impact characteristic parameters.

The peak load indicates the maximum load that the composite can bear before undergoing to major damages [11]. Fig. 2a presents a comparison of the peak load values for the tested hemp/epoxy composites and selected data available in literature for glass/epoxy [12] and Kevlar/epoxy [13] fabric reinforced composites.In the graph of Fig. 2b, the ratio between absorbed and impact energy is plotted for different impact energies and compared to data (green points) from a similar hemp/epoxy composite[14] to observe the trend for higher impact energy. These results show that this ratio increases with the impact energy level, which indicates growing impact damage for increasing impact energy.

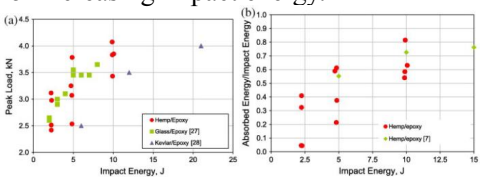

Fig. 2. Comparison of results from impact tests of the present work with data from literature reported on woven composites: (a) peak load and (b) ratio between absorbed and impact energy as a function of impact energy.

Surface damage modes were analysed and are presented in Fig. 3 for specimens impacted at 2.5 J, 5 J and 10 J. Pictures on the left show the impacted sides (front face), where the damage appears as a circular indentation caused by the falling hemispherical head. The depth of this indentation increased with increasing impact energy and there were no visible crack or perforation on the front face for the applied impact energies. The damage on the opposite sample side (back face) starts with ±45° oriented cracks with respect to warp yarns in the specimen impacted at 2.5 J and proceed in the radial direction from the centre of the specimen, in samples impacted at 5 J and 10 J. For these higher energies, the crack tends to propagate along the direction of fabric yarns, as clearly visible in Fig. 3.

The damage visible on the back face is an indicator of the impact resistance of a composite material and it is interesting to compare its size with that of other types of composites even if there is no uniform standard for comparison. In this study, the damage size is considered as the area of the ellipse encompassing the damage. In Fig. 4, the back face damage size is measured on the studied hemp/epoxy composites and plotted versus the impact energy showing that the damaged area at the back face increases significantly with the impact energy. Fig. 4 clearly shows that the damaged area of the studied hemp/epoxy composites is comparable to that obtained from the considered synthetic fibre composites.

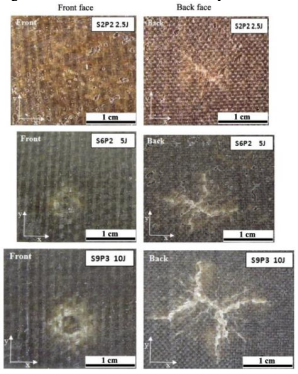

Fig. 3. Front and back faces of hemp/epoxy specimens impacted at 2.5 J, 5 J and 10 J.

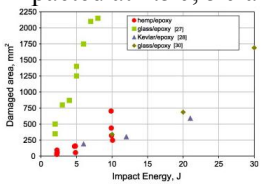

Fig. 4. Damaged area on the back face of hemp/epoxy composites impacted at 2.5 J, 5 J and 10 J and comparison with glass/epoxy and Kevlar/epoxy composites from literature data.

Impacted specimens were cut, along the warp yarn direction, in the centre of the damaged zone through specimen thickness, with a diamond wire cutting process, and then polished. Optical microscope observations revealed a brighter area in the matrix with a conical shape (Fig. 5), which corresponds to the internal damage that grows toward the back face, a characteristic phenomenon present in impacted composite materials[15-18]. It has also been observed that the damaged area increases with the impact energy. For impact energy of 2.5 J, the conical zone reaches the 4th and 5th plies far from the impacted face (Fig. 5). At impact energy of 5 J, the conical region reaches the 1st and 2nd plies from the front face. Finally at impact energy of 10 J, damage expands in the laminate and a residual deflection of the sample is visible.

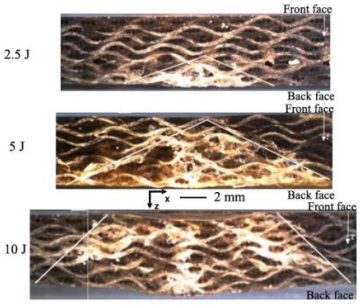

Fig. 5. Microscopic observation of the cross section of

hemp/epoxy specimens impacted at 2.5 J, 5 J and 10 J.

Samples impacted at 5 J were then cut at 90° and 45° from the warp yarn direction to observe the damage along the directions outlined in the sketches (Fig. 6). In these photos, semi-conical brighter areas representing damage are present in the cross-sections. These observations are in very good agreement with the theoretical shape of the back face damaged area in the XY plane as represented in Fig. 7. A significant difference is observed in the size of the cone base for the 45° cross-section, which is substantially lower than those in 0° and 90° cross-sections. This indicates that the damage spreads easily in yarns directions, even if it is initially oriented at 45°.

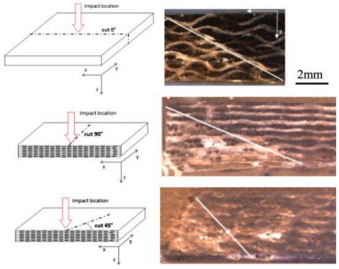

Fig. 6. Comparison of internal damage in the direction of cutting (0°, 90° and 45°) for the hemp/epoxy composite impacted at 5 J.

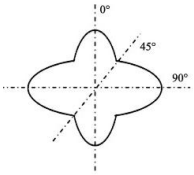

Fig. 7. Theoretical shape of damaged area on back face in the XY plane, for the hemp/epoxy composite impacted at 5 J.

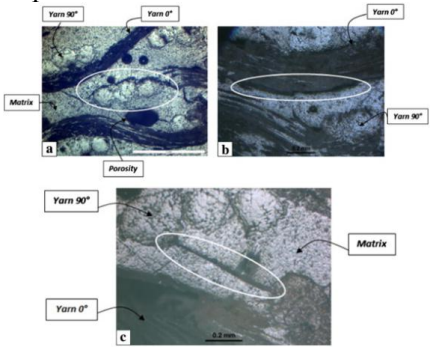

Fig. 8. Internal damage of a 5 J impacted hemp/epoxy composite in different thickness positions.

At higher magnification (Fig. 8), it was possible to distinguish two types of internal damage: interface (Fig. 8a and b) and matrix (Fig. 8c) cracks, located in the conical zone previously observed.The damage at the yarn/matrix interface (“type 1”) tends to bypass the yarns of each strand and it has been found around both weft (Fig. 8a) and warp (Fig. 8b) yarns. For the three levels of impact energy used, this type of crack was found through the whole thickness of the specimen just below the impacted area. The Fig. 8c shows matrix cracks (“type 2”). The qualitative evolution in the distribution of both types of damage for the three impact energies is shown in the diagrams of Fig. 9, coupled with photos showing conical damage areas from sample cross sections. These pictures show a clear similarity between the qualitative evolution of matrix cracks (“type 2”) and the bright areas in all samples.

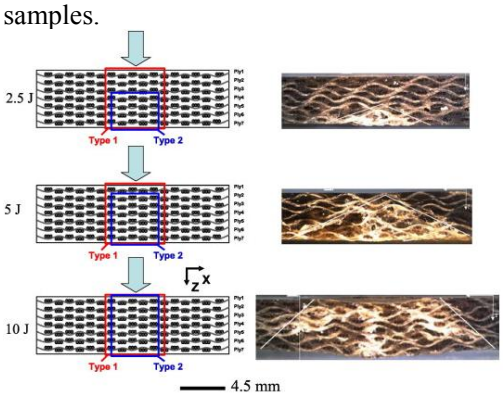

Fig. 9. Qualitative distribution of the two types of damage in cross-sections at 0° of specimens of hemp/epoxy composite for each level of impact energy.

Impacted specimens were tested in quasi-static tensile tests to analyse the influence of impact damage on residual tensile strength and stiffness. Systematically for each level of impact energy, the final failure of specimens tested in tension occurred in the area previously damaged by impact, as shown in Fig. 10. It has been observed that the final failure of impacted specimens is asymmetrical between the front and back faces. On the back face, the tensile failure tends to follow the 45° defect at the centre of the damage created by the impact, while on the front face the failure is always oriented perpendicularly to the tensile axis. This asymmetry of the specimen tensile failure is due to the asymmetry of the impact damage.

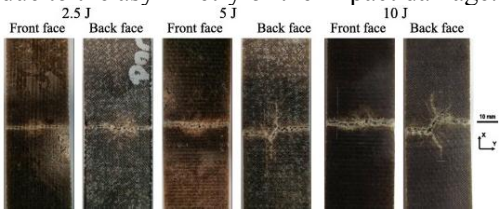

Fig. 10. Optical micrographs of the front and back faces after the final failure of hemp/epoxy composite specimens tested in tension after being impacted at different impact energy levels.

Fig. 11a compares the ultimate tensile stress (UTS) of as-manufactured and impacted specimens at different impact energies. These tests indicate that tensile strength of composites is reduced to about 85% after an impact at 2.5 J, to 70% after an impact at 5 J, and to about 60% after an impact at 10 J. One can also observe the increase in standard deviation of UTS for impacted specimens compared to non-impacted ones. This higher standard deviation is probably due to the combined effect of data dispersion from the material tensile strength and data dispersion from impact tests, partly related to the data dispersion of mechanical

properties of natural plant fibres. On the other hand, the elastic stiffness of impacted specimens does not present significant change as it remains into the data dispersion of non-impacted ones, as represented by dashed lines in Fig. 11b. This can be related to the absence of fibre damaging during impact tests at the used impact energies, as previously confirmed by the optical microscope analysis.

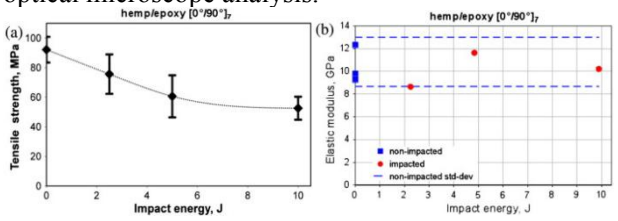

Fig. 11. Comparison of quasi-static properties of non-impacted and impacted woven hemp/epoxy composites: (a) ultimate tensile stress and (b) Young's modulus.

Fig. 12 shows that fatigue strength, as expected, decreases with the increase in fatigue stress for both impacted and non-impacted composites. For a given fatigue stress, the number of cycles to failure is reduced for impacted specimens compared to non-impacted ones. Also, it is worth to note the more larger dispersion of fatigue data resulting for impacted specimens compared to non-impacted ones, as also experienced in tensile tests.

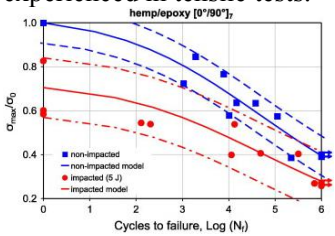

Fig. 12. S–N fatigue curves for 5 J impacted and non-impacted specimens of woven hemp/epoxy composite.

The good fit of the S–N curve model for impacted specimens using material parameters from non-impacted ones means that, for the studied composite and for low energy impacts, the influence of impact on the fatigue behaviour can be determined from the influence of impact load on the laminate tensile strength. It is thus possible to predict the fatigue life of impacted specimens just knowing the fatigue life of non-impacted specimens and the residual UTS for the given impact energy. For example, in Fig. 13 are shown the S–N curves for non-impacted specimens.

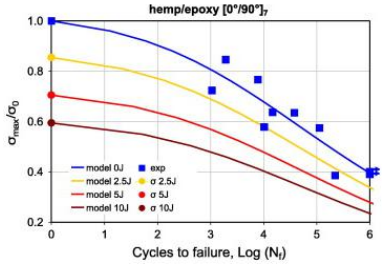

Fig. 13. Prediction of fatigue lifetime for hemp/epoxy composites impacted at 2.5 J, 5 J and 10 J.

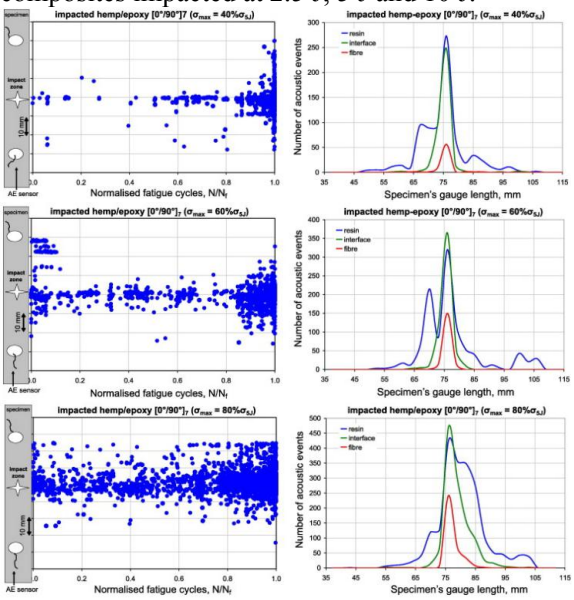

Fig. 14. Distribution of acoustic events during fatigue tests on hemp/epoxy composite specimens impacted at 5 J (left) and number of acoustic events, per damage mode, along the specimen length (right).

AE events, which are related to occurrence of damage, were recorded during fatigue tests and are presented in Fig. 14 (left side). The vertical axis represents the specimen's gauge length between AE sensors and the horizontal axis represents the normalised fatigue cycles.

In Fig. 15a are represented the curves of the cumulative number of acoustic events plotted against the position for the impacted specimens for three stress levels. Comparing the curves in this figure with those obtained from non-impacted specimens (Fig. 15b), it is evident that the acoustic events are distributed more uniformly over the entire length of the specimen and along fatigue lifetime [10] in the case of non-impacted specimens.

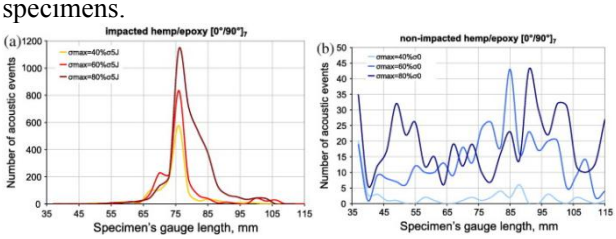

Fig. 15. Cumulative number of acoustic events along the specimen's gauge length for (a) impacted at 5 J and (b) non-impacted hemp/epoxy composites for the three stress levels studied.

Another significant difference between AE events on impacted and non-impacted specimens during fatigue tests emerges from Fig. 16, where the cumulative numbers of AE events for impacted and non-impacted specimens are plotted against normalised fatigue cycles, for fatigue stress levels of 40%, 60% and 80% of the respective UTS.

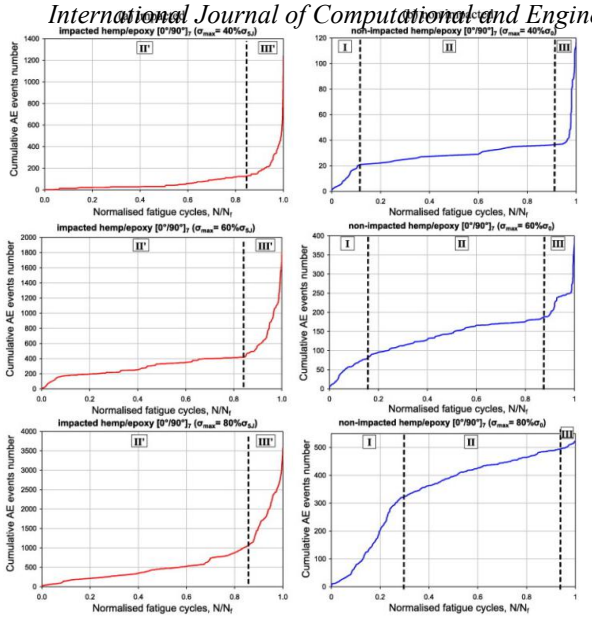

Fig. 16. Cumulative number of acoustic events versus the normalised number of fatigue cycles for (a) impacted specimens and (b) non-impacted specimens for the three levels of fatigue loading.

4. CONCLUTIONS

Impact tests have been performed on woven hemp/epoxy composites. Impact related parameters such as peak load, elastic energy and absorbed energy were studied and compared to those reported in the literature for other composites. Results show that the studied eco-composite has an impact behaviour which is comparable to the one of synthetic composites.

ACKNOWLEDGEMENTS

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Finite Element Modeling Of Damage Development In Composite Laminates Subjected To Low Velocity Impact

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Abstract: This paper presents a damage analysis process of composite laminates subjected to low-velocity impact. Drop weight tests were carried out on specimens with two kinds of stacking sequence. Ultrasonic C-Scan was used to investigate the delamination area of each interface. Numerical models were built based on a damage model where cohesive contact method was involved. The efficiency of delamination modeling was discussed and the damage model was validated. The results of the FEM were found to agree well with experimental observation. According to the results, a prediction process of delamination shape was made for composite laminates under low-velocity impact. The delamination area was found to distribute symmetrically around the impact point while the shape is related to the ply angles of the layers close to the interface. The prediction was proved to have good accuracy and efficiency.
Keywords: Composite laminates; Delamination; Damage prediction; Low-velocity impact; Numerical simulation

1. INTRODUCTION

A large amount of experiments were carried out on the damage behavior of composite laminates. Tita [1] tested three kinds of composite plates with typical stacking sequences under different impact energies. The mechanical behavior of the specimens was classified by the ratio of absorbed energy versus impact energy. Matrix crack and delamination were found when the fraction of absorbed energy was above 35%, while fiber rupture appeared as the fraction increased to 75%. Schoeppner [2] investigated the delamination threshold load of composite laminate under low velocity impact. The threshold load level was obtained from the load–time history or load–displacement plot, at which a sudden load drop occurs due to specimen stiffness loss as a result of laminate level damage. Sebaey [3] and Lopes[4] ; [5] studied the effect of mismatch angle between plies on the delamination areas of composite laminates. Specimens with different stacking sequences were subjected to drop weight impact, and damages under different load levels were gained through C-Scan. The results indicated that by reducing the mismatch angle between the adjacent layers, the response of CFRP composites to low velocity impact could be improved. The experiments made by these researchers were mostly based on drop weight impact machines. Hou [6]and Joshi [7] carried out impact tests using a gas gun. This kind of loading method can avoid repeated loading appeared in drop weight tests, and impact energy can be easily controlled in the experiment procedure.

This paper presented a damage analysis process for composite laminates under low-velocity impact. First, a damage model for composite materials is proposed which has considered intra-laminar and inter-laminar damage. Then, drop weight tests were carried out on laminated composite specimens. Ultrasonic C-Scan was used to investigate the delamination area in each interface and image processing method was applied to characterize the damage scopes. Based on the damage model, numerical simulations were made to study the efficiency of delamination modeling. Validation was also made for the damage model, and numerical result was found to agree well with experimental observation. Furthermore, the relationship of stacking sequence and delamination shape was summarized. Several conclusions were made and some future work was listed.

2. EXPERIMENTAL

The damage behavior of composite laminates can be divided into two types: intra-laminar damage and inter-laminar damage. The intra-laminar damage consists of fiber damage and matrix damage, while the inter-laminar damage is mainly contributed by delamination.Linear damage evolution law was used after damage appeared in the composite material. The evolution law of fiber tensile damage was presented in Fig. 1.

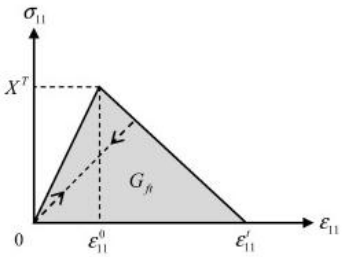

Fig. 1. Stress–strain relationship for fiber tensile damage.

The three directions correspond to the three fracture modes which are shown in Fig. 2.

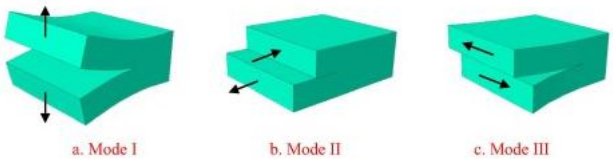

Fig. 2. Three fracture modes for delamination.

The damage evolution law of delamination is similar with

the law of intra-laminar damage discussed above. Before delamination appeared, the interaction was considered to have a linear behavior. Once the damage criterion was satisfied, the cohesive stiffness degrades linearly (see Fig. 3).

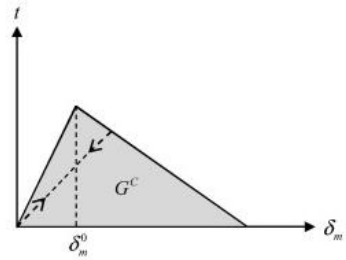

Fig. 3. Traction–separation law for cohesive contact.

Drop weight impact tests were carried out based on ASTM-D7136. The standard is a test method for evaluating the damage resistance of a fiber-reinforced polymer matrix composite to a drop-weight impact event. The laminate plate was manufactured with T700/3234 UD carbon/epoxy composite. According to the standard, the specimen was cut into a plate with a size of 150 × 100 mm, and clipped on a rigid supporting structure with a rectangular cut of 125 × 75 mm in the center. The low-velocity impact was made by InstronDynatup 9250HV drop weight machine. The punch, with a diameter of 16 mm, was made of aluminum. The impact energy varies with the weight and drop height of the punch. The setup for impact tests were presented in Fig. 4.

Fig. 4. Setup for impact tests.

Curves of impact force versus time and displacement were obtained through the load sensor and the displacement sensor, as presented in Fig. 5. After the drop weight tests, the dent depth of the impact point on each specimen was measured using a micro-digital indicator. The visual damage on the surface of specimen A is presented in Fig. 6.

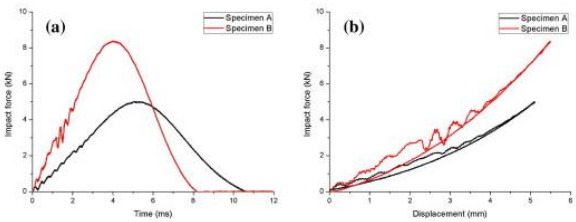

Fig. 5. Curves of impact force versus time (a) and displacement (b) obtained from the tests.

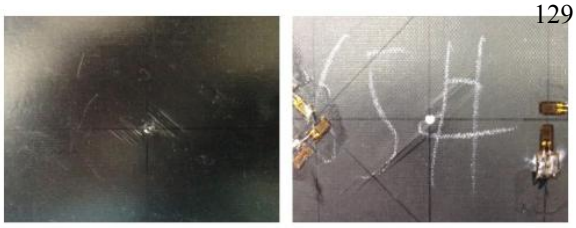

Fig. 6. Visual damage on the specimen surface.

Matrix crack and fiber failure appeared at the impact point, while small bulges were found on the back surface, which indicates delamination of the bottom layer. In order to investigate the delamination area directly, C-Scan technique was used. The results of specimen The specimens were examined under an ultrasonic scanning microscope made in Germany. Delamination areas were obtained layer by layer along the thickness direction of specimen A (Fig. 7). The experimental results will be discussed more specifically in Section 5.

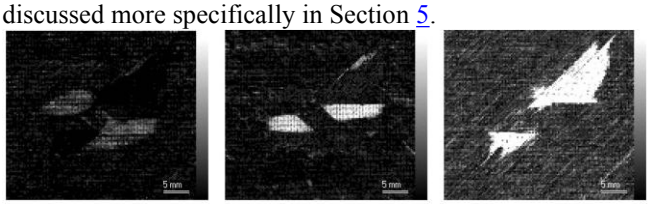

Fig. 7. Delamination image of specimen A through C-Scan.

In this paper, five models were built to find the most suitable number of cohesive interfaces. Since test results have shown that delamination just took place between the layers away from the impact surface, we introduce cohesive contact into the laminate gradually from the bottom. For example, the contact information of model 3 is presented in Fig. 8. The layers of the laminate are numbered from the bottom to the top. Layers 5 to 8 are tied together, while cohesive contact is introduced between layers 1 and 2, layers 2 and 3, layers 3 and 4.

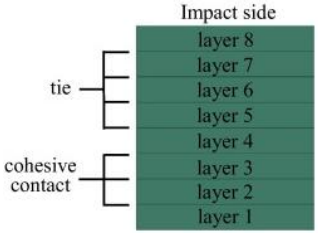

Fig. 8. Interaction in model 3.

The finite element model of specimen A was presented in Fig. 9. The model contains 48,000 continuum shell elements and 928 solid elements. Each layer contains 2400 elements with 3 Simpson integral points. The displacement of the edge was fixed along X, Y and Zdirections. Initial velocity field was defined on the punch model. Ultrasonic C-Scan presented the delamination area in the bottom 3 layers.

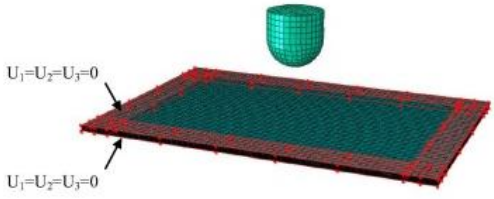

Fig. 9. Finite element model.

3. RESULTS AND DISCUSSION

Time history curves of impact force are shown in Fig. 10. The black and red curves represent the experimental and numerical result respectively. Good agreement can be found in both specimens.

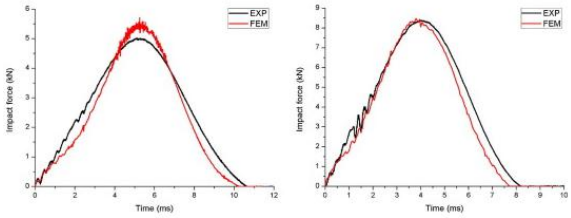

Fig. 10. Time history curves of impact force.

In the studies before, delamination was found along the fiber direction of the layer below the interface. This law was proved once again by the results presented in Fig. 11 ; Fig. 12. However, it should be noticed that the delamination shapes are not the same for interlayer 3|4 in specimen A and interlayer 4|5 in specimen B, although the fiber directions of the layers below the interfaces are both 0°. This phenomenon indicated that the delamination shape is affected by the fiber direction of both layers close to the interface.

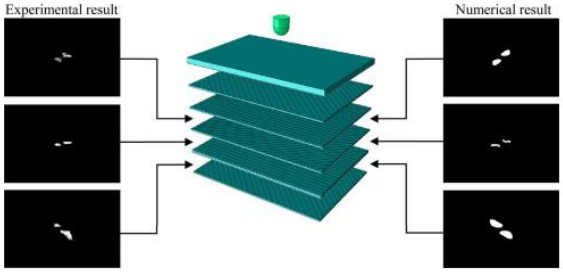

Fig. 11. Delamination shapes of the bottom 3 interfaces in specimen A.

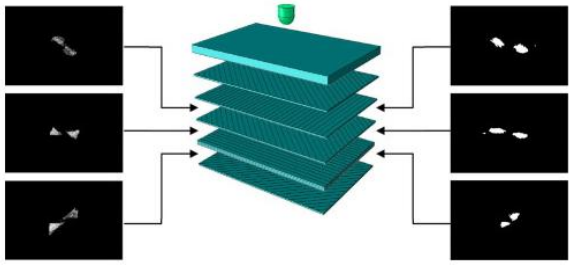

Fig. 12. Delamination shapes of the bottom 3 interfaces in specimen B.

4. CONCLUTIONS

delamination analysis process for composite laminates under low-velocity impact was presented in this paper. A damage model which considered both intra-laminar and inter-laminar damage was proposed. Experimental analysis was carried out through drop weight tests. Ultrasonic C-Scan technique was used to reveal the delamination appeared in the interfaces.

Future works will focus on the damage models. Since the dent depth predicted by the damage model proposed in this paper was inaccurate, plastic behavior should be taken into account in the future. The stacking sequence of composite laminates studied in this paper is limited to combinations of 0°, 90° and ±45°. More ply angles should be taken into account in the prediction of delamination area.

ACKNOWLEDGEMENTS

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Effect of Grain Import on Grain Price Fluctuation in China

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Abstract: Along with the population increasing and speed up the pace of urbanization, China's food gap is more and more big, need a large number of imported from international market, China's food market is more and more under the influence of the world grain market, China's grain price is closely related to food imports. This article uses the 2008-2015 grain monthly import quantity and the price data, uses the cointegration examination and the VEC model around grain import to the Chinese grain price fluctuation influence question to carry on the empirical analysis. There is a balance between grain import and domestic grain price, but the difference between soybean and rice imports has a certain effect on domestic price fluctuation, and there is no long-term equilibrium relationship between the import of wheat and corn and domestic price. Therefore, the choice of moderate import scale and adjustment of grain import variety structure can effectively stabilize the grain price level of our country in the future.
Keywords: Grain import; Food price; Fluctuation

1. GRAIN IMPORT AND THE TREND OF GRAIN PRICE FLUCTUATION IN CHINA

Grain price is an important part of the consumer price index of our country, which has an important influence on the people's livelihood. The moderate fluctuation of grain price is advantageous to the allocation of resources and grain production, but the frequent fluctuation or excessive fluctuation may have adverse effects on food security and social stability. Therefore, stabilizing grain prices has been the important policy objective of safeguarding food security in China. At present, grain import has become an important source of grain supply in China, and its influence on grain price is gradually enhanced. Therefore, it is of great significance to explore the effect of grain import on the fluctuation of grain price and to make an empirical study on China's grain trade policy.

Since entering WTO, China has become the most important food importer in the world, with the increasing dependence of grain trade, the influence of international grain market on China's grain price is more and more remarkable. In 2008-2015, the grain price and the grain import quantity of our country have the same direction change (see Figure 1), this is mainly because before 2013, the formation of grain price of our country is mainly dominated by government. Since 2004, our country has started to implement the minimum purchase price policy, and in 2008, it started the temporary stockpiling policy. and successive years to increase support prices, leading to the continued growth of China's grain prices. It was not until 2014 and 2016 that our country canceled the price of temporary stockpiling of soybean and corn, and the price of grain was changed into market pricing mechanism, which reflected the information of market supply and demand.

By calculating the correlation coefficient between the import quantity of China's grain and the four major grains and its price, it is found that the correlation coefficient between grain import and domestic grain price is 0.803, which is highly correlated (see table 1). However, the correlation coefficient between rice, soybean, wheat and corn is 0.741, 0.698, 0.500, 0.496, and the correlation between rice import and domestic grain price is the highest. This is mainly because rice is China's largest consumption, the highest proportion of the food variety, about 30% of the food consumption, so the change in the supply of the domestic food price impact of greater.

2. THEORETICAL ANALYSIS ON THE EFFECT OF GRAIN IMPORT ON GRAIN PRICE IN CHINA

2.1 SHORT-TERM EFFECTS

In the short term, grain import affects our country's grain price by adjusting market supply and reducing factor price. On the one hand, according to supply theory, in the case of constant demand, the increase of a commodity supply will lead to the decline of its price. At present, our government accelerates the grain marketization reform, adjusts the price policy, cancels or lowers the food support price, realizes the government direct control price to the indirect influence price change, the grain price marketability degree gradually enhances.

On the other hand, according to the Theory of factor price equalization, a country's imports of products produced by intensive use of its scarce elements will reduce the price of the element. China is a country where arable land and water resources are scarce, and grain import has become an effective way to utilize international natural resources in China. The import of grain is equivalent to the import of land and water from other countries, which can indirectly increase the supply of domestic resources and reduce the price of elements.

2.2 LONG-TERM EFFECTS

Food as a necessaries of life, its demand is rigid. The increasing of grain production cost leads to the rising

of grain price in our country, which makes imported grain more and more favored by consumers by technology and price advantage, and imports increase greatly. This will aggravate the competition of grain market and affect the consumption of domestic grain products, but it can also force the operators to adjust production, speed up technological innovation, promote the progress of agricultural technology and reduce the grain price in our country in the long run.

It must also be seen that food imports will bring certain market risks. Excessive dependence on imports will bring a certain impact on our country's grain production and processing enterprises, resulting in oversupply of domestic supply and reduction of China's grain production capacity. In the event of the shortage of food supply in the international market, our country's food supply will not be effectively safeguarded, but will aggravate the fluctuation of grain price. Therefore, to speed up the development of global food strategy, give full play to its positive effect, make it become the effective guarantee of China's food security.

3. EMPIRICAL EXAMINATION

Based on the monthly data from January 2008 to December 2015 as a sample, the domestic grain price index is selected as domestic grain prices (P), and the prices of soybean (PB), wheat (PW), corn (PC) and Rice (PR) in the domestic market are respectively used in the market price indices of their respective markets. All price indices were converted to a base price index based on January 2008, and data on grain imports, soybean imports, wheat imports, corn imports and rice imports were derived from the network.

a. Cointegration Analysis

(1) ADF test

In order to avoid the pseudo regression, the stability of the studied sequences is tested. According to the results of the ADF test, food Price (P) and Grain Import (IM), soybean price (PB) and soybean import (IMB), Rice Price (PR) and rice Import (IMR) are all the same order I (1) sequence. The single order number of corn price (PC) and import quantity (IMC), wheat Price (PW) and wheat Import quantity (IMW) are inconsistent. Therefore, the cointegration test of three sets of variables of the same order single integer is further carried out. The long-term relationship between variables is examined by trace statistics and maximum eigenvalue statistics.

(2) Cointegration test

The basic idea of cointegration testing is that for multiple variables, a single sequence may be non-stationary, but the linear combination of these time series may have a property that does not change over time. If such a stationary linear combination exists, these non-stationary sequences are considered to have a cointegration relationship. Cointegration analysis is an important method for the study of price conduction, and this paper will use cointegration test to analyze the transmission of grain import to domestic grain price in China.

According to the test results in table 2, there is a long-term cointegration relationship between domestic prices and imports of grains, soybeans and rice. The fluctuation direction and relative fluctuation range between grain import and domestic grain price can be obtained from the cointegration vector. On the whole, the cointegration vector of grain import and Grain price is (1,-0.097 6), which shows that the two are negatively correlated, and every 10,000 tonnes of grain import increases, and the domestic food price index decreases by 0.097 6 in the long term. The coefficient of the trend item is positive, which indicates that the food price index has an upward trend over time. The domestic price index of rice and soybean imports decreased by 26.117 7 and 0.207 2 respectively in each of the 10,000 tonnes. This shows that there are obvious varieties difference in grain import effect on domestic grain price.

b. The establishment of error correction model (VEC)

On the basis of cointegration analysis, this paper uses VEC model to analyze the short-term fluctuation relationship between grain import and domestic grain price. The five standards of LR statistic, FPE prediction Error, AIC information criterion, SC information criterion and HQ information Standard are used as considerations. According to this guideline, the VEC model is constructed for food imports and prices. The results show that the maximum lag order is 2. The unit root of VAR model is tested and all the root values fall within the unit circle (the root modulus is less than 1), which indicates that the model is stable and effective. The model equation expression is as follows:

$$\Delta P_t = -0.0019\times(P_{t-1}+0.0976\times IM_{t-1}-1.4090\times t-127.5104)+0.8144\times\Delta P_{t-1}-0.1789\times\Delta P_{t-2} -0.0003\times\Delta IM_{t-1}+3.8438\times\Delta IM_{t-2}+0.2183$$

$$\Delta IM_t = -8.5868\times(P_{t-1}+0.0976\times IM_{t-1}-1.4090\times t-127.5104)+13.7169\times\Delta P_{t-1}+9.6479\times\Delta P_{t-2} +0.3384\times\Delta IM_{t-1}+0.0591\times\Delta IM_{t-2}+9.2979$$

The error correction term indicates the extent to which the short-term fluctuations in the subsequent period will be corrected and the short-term fluctuations to the long-term trend when the index is deviated from the long-term trend. It can be seen from the result of the equation that the coefficient of the error correction term is-0.001 9, which indicates that the short-term adjustment of the long-term reverse, that is, the imbalance error of the previous period with 0.001 9 units is to revise the grain price in this period, so that the grain import is consistent with the long-term trend of The effect of import quantity on the price of each period is 0.000 3 and 3.843 8, which indicates that the import quantity of grain can affect the fluctuation trend of grain price to some extent. The error correction coefficients of domestic soybean price and rice price are-0.031 6 and 0.018 7 respectively, so the reaction of domestic soybean price is more sensitive and the degree of soybean import is more obvious compared with the fluctuation of import volume.

4.CONCLUSIONS AND POLICY RECOMMENDATIONS

Based on monthly data of domestic grain price and import volume in January 2008-December 2015, this

paper studies the relationship between grain price and import quantity in China by cointegration Test and VEC model. The conclusions are as follows: (1) There is a long-term equilibrium relationship between grain import volume and domestic grain price, but there is a long-term equilibrium relationship between the import volume of soybean and rice and the domestic price index, and there is no long-term equilibrium between the import quantity of wheat and corn and the domestic price index. (2) The Grain import quantity has certain influence to the domestic grain price fluctuation, but there are variety difference.

In 2014, our country put forward the new strategy of "basing on domestic and moderate import", so we should adjust grain trade strategy timely, stabilize the fluctuation of grain price and safeguard the security and stability of our country's grain market.

(1) Select the appropriate size of grain imports. Food supply must be based on the domestic, in order to guarantee the long-term effective food security in China. Grain import can only be used as an effective supplement of domestic food supply, timely remedy the shortage of domestic supply, stabilize the fluctuation of grain price and stabilise the grain market.

(2) Adjust grain import variety structure. The import of different grain varieties has different influence on domestic food price, we should actively adjust the variety structure of grain imports and increase the proportion of food imports to the domestic food prices, such as soybeans and maize, so as to release some of the resources for rice and wheat cultivation, to ensure the absolute self-sufficiency of rations, At the same time, it can stabilize the grain price of our country quickly and effectively by adjusting the import quantity when the domestic grain price fluctuates greatly.

(3) Improve the comparative advantage and competitive advantage of agriculture through technological progress and improvement of agricultural infrastructure, thus reducing grain import and its impact. Strengthening the technological progress, enhancing the foreign technology utilization ability, can improve the production efficiency of our country grain industry, reduce the production cost, enhance the comparative advantage of our country grain product, thus effectively control the grain import scale of our country, achieve the goal of guaranteeing food security.

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Analysis of Per Capita Consumption Level in China Based on Principal Component Analysis

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Abstract: Principal component analysis (PCA) is a multivariate statistical method of multi-index decision-making and comprehensive evaluation. This paper introduces the basic principle of principal component analysis, constructs the principal component analysis model and uses R software to make relevant empirical research on the average per capita consumption level in 31 provinces, municipalities and autonomous regions in our country, and verifies that the model is applied in the comprehensive evaluation of related indicators Sexuality and rationality.
Keywords: Principal component analysis; R Software; per capita consumption level

1. INTRODUCTION

At present, the level of per capita consumption in our country is uneven. Therefore, in the decision of macroeconomic policies, it is very important to analyze the impact factors of per capita consumption. We urgently need an effective and comprehensive approach to dealing with so much consumption information to help analyze and make decisions.

In the aspect of per capita consumption level analysis, some researchers have used BP neural system, principal component analysis, factor analysis, cluster analysis and correlation analysis to establish the mathematical model of risk measurement. Principal component analysis is a multivariate statistical method of multi-index decision-making and comprehensive evaluation, which can effectively evaluate the per capita consumption level of provinces, municipalities and autonomous regions based on factor scores and comprehensive scores.

2.THE CONTRUCTION OF PRINCIPAL COMPONENT ANALYSIS MODEL

(A) The principal components of the comprehensive evaluation of the basic principles.

In practical problems, which often needs to study a number of variables. These variables are usually relevant, principal component analysis is a way to find the original number of a certain number of related indicators and reorganize into several new unrelated comprehensive indicators. These new integrated indicators as far as possible to reflect the original indicator of the information is a mathematical way to reduce dimensions.

Mathematical approach is to linear combination of the original p indicators to form a comprehensive index, but this linear combination due to unrestricted, a large number, so to make this comprehensive index reflect the original information enough to require comprehensive. The variance of the indicator should be large, that is $Var(F_1)$ the larger the information, the more information F_1 contains. F_1 is called the first principal component, that is F_1 the variance is the largest among all the linear combinations. If not enough to represent the original information, consider selecting the second linear combination F_2 , F_2 called the second principal component. In order to effectively reflect the original information, we should avoid the existing information, and the mathematical expression is the requirement $\mathrm{cov}(F1, F2) = 0$. And so on, you can construct the third, fourth ... the first principal component p, these principal components are not related, and the variance decreases. In practice, the first few largest principal components are usually selected. Although a small amount of information may be lost, the main contradiction is captured.

(B) the principal components of the comprehensive evaluation of the basic steps.

1. The main component of the calculation steps

(1) There is n sample, p target. And makes the original data standardization, a standardized data matrix as follow:

$$X=\begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1p} \\ x_{21} & x_{22} & \cdots & x_{2p} \\ \cdots & \cdots & \cdots & \cdots \\ x_{n1} & x_{n2} & \cdots & x_{np} \end{bmatrix}$$

(2) Establish the correlation coefficient of variables array:

$$R=(r_{ij})_{p\times p}=X'X$$

(3) Find R eigenvalues of $\lambda_1 \geq \lambda_2 \geq \ldots \geq \lambda_p > 0$ and the corresponding unit eigenvectors:

$$u_1 = \begin{bmatrix} u_{11} \\ u_{21} \\ \cdots \\ u_{p1} \end{bmatrix}, u_2 = \begin{bmatrix} u_{12} \\ u_{22} \\ \cdots \\ u_{p2} \end{bmatrix}, ..., u_p = \begin{bmatrix} u_{1p} \\ u_{2p} \\ \cdots \\ u_{pp} \end{bmatrix}$$

(4) Write the main component:

$$y_i = u_{i1}x_1 + u_{i2}x_2 + ... + u_{ip}x_p,\ i = 1, 2, ..., p$$

2.THE MAIN COMPONENT OF THE ANALYSIS PROCESS

(1) Standardize the original data to eliminate the order of magnitude and size difference between the variables.

(2) Find the correlation matrix of standardized data.

(3) Find the eigenvalues and eigenvectors of the correlation matrix.

(4) Calculate the contribution rate of variance and cumulative variance contribution rate: The contribution rate of each principal component represents the percentage of the total amount of information of the original data.

Variance contribution rate:

$$b_i = \frac{\lambda_i}{\sum_{k=1}^{p} \lambda_k} (i = 1, 2, ..., p)$$

Cumulative variance contribution rate:

$$\frac{\sum_{k=1}^{i} \lambda_k}{\sum_{k=1}^{p} \lambda_k} (i = 1, 2, ..., p)$$

(5) to determine the main component: set $C_1, C_2, ..., C_P$ as p principal component, in which the former m contains a main component of the total amount of information (ie, the cumulative variance contribution rate) of not less than 80%, the former m principal component can be taken to reflect the original evaluation object.

(6) Use the linear combination of the original indicators to calculate the score of each principal component: take the correlation coefficient of each principal component to the original index (ie, the load coefficient) as the right, represent each principal component as the linear combination of the original indicator, and the principal component of the economy The significance is determined by the comprehensive significance of the indexes with larger weights in each linear combination, that is:

$$C_j = a_{j1}x_1 + a_{j2}x_2 + ... + a_{jp}x_p,\quad j = 1, 2, ..., m$$

(7) Comprehensive score: the variance contribution rate of each principal component is the right, linear combination of comprehensive evaluation function.

$$C = \frac{\lambda_1 C_1 + \lambda_2 C_2 + ... + \lambda_m C_m}{\lambda_1 + \lambda_2 + ... + \lambda_m} = \sum_{i=1}^{m} \omega_i C_i$$

(8) Scoring Order: Use the total score to get the score ranking.

3.THE EMPIRICAL ANALYSIS OF THE APPLICATION OF PRINCIPAL COMPONENT ANALYSIS

According to the basic steps of the principal component analysis and comprehensive evaluation, the author uses the eight indicators of food, clothing, equipment, medical care, transportation, education, housing and miscellaneous as the original variables and uses the programming language R to analyze the per capita consumption level of 31 provinces, municipalities and autonomous regions to make analysis and evaluation, and make a comprehensive analysis of the per capita consumption level of all provinces, municipalities and autonomous regions according to factor scores and comprehensive scores.

Table 1 Per Capita Consumption Expenditure by Region for Residents in 2014

	x1	x2	x3	x4	x5	x6	x7	x8
Beijing	7467.8	2359.8	9497.7	2041	3578.6	3268.3	1914.2	975.2
Tianjin	7376.6	1859.3	4873	1295.5	2904.7	1833.8	1584.5	615.5
Hebei	3263.7	971.8	2727.7	773.6	1749.3	1144.5	1027.5	273.5
Shanxi	2940.5	1084.8	2198.8	619.4	1214.7	1484.6	1008.6	312.4
Neimenggu	4746.4	1688	2795.2	1008.9	2405.1	1813.2	1319.7	481.5
Liaoning	4554.8	1477.8	3400.5	918.7	1949.7	1834.4	1419.2	512.9
Jilin	3531.6	1228.9	2561.3	689.5	1636.3	1550.8	1459	369.6
Heilongjiang	3537.9	1292.8	2689.6	670.9	1588.4	1406.8	1258.3	324.1
Shanghai	9011.6	1613	10789.1	1531.6	3596.5	3311.4	2223.9	987.6
Jiangsu	5591.7	1385.2	4126.7	1107.2	2869.3	2238.2	1331.3	514
Zhejiang	6569.2	1587.1	5577.2	1117.7	3670.6	2169	1358.2	503.1
Anhui	4003.1	870.3	2541.8	694.2	1324.9	1157.3	870	265.3
Fujian	6081.9	1097.5	4278.5	1032.3	2067	1667.2	926.8	493.1
Jiangxi	3785.8	853.4	2576.6	679.3	1164.3	1151.1	635	243.4
Shandong	3932.3	1168.9	2825.8	993.6	1821.9	1303	989.6	293.7
Henan	3202.4	1111.8	2208.6	875.1	1225.5	1160.8	929	287.1
Hubei	4139.7	1009.7	2810.2	813.4	1339.8	1479.8	1056.2	279.3
Hunan	4240.5	914.1	2708.4	796.9	1600.2	1764.9	972.2	291.4
Guangdong	6589.8	1014.6	4300.2	1116.5	2795.1	1965	890.5	533.9
Guangxi	3680.1	460.5	2341.5	614	1198.3	1115.3	679.3	185.3
Hainan	4915	549.9	2558.2	686	1437.4	1358.4	716.8	248.8
Chongqing	4971.9	1275.9	2554.4	978.8	1476.2	1319.3	966.1	268.1
Sichuan	4548.2	974.3	2217.3	879.6	1437	1061	964.5	286.5
Guizhou	3151.9	666.3	1826.9	619.1	1080.4	1222	572	164.7
Yunnan	3211.5	567	2018.5	568.4	1513.6	1096.7	739.4	154.4
Xizang	3370.2	733.7	1311.5	399.7	796	266.7	197.6	241.5
Shan'xi	3405.1	944.6	2585.8	796.2	1535.4	1500.4	1178.2	257.9
Gansu	3218.2	884.2	2015	652.1	1072.2	1092.4	737.2	203.3
Qinghai	3854.4	1153	2374.5	733.5	1790.1	1293	1071.2	335
Ningxia	3555.6	1170	2214.4	797.9	1763.5	1416.4	1239.9	326.7
Xinjiang	3855	1205.6	2226.4	669.2	1624.5	1102.2	978.3	242.4

The data was from National Bureau of Statistics 2015. The eight consumption factors are as follows: X1 is food, X2 is clothing, X3 is equipment, X4 is medical care, X5 is transportation, X6 is education, X7 is housing, X8 is miscellaneous.

The use of principal component analysis of the above-mentioned 31 provinces, municipalities and autonomous regions eight indicators analysis, the specific programming as follows:

```
X=read.table("clipboard",header=T) #Data
cor(X)
PCA=princomp(X,cor=T)# Principal component analysis
PCA# Eigenvalue root number result
options(digits=3)
summary(PCA)
PCA$loadings# The main component load
par(mar=c(4,4,2,1),cex=0.75)
screeplot(PCA,type="lines")
PCA$scores[,1:2]  #The main component score
library(mvstats)
princomp.rank(PCA,m=2)#The main component ranking
princomp.rank(PCA,m=2,plot=T)#Principal component ranking and mapping
```

(1) Determine the principal components: According to the principle that the cumulative variance contribution rate is greater than 80%, two principal components are selected, the cumulative variance contribution rate is 80.7%, where m = 2, as shown in the following figure:

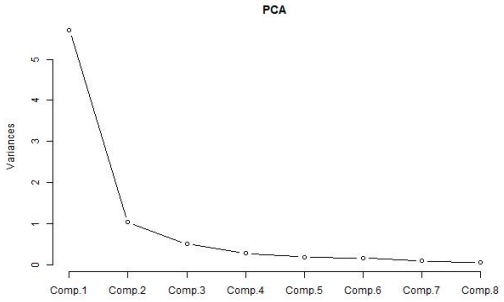

Figure 1 a gravel map

(2) Principal component score: As can be seen from Figure 1 and principal component load matrix, Comp.1 can be seen as the main component of Comp.1 in X3 (per capita household equipment and service expenditures), X5 (per capita transport and communications expenditures), X6 (Education and cultural services expenditure), X7 (per capita living expenses), X8 (per capita miscellaneous goods and services expenditures) are very large and can be regarded as the main components of non-essential consumption; Comp.2 is defined as X1 (per capita food expenditure) X2 (per capita expenditures on clothing), X4 (per capita health care expenditure) have a greater load, can be regarded as the main component of daily consumption.

Take the first principal component as the horizontal axis and the second principal component as the vertical axis, draw the composition map of each province, municipality and autonomous region, as shown in the following figure:

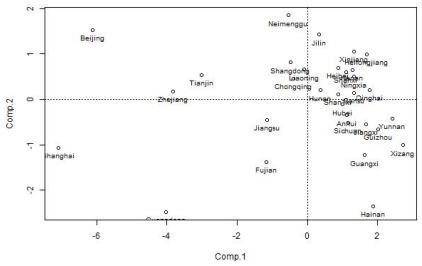

Figure 2 The main component diagram

(3) Analysis of results: The top five provinces, municipalities and autonomous regions with the highest scores on Comp.1, followed by Shanghai, Beijing, Guangdong, Zhejiang and Tianjin, and Shanghai and Beijing have significantly higher absolute values than other provinces Municipalities and autonomous regions, that is to say, the consumption level of Shanghai and Beijing is far higher than that of other provinces, municipalities and autonomous regions in terms of non-daily necessities such as equipment, transportation, education, housing and miscellaneous. Tibet and Yunnan Consumption in these areas is relatively low. Beijing, Inner Mongolia and Jilin scored higher on the Comp.2 main component, showing that the expenditure on clothing and medical services used by these autonomous regions is not small.

4. CONCLUSION

This paper selects eight indicators of 31 provinces, municipalities and autonomous regions to reflect the level of per capita consumption. In the operation process, according to the consumption of different provinces classified. Since the five provinces and municipalities of Beijing, Shanghai, Guangdong, Zhejiang and Tianjin are the five provinces and municipalities with relatively high level of economic development in our country, Tibet, Yunnan, Hainan and Guizhou provinces are the poorer provinces in our country. The per capita consumption level in cities and towns is mainly determined by the level of economic development. Provinces, municipalities and autonomous regions with relatively high levels of economic development have relatively high per capita consumption levels in urban areas and relatively lower per capita consumption levels in urban areas low.

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Analysis on Behavior of Straw Utilization and Its Optimization Countermeasures —Taking Yian County in Heilongjiang Province as an Example

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Abstract: Nowadays, farmers deal with straw mainly by open burning. The utilization of straw in Heilongjiang province was analyzed and the study showed that the pollution caused by straw burning had become a significant environmental problem in China, which had caused the serious haze phenomenon. However, open burning of straw was the behavior of rational economic man. The principal influencing factors of the way to deal with straw were the cost-benefit of recycling and reuse of straws, the government's support to the utilization of straw, and the farmers' own cognition. This paper attempts to put forward a reasonable method to optimize the utilization of straw, to realize the win-win aim of maximizing the government's macro objective and the farmer's economic benefit.
Keywords: farmers` behavior; utilization of straw; behavior; Heilongjiang Province; Strategy and suggestion.

1. INTRODUCTION

Building ecological civilization was put forward at the 18th National Congress of the Communist Party of China (CPC). According to experts, the haze in winter is related to the burning of straw. Liu Xingrong(2014) pointed out that crop stalks was used as living fuel less and less, and they were burned in the field for these reasons such as scattered distribution, great bulk, the high cost of transport, the poor economic and low degree of industrialization. Wu Hongwei and other scholars (2014) pointed out that the comprehensive utilization of straw and technological innovation, the effect of government administration and economy of straw burning are crucial to solve the negative externalities of straw burning. And they explained the problem of straw recycling from cost-benefit and economic perspective. Local and township tried to combat the burning of straw by punishment, but the effect is not obvious. In china's major grain producing areas, most farmers deal with straw by burning. Guo Lijing (2014) constructed the mechanism model of pro-environmental behavior, that is, psychological cognition-context-behavior model, and he put forward the policy suggestion and path of intervention of farmer's behavior. His research found that the four factors had a significant influence on the environment friendly behavior of farmers such as psychological cognition, behavior cost, social constraint and regulatory industry status. Tian Bo et al. (2014) investigated the farmers in Hubei Province and Hunan Province and they considered that the main factors affecting the utilization of crop straw were farmers' gender, proportion of agricultural income, farmers' appreciation of straw resource value, support from rural college students, the degree of concern for the rural ecological environment, farmers' technical learning ability. And they put forward that government should strengthen the guidance of female farmers and pay attention to the straw resource technology demonstration and word of mouth effect, and improve the agricultural subsidies. Edi Defrancesco (2008) stated that the operating characteristics of production affected the behavior of farmers.

In Heilongjiang Province, there are vast land resources and rich arable land. In 2013, the province's corn sown area has reached 10143 million mu, it is the first time to achieve billions of goals. In 2012, maize and rice planting area respectively reached 992.28 million mu and 5730.7 million mu in Heilongjiang Province, with output reaching 28.88 billion kg and 21.71 billion kg, respectively accounting for 47.4% and 27.4% of the total grain crop area in the province, accounting for the total grain output 50% and 37.7%.

Obviously, policy on farmers' utilization of straw is not perfect, then why farmers deal with straw by burning rather than acting on the policies. This paper tried to study farmers' utilization of straw and put forward some targeted advice to complete the policy about utilization of straw according to

survey data of Yian County, Qiqihar City, Heilongjiang Province. The policy could achieve government's goals and protect the interests of farmers. In addition, the policy could contribute to the construction of ecological civilization society, save bio-energy and make full use of it, which could achieve maximum efficiency and win-win situation.

2.PRESENT SITUATION OF FARMERS' STRAW UTILIZATION IN HEILONGJIANG PROVINCE

Look at Yian County, Qiqihar City, Heilongjiang Province, it is an agricultural, with corn, soybean, rice, potato, grains, miscellaneous beans and other food crops and sugar beet, sunflower and other economic crop production, the county arable land area of 371 mu, of which perennial cultivation of grain crops 300 million mu, 68.9 million mu of cash crops. In 2014, the production of straw in the county were 144605.6 million kg, and application potential of straw resources is huge (Tab. 1)

Tab. 1 Production of straws in Yian County in 2014

Crops	Sown area (mu)	Straw production (10,000 kg)
Maize	130	97500
Paddy	13.4	7884
Soybean	60	9600
Wheat	1.83	523.6
Sorghum	3.32	1364
Millet	1.1	192
Miscellaneous beans	29.3	3984
potato	60	9000
sunflower	29	14558

After investigating Yian County, we learn that the way to use straws is diversity due to many straws. In 2014, the utilization rate of straw in Yian County has reached about 77%, and it is expected to reach more than 90%. The ways for farmers to use straws mainly include: straw returning to the field, straw into the stove, straw feed, straw grass products and straw biogas and straw burning. Through analyzing statistics, we learn the way to use straws has been diversified, but its efficiency is lower (Tab. 2).

Tab. 2 Farmers' Straw Utilization Behavior in Yian County in 2014

Utilization method	Straw Quantity (10,000 kg)	Percentage of total straw (%)
straw returning to the field	34125	35%
Straw into the stove	39000	40%
Straw feed	487.5	0.5%
Straw grass products	975	1%
Straw biogas	487.5	0.5%
Straw burning	19500	20%

(1) Straw returning to field is an effective method to add and balance soil nutrients and improve the soil. And it is one of the basic measures for high-yielding field construction, which is of great significance to improve the efficiency of resource utilization, save cost and improve land fertility and agricultural sustainable development. Especially in Western countries, straw returning to field is a main means to develop organic food. At present, straw utilization is still in the more primitive and traditional stage in Yian county, Qiqihar City. The survey shows that straws burned account for about 35%, about 34.25 million kg. Straw returning to field for many years not only can improve the utilization of phosphorus and supply soil potassium, but also can improve the level of soil fertility. After straws return to the field, the average yield is more than 10%.

(2) Straws into the stove accounted for about 40%, about 39 million kg. And it is a relatively simple way. Due to latitude factors, winter in Heilongjiang Province is long and cold, so straw into the stove is economic and convenient for farmers to heat.

(3) Straws as livestock feed for cattle, sheep and others account for about 0.5%, about 4.875 million kg. For a long time, animal husbandry has been an important part of economic development in Heilongjiang Province. Previously relying on many consumption of resources and sacrifice the ecological environment to develop aquaculture seriously restricts the sustainable development of animal husbandry. To the sustainable development of animal husbandry, maximizing the use of local straw resources is proposed to develop animal husbandry and aquaculture in Heilongjiang Province.

(4) Straws for the weaving of grass products account for about 1%, about 9.75 million kg. Straw for grass products is economic and environmental benefits, and it promotes the diversified development of rural labor force.

(5) Biogas is an infrastructure of rural areas in China, and it receives much concern because of "warm home cleaning, courtyard economy, agricultural production harmless". The rural household biogas project, which was implemented by the Rural Biogas Treasury Project, started in the country in 2003. Most farmers benefit from the project that Government will give four out of five subsidies to the construction of a biogas digester. The survey shows that the straws used as raw material for biogas fermentation in Yian County

account for 0.5%, about 4.875 million kg. Straw marsh project is the focus of the use of rural waste resources, which produce biogas through the treatment of livestock and poultry manure, straw, garbage and other organic waste, meanwhile biogas slurry 、 biogas residues and other efficient organic fertilizer energy are produced.

(6) Straws used for burning account for about 20%, about 195 million kg. For incineration, one characteristic is low-cost, without adding other cost like transportation costs. Secondly, the ashes after burning can increase the soil fertility, but also can stay warm. Moreover, high temperature incineration will work obviously for sterilization, insecticide and heightening benefit.

Through analyzing the straw utilization behavior of the farmers in Yian County, we know that the rate of straw's comprehensive utilization is low, straw feed, straw grass and straw biogas account for about 2%, while most farmers deal with straws by burning in oven or locally. Meanwhile, straw's comprehensive utilization in Yian County is on a small scale, the scale of grass preparation and biogas fermentation is smaller; there is no large straw gasification station and straw power station. In short, the straw's comprehensive utilization in Yian County is still in the initial stage, which is characteristic by small scale, scattered, not concentrated, single utilization methods, without large-scale, industrialization. And many new technologies have not been converted applications.

3. Analysis on the Factors Influencing the Straw Utilization Behavior of Farmers and the Existing Problems

Impacts of straw utilization behavior of farmers frame diagram are below (Fig.1):

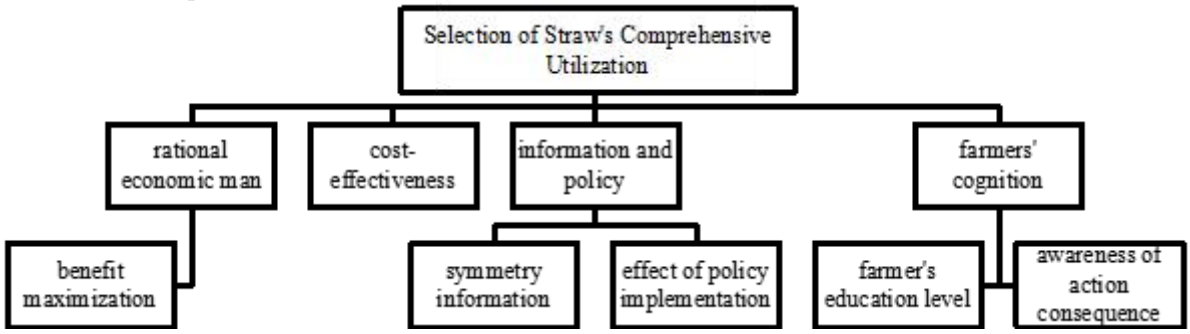

Fig.1 Analysis Framework of Straw Use Behavior of Farmers

3.1 Rational economic man

Adam Smith (nineteenth century) pointed out rational economic man is the one who is an intelligent economic decision-maker, neither emotional, nor blind obedience, but good at judging and calculating. In the economic activities, the only goal pursued by subject is to maximize the economic interests of their own. For example, consumer pursuits the greatest satisfaction, and the producers are seeking to maximize profits. The "rational man" hypothesis is a continuation of the hypothesis of Adam Smith's "economic man". The choice of farmers for the treatment of straw is in line with rational economic man hypothesis. For an approach, the first thing to consider is whether it can achieve their max interests. Once the approach is in line with farmers' own interests, it will be employed.

3.2 Cost-effectiveness

Firstly, the cost of incineration is low, without additional cost like transportation costs. Secondly, these simple methods require lower cost, higher self-generated benefits such as straw into the stove, in situ burning of straw. And it not only saves the farmers' heating costs in winter, but also reduce the transportation cost of straw. Thirdly, straw recycling is characterized by higher costs for transportation cost, cost of hiring labor and other costs. Moreover, for straws used for biogas, it is worth considering the cost of building a biogas digester and whether the local climate is suitable for straw used to produce biogas. In general, the way into the stove and open-air incineration on the way means low-cost and high-income for farmers, whereas other ways are inconformity with farmers own interests. Thus, farmers mainly take a simple way.

3.3 Asymmetric information and policy

The main reason why the government bans open burning of straw is that open burning of straw will cause more serious environmental pollution. In the harvest season of crops, the government will introduce a series of regulations on the prohibition of burning straw and the corresponding punishment to prevent straw burning. However, the policy cannot be better implemented.。 The main reason is that the government's policy ignored the interests of farmers. Although considering the overall situation, it does not consider the interests of farmers, so that some farmers do not implement the policy. Government policy aims to protect the environment and farmland to develop agricultural economy healthily and sustainability. Farmers burning straws is to maximize their own interests

and gain the maximum income. The asymmetry of information leads to difficult policy enforcement. Therefore, the Government should consider the interests of the community and farmers when making the policy and guide farmers to use straws in an efficient way.

3.4 Farmers' cognition

Farmers' personal cognitive behavior also has an important impact on whether they choose to burn straw. In general, farmers with high educational levels pay more attention to agricultural technology than those with low levels of education, both from the choice of technology and the use of technology. The characteristic of farmers in China is the total amount, wide distribution and low quality, making the relatively high level of education of farmers is relatively small. Under investigation, we know whether many farmers burn straws openly mainly depends on these factors such as convenience, low- cost, other factors to ensure that their own interests and so on. Only a few people focus on the efficient use straws, and they obtain information generally through television and other media. Few farmers are interested in participating in agricultural technology promotion of straw utilization efficiency. In addition, farmers do not take the consequences of their own on-site burning of straw seriously. Farmers do not care about the sustainable development of agriculture, environmental pollution, bio-energy waste and so forth, and they failed to deeply realize the seriousness of the consequences of incineration.

4. Suggestions on Optimizing Farmers' Straw Utilization Behavior

4.1 The government increases financial support for farmers' straw utilization

The increase in financial support is the most direct way to maximize profits of farmers. Government financial support can be divided into two parts: direct subsidies and indirect subsidies. On the one hand, direct subsidies are to give a certain amount of cash subsidies to farmers who actively participate in the comprehensive utilization of straws and award farmers or enterprises which have a special contribution to straw recycling, so that farmers and enterprises feel Strong support of the national policy. On the other hand, indirect subsidies are to reduce business' tax of the recycling of straw, and it indirectly promotes enterprises to recover straw.

4.2 Government should implement the policy of comprehensive utilization of straw

Firstly, the government needs to ensure the symmetry of information in policy communication. Township government should take a positive and correct guidance on the treatment of farmers straw, which requires grassroots cadres to strengthen environmental consciousness and motivates the leader using straws comprehensively, to make everyone have the responsibility to truly implement the straw recycling policy. Secondly, when formulating relevant policy of straw utilization, the relevant government should put forward the policy which meets the local economic and environmental sustainable condition. Thirdly, establish sound rural environmental supervision mechanism. Most villages neglect the regulation of environment quality, and dirty, chaotic, poor have become a typical synonym for rural environment. Therefore, the Government should establish sound rural environmental supervision mechanism to govern rural environment problems at the source.

4.3 Raise farmers' awareness of straw use behavior

Agricultural technology-extension workers should be encouraged to go to the countryside to guide farmers, and benefits of the comprehensive utilization of straw should be actively promoted, so that farmers can get more complete information and improve the awareness of agricultural technology selection. Moreover, farmers should learn more knowledge about agricultural technology selection. Through the media, popular opinion and other means, government should actively promote the importance of environmental protection, and enhance farmers' attention to environmental protection.

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The Study On Peek Composites In The Field Of Dental Implant

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Abstract: As a kind of synthetic thermoplastic polymer, Polyetheretherketone (PEEK) has good biological compatibility, chemical stability and radiolucency, and has been widely used in the field of medicine. The elastic modulus of PEEK is much closer to human cortical bone than metal titanium, so PEEK is an ideal substitute for implant. However, PEEK has low osteogenic activity and biological inertness which limit its wider clinical applications. Therefore, how to improve the performance of biology is a study hotspot. This paper reviews the research progress of application of PEEK composite in dental implant.
Keywords: PEEK composites; Biological properties; Dental implant

1. INTRODUCTION

PEEK is a kind of synthetic semi-crystalline aromatic organic polymer that exhibits outstanding properties, such as: antioxidant, high strength, high thermal stability, good fatigue resistance, excellent processing performance and reasonable biocompatibility. It has been successfully applied in aerospace, automotive, chemical manufacturing and medical field. The material of choice for oral endosseous implants is pure titanium, introduced at the end of the1960s by Branemark. Although this argument is well evidence-based, it was demonstrated that their use can be correlated with a range of problems. One problem is a potential hypersensitivity to titanium; Another problem could occur due to the gradient difference in the elastic modulus of a titanium implant and its surrounding bone, this may cause stress in the implant-bone interface during load transfer, probably resulting in peri-implant bone loss, eventually lead to implant loosening and shedding [1,2]. Also, titanium can cause esthetic problems due to its lack of light transmission. Additionally, an increasing number of patients are demanding dental reconstructions of completely metal-free materials [1]. PEEK is a kind of non-metallic material and has elastic modulus similar to bone, so compared with titanium, PEEK can be used as a new type of dental implant material. Although PEEK has a wide range of advantages, the inherent bio-inert nature hinder its good combination with surrounding bone，finally limits its wider clinical applications, so people used lots of methods to improve its biological properties. In this article, the research of PEEK composites as the dental implant materials is reviewed.

The PEEK composites were classified into two kinds by the size of the impregnating bioactive materials: the conventional PEEK composites and the nano-sized (<100nm). Conventional PEEK composites include carbon fibre-reinforced PEEK (CFR-PEEK), glass fiber-reinforced PEEK (GFR-PEEK), hydroxyapatite/PEEK (HA/PEEK), strontium-containing hydroxyapatite/PEEK (Sr-HA/PEEK). Nano-sized PEEK composites include Nano-TiO2/PEEK (n-TiO2/PEEK), Nano-Fluorineap-
atite (n-FA/PEEK), Nano- hydroxyapatite/PEEK (n-HA/PEEK).

2. TYPES OF PEEK BIO COMPOSITES

A. CFR-PEEK

Carbon fiber is a kind of linear material with a special size effect from several microns to tens of microns. As an important reinforcement material, carbon fiber has been widely used in many fields. CFR-PEEK has the advantages of high strength, low modulus of elasticity (similar to bone) and so on, which make it great potential in human bone tissue repair and implant materials. CFR-PEEK is beneficial as an implant material, since it appears to stimulate osteoblast protein content, without inhibiting that of fibroblasts, neither material appeared to cause any alteration in osteoblast morphology [3]. In vitro study on CFR-PEEK found that: CFR-PEEK not only has good mechanical properties and biocompatibility, but also can adapt to the mechanical requirements of the bone defects. Mandible stand the force produced by chewing movement, after the bone defect was repaired, the mechanical properties of the bone were not well adapted to the mechanical requirements of the mandible due to the mechanical properties of the implant material, which could easily lead to loosening of the implant materials [4]. However, CFR-PEEK has an elastic modulus similar to that of normal human cortical bone, the probability of occurrence of the above problem was significantly reduced when the

CFR-PEEK as the implant material.

B. GFR-PEEK

Glass fiber has the advantages of high elastic modulus, high strength, good thermal stability and stable expansion coefficient. GFR-PEEK is made up of PEEK and 10% glass fibers with diameters ranging from a few microns to tens microns and GFR-PEEK has elastic modulus similar to bone. Above all, it can promote the proliferation and differentiation of MG-63 cells. In vitro studies showed that GFR-PEEK can provide a suitable environment for the formation of osteocalcin [5]. This can promote the bone formation process, so that GFR-PEEK can form a good combination with surrounding bone, which can improve the success rate of oral implants.

C. HA/PEEK

HA is a kind of inorganic material, which is the main component of inorganic substance in human bone tissue. Khor et al. [6] made HA/PEEK composites by compounding, granulating and injection molding technique, the particle size of HA is 3～100 micron. Experiment find that when the volume fraction of HA was 30%, it has elastic modulus similar to human cortical bone. Zhang et al. [7] used the selective laser sintering (SLS) technique to make HA/PEEK composite, the particle size of HA is 3.80 micron. Experiment revealed that the composite can promote the growth of osteoblasts, and with the increase of HA content, the degree of proliferation and differentiation of osteoblasts will increase accordingly. Yu et al. [8] prepared HA/PEEK composite by mixing, compaction, and pressureless sintering process and evaluated the bioactivities of HA/PEEK composites with 10 vol %, 20%, 30 vol % and 40 vol % HA by immersing the composite disks in SBF, finding that with the increase of HA volume fraction, the time of formation of bone like apatite will decrease, the result showed that the biological activity of the composites increased with the increase of HA content. Prepare HA/PEEK composites by injection molding, the amount of HA incorporated into the PEEK polymer matrix ranges from 5 to 40vol%, the particle size of HA is 25.68 micron. Experiment find that when the volume fraction of HA was 20%-30%, the elastic modulus of the composite is 5-7Gpa, which is similar to the human cortical bone. In addition, the HA/PEEK composite with a volume fraction of 20% was implanted into the femur of the pig, which proved that the composite has good bioactivity and biocompatibility [9].

D. Sr-HA/PEEK

Strontium is a biologically active element, which can promote the adhesion and mineralization of osteoblasts, induce bone formation and reduce the risk of bone fracture. Sr-HA/PEEK composites were successfully fabricated with 15–30 vol% Sr-HA filler reinforcement using compression molding with the particle size of 43.34±0.08 micron. The Sr-HA/PEEK composite was proven to outperform HA/PEEK in providing bioactivity. More apatites were formed on the surface of Sr-HA/PEEK composite than HA/PEEK composite indicating that Sr-HA/PEEK offer better bone-bonding ability than HA/PEEK composite. More bone-like nodules were formed on the Sr-HA/PEEK composite than HA/PEEK composite, which indicated that strontium can stimulate more bone mineralization. It can be seen that the Sr-HA/PEEK composite not only inherit the good mechanical properties of PEEK, but also have stronger biological properties [10].

E. n-TiO2/PEEK

TiO2 has good biocompatibility, bioactivity and is hydrophilic, the preparation of n-TiO2/PEEK composite by integrate n-TiO2 with PEEK can significantly improve the biological activity of PEEK. Wu et al. [11] fabricated the n-TiO2/PEEK composite by powder mixing and compression molding methods, the amount of n-TiO2 in the n-TiO2 /PEEK composite was 40 wt%. The results showed that n-TiO2 could promote the adhesion and proliferation of osteoblasts, and when the composite was implanted into the tibia of the Beagle dog, it was found that it could significantly promote bone regeneration around the implant compared with the pure PEEK implant, indicating that n-TiO2 significantly improves the biological activity of PEEK. Tsou et al. [12] found that the nano-TiO2/PEEK composites had higher osteoblast compatibility.

F. n-FA/PEEK

Metal and polymer implants are susceptible to bacteria during the implantation, eventually lead to implant infection or implant failure, which is one of the most serious complications of implant surgery. Therefore, when we select bone implant materials, not only good mechanical properties and biocompatibility but also antibacterial properties of the material should be taken into account. The fluoride ions from the n-FA can affect the energy metabolism and enzyme activity of the bacteria, so n-FA/PEEK composite have antibacterial effect [13]. n-FA was incorporated into PEEK to improve the performance of the new n-FA/PEEK composite, and to explore its biocompatibility and osteogenesis in vivo. The result showed that wound healing was good and no implants removal [14]. The rate of bone mineralization deposition is

one of the important parameters of bone dynamics, which is the most commonly used measure of bone remodeling rate. The rate of bone mineralization deposition of n-FA/PEEK was significantly higher than that of PEEK. Fluoride ion inhibits the activity of osteoclast and phagocyte and stimulate new bone formation [15].

G. n-HA/PEEK

Due to the low physical bond energy between PEEK and HA, the mechanical properties of the HA/PEEK composites were decreased compared with that of pure PEEK. However, when n-HA was added into PEEK to prepare n-HA/PEEK composite, the composite had good mechanical properties and high bioactivity [16]. Because of the debonding between the HA filler and the PEEK matrix, the conventional HA/PEEK composites cannot bear the long-term critical loading, but nanotechnology can solve this problem partially. Wang et al. [17] prepared HA/PEEK nanocomposites by a compounding and injection molding process, they found that this novel HA/PEEK nanocomposite exhibited satisfactory mechanical properties. More importantly, no debonding occurred between the well-dispersed HA nanoparticles and the PEEK matrix. A nanocomposite of PEEK with 10 wt % HA was produced by extrusion and injection molding and particle size of HA is less than 100 nanometer. It was found that the composite could promote the proliferation of human adipose stem cells (hASCs) compared with PEEK [18].

3. OUTLOOK

The biological properties of PEEK were greatly enhanced by the preparation of PEEK composites, so the prospect of PEEK and its composite materials in the field of oral implant materials is immeasurable. With the progress of materials science, it is possible to improve its biological properties through a variety of ways to make it more widely used in oral clinic.

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Comparison of BP Neural Network and Multiple Linear Regression Model in Predicting Age of Coal Pneumoconiosis

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Abstract: To study the predictive performance and comparison of each model when predicting the working age of coal worker's pneumoconiosis by BP neural network and multiple linear regression prediction model. The BP neural network model and the multiple linear regression model were used to predict the research data by SPSS 24.0. The prediction results of the two models are analyzed by standard error, average relative error and average absolute error, and the prediction results of each model are obtained. Then the pros and cons of the two models are compared. There was no statistical significance between the true value and the predicted value of multiple linear regression model and BP neural network model. Respectively the t values were 0.143 and 0.195 and the P values were 0.878 and 0.832. The multiple linear regression and standard deviation of BP neural network were 2.40 and 2.30. The average relative errors were 7.36% and 5.17%. The average absolute errors were 1.85 and 1.62. The results show that the prediction performance of BP neural network model is better than multiple linear regression in predicting the working age of coal workers with pneumoconiosis, and its prediction accuracy is high, the result is reliable, which is worth popularizing and applying.

Keywords: BP neural network; multiple linear regression model; working age of onset; prediction

1. INTRODUCTION

Pneumoconiosis is a major occupational disease in China [1]. Coal worker's pneumoconiosis is the most serious one in the pneumoconiosis, accounting for nearly 50% of the total cases of pneumoconiosis [2, 3]. Workers who suffering from pneumoconiosis will lose their labor force, significantly reduce their life expectancy, and seriously affect the economic construction [4]. Therefore, the social and economic conditions in our country are closely related to the health and life conditions of coal miners. The stable development of society is closely linked with the physical and mental health of coal miners [5], which will help the government to take appropriate control measures to protect the health of coal miners and promote the social and economic development of our country. Coal miners sick and dust exposure, dust exposure time, smoking and many other factors are closely related [6]. These factors are complex and nonlinear. Since the collection of raw dust collection queue data takes a long time, the working hours of workers and dust concentration in the working environment directly affect the size of the dust collection value in each year of the queue. There is not yet a definite proprietary Model, because it is difficult to accurately predict the length of service. In this study, we use multiple linear regression model and BP neural network to predict the data collected. Multiple linear regression is a statistical method to study the correlation between variables. It is a more intuitive method in many prediction methods Statistical methods; BP neural network model has a high degree of nonlinear mapping ability, self-learning adaptability, high generalization ability and fault tolerance, but the two models are also flawed, the study shows that the best prediction method to judge the existing model Is a comparative analysis of the two models, in order to explore the multiple linear regression model and BP neural network model in the prediction of service life of coal worker's pneumoconiosis, the pros and cons of performance, deliberately conducted this study.

2. OBJECTS AND METHODS

(1) Research object

Data which is from a professional hospital in Tangshan provided since the establishment of this hospital to 2009 all confirmed coal workers pneumoconiosis. It is reliable and complete.

(2) Survey content and methods

Coal worker's pneumoconiosis patients' information is collected according to the coal worker's pneumoconiosis questionnaire. The contents include the type of work, dust pick-up, mine age, birth date,

Table 1 Select coal workers pneumoconiosis length of service factors and coding

Project name	Variable type	Quantification methods or units
Type of work	Categorical variables	1= Pure digger；2= The main digging workers；3= Pure mining；4= The main mining；5= Mixed workers ；6= Helper

Seniority to dust	Continuous variables	（Year）
Age of birth	Continuous variables	1=1910～1919；2=1920～1929；3=1930～1939；4=1940～1949；5=1950～1959；6=1960～1969；7=1970～1979；8=1980～1989；9=1990～1999； 10=2000～2009
Period of beginning to pick the dust	Continuous variables	1=1910～1919；2=1920～1929；3=1930～1939；4=1940～1949；5=1950～1959；6=1960～1969；7=1970～1979；8=1980～1989；9=1990～1999； 10=2000～2009
Age of beginning to take the dust	Continuous variables	（Years old）
age of onset	Continuous variables	（Year）

the age of dust pick-up, the age of onset of dust pick-up and smoking or not. All pneumoconiosis patients' information was verified with the occupational diseases section of the group's staff hospital on the basis of the hospital's case record. For the convenience of calculation, the data are processed uniformly and re-encoded. The results are shown in Table 1. Take the type of work, the seniority to dust, the age of birth, the period of beginning to pick the dust, the age of beginning to take the dust as a predictor of age, age of onset as a dependent variable to predict the seniority to dust of coal workers pneumoconiosis.

3. QUALITY CONTROL

Data entry project is selected and then reunify definition, the selection of work should be serious and responsible, there is a certain amount of professional knowledge of the staff to act as investigators, investigators are trained, and the unified survey data will enter the criteria. After all the data verified, double entry it with excel, compare to check the error, and logic error detection, to ensure the quality of input.

(1)Statistical method

SPSS17.0 statistical software is used for data processing, use excel data input data. Comparison of two means using paired T test. The standard error, average relative error and average absolute error are used to compare the predictions of the two models.

II. Results and analysis

The basic principle of BP neural network modeling

BP neural network has strong nonlinear mapping meet the calculation conditions of the model, and the data must be processed. In this study, Analysis of the type of job is to set dummy variables.

ability. The nonlinear relationship between input and output of sample data can be realized through the self-learning ability of each neuron. BP neural network is a kind of multi-layer feed-forward network with mature back propagation algorithm in theory and application. The network is a kind of non-linear dynamic system, and the calculation flow chart is shown in Fig.1. Each neuron in BP neural network is connected with other neurons by weight and accepts the output of other neurons and outputs it through the transformation and threshold of its own transfer function to exert its effect on other neurons. The neural network consists of a number of parallel neurons with single function. The BP neural network gives the training samples under the initial weights of the network. The information is input from the input layer, processed by the hidden layer, and then transmitted to the output layer. If you cannot get the expected output, turn to reverse propagation, reverse propagation and forward propagation contrary to the process, in the process of layer by layer to adjust the weight of the connection until the input layer. Then it goes to the forward process until the error between the actual output and the expected output reaches an acceptable range. Because BP neural network is more sensitive to the data between [0, 1], we use normalized formula $S_i = \frac{x_i - \min(x)}{\max(x) - \min(x)}$ when making predictions, normalizing the data for each of the predictions.

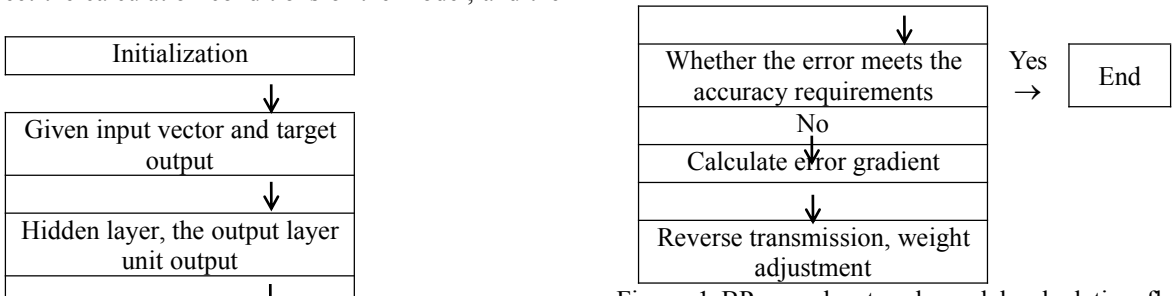

Figure 1 BP neural network model calculation flow chart

4. RESULTS

(1) Predictive effect of the model

Using the output of the model and the real value as the scatter plot, the distribution of the scatter gram in the ideal state should lie on the 45 ° line from the origin. From Figure 2 and Figure 3, it can be seen that the predicted distribution of the BP neural network and multiple linear regression model is generally in line with the ideal distribution, of which the overall distribution of Figure 2 linear trend is obvious, Figure 3 linear trend is not too extreme. Scatter gram shows that BP neural network and multiple regression model can be used to predict the length of service in coal workers with pneumoconiosis, of which BP neural network prediction accuracy is more accurate. The results of the two methods are paired t-test respectively. The results are showed in Table 2, after statistical test, the t-values of multiple linear regression model and BP neural network model were 0.143, 0.195, P values are 0.878, 0.832. P values are greater than 0.05, the difference between the true value of the two models and the predicted value has no statistically significant, further suggests that the two models can be used to predict the length of service life of coal workers pneumoconiosis, and the results are reasonable and credible.

Table 2 Comparison of age of onset and the results of predicted value（$\overline{x} \pm s$）

Model	True value（year）	Predictive value（year）	*t*	*P*
Multiple Linear Regression Model	28.59±7.103	28.17±6.842	0.143	0.878
BP Neural Network	28.59±7.103	28.09±6.283	0.195	0.832

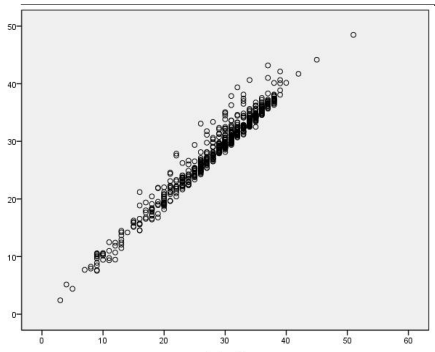

Figure 2 Scatter gram of predictive value and true value of the age of onset with BP neural network

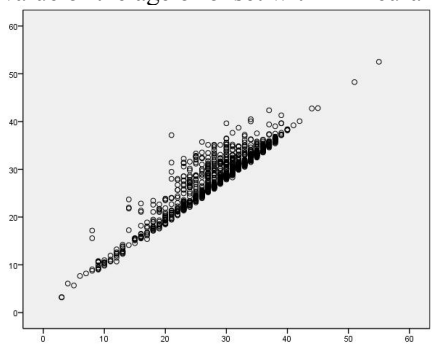

Figure 3 Scatter gram of predictive value and true value of the age of onset with multiple linear regression model

(2)Comparison of two models' predictive performance

In order to compare the prediction effect and prediction accuracy of the two models, the standard error, the average relative error and the average absolute error are selected as the evaluation indexes in this paper. The results are showed in Table 3. The standard errors can reflect well the precision of the measurement, it only analyzes the reliability of one set of prediction data with small standard error and greater reliability of prediction. The results show that the prediction reliability of BP neural network model (2.30) is better than that of multiple linear regression model (2.40). The results show that the average relative error is ideal when the relative error is less than 5%. From Table 3, the average relative error of BP neural network is close to 5%, and its prediction accuracy (5.17%) is better than that of multiple linear regression model (7.36%). Through the comprehensive analysis of the three evaluation indexes, it can be seen that the BP neural network model is better than the multiple linear regression model in predicting the age of coal pneumoconiosis.

Table 3 Prediction error analysis

Model	Standard error	Mean absolute error	Mean relative error（%）
Multiple linear regression model	2.40	1.85	7.36
BP neural network	2.30	1.62	5.17

4. DISCUSSION

In this study, the pros and cons of BP neural network and multiple linear regression models in predicting the age of coal workers 'pneumoconiosis were studied. The results show that both prediction models can be used to predict the service age of coal workers' pneumoconiosis. BP the prediction performance of neural network model is better than multiple linear regression model. Through the analysis of prediction error, it is found that the errors of the two models have little difference or even close to each other, this phenomenon may occur, although the application conditions of the multiple linear regression model are harsh, the prediction accuracy of the model can be improved by changing the data. In general, because BP neural network is a kind of artificial neural network, its information processing system is to imitate human brain structure and its function. Through the information processing function of BP system, BP neural network has strong nonlinear mapping Ability [7], good self-learning, adaptive process and high generalization ability, as well as better fault tolerance, etc., and does not require the type and distribution of data. Therefore, compared with the traditional statistical prediction methods, its application space and prospects are more extensive. However, it should also be noted that there are still many deficiencies in the prediction of the age of coal workers' pneumoconiosis, such as prone to overfitting [8] and slow convergence [9], and at present, there is no authoritative statement on the network structure selection of the BP neural network, which is generally determined by the user's experience and continuous repetitive computing. Thus, the network learning process inevitably has greater repetition and increases the burden of network learning. In addition, the result of BP neural network is only the output value, that is, the predicted value, but the relationship between the input and output values cannot be expressed, so that the obtained predicted value cannot be exactly explained or the statistical analysis of the obtained data cannot be made. This requires that a certain solution be used in the process of using BP neural network, such as using early stop strategy [10] to solve the overfitting phenomenon and reduce the prediction error.

Due to the limited information collected, the study predicted the age of coal workers' pneumoconiosis. The independent variables are the type of work, the seniority to dust, the age of birth, the period of beginning to pick the dust, the age of beginning to take the dust. However, the lack of concentration of dust in the work environment and the factors such as free silica content that are closely related to the pathogenesis of coal worker's pneumoconiosis [11] affect the predictive effect of the model. Therefore, this study added the birth date and the age of dust collection. This is because different age of birth and era of dust collection, workplace construction equipment, dust and dust prevention measures are different, on the other hand it reflects the concentration of dust in the working environment to make up for the lack of dust concentration caused by defects. In order to make the prediction effect of the model higher, this requires constantly improving the data and constantly exploring suitable models and prediction methods. In other fields, the combination model is more and more widely used, and its fitting effect is better than the single model, and few studies have been conducted on the prediction of the age of the coal worker's pneumoconiosis. This is also the breakthrough and research point to improve the prediction performance in the future direction

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The Reform of Industry Barriers to the Integration and Development of Sports Industry and Tourism Industry

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Abstract: For to the barriers to reform, this article takes the current industry of sports industry and the development of the tourism industry an important "new normal" for the premise of industrial convergence, industry barriers to the development of industry is studied. However, the integrated development of the two is still in its early stage. Therefore, this paper starts with the path of the integration and development of sports and tourism industry. From the aspects of enterprise transformation, industry standard and platform development, the trend of industry is predicted, and the various positive and negative factors of the barrier are obtained. Link by reform and development, explore the barriers to the correct path of the reform of an era, is not only for the integration of national sports industry and tourism industry development, also provides theoretical basis for trade barriers to the industry reform. In addition, puts forward to promote according to the current development status of industrial convergence industry barriers to reform, development and countermeasures and Suggestions.
Keywords: Industry integration; Industry barriers; Dimensionality measurement; Refactoring mode

1. INTRODUCTION

With the gradual reduction of the barriers of sports and tourism industry, the impact of new barriers on industrial integration is gradually increasing. But as the barriers to reform, report the number of increasing year by year, the convergence of barriers cannot continue forward, further reform in physical education and tourism industry integration barriers to the development of the industry has become a has been the focus of attention. This is because the integration of material capital and human resources is relatively loose, which limits the normal barriers between them.

On the other hand, the integration barriers [1] of sports and tourism industry will also interfere with the effectiveness of industrial policy implementation and have a significant impact on China's macro-economic operation. Once a foreign enterprise is restricted or even banned in the host country, the enterprise naturally increases the rent seeking for export trade, thus affecting the development of tariff policy and the result of trade competition. In this way, foreign direct investment barriers have a critical impact on FDI, import and export trade and even macro-economic operation.

In reality, the latest round of reform is often the result of a lack of reform in the last round or the improvement in the new system (the old system now). From the point of theory, market competition and the high price, forming the strange phenomenon, the validity of trade policy and foreign capital admittance barriers system, the influence of both intellectual to delve into. Therefore, the industry barrier system and reform of industrial integration is obviously a theoretical and practical problem that should be explored in economics.

In industrial marketing environment bring more profits for the enterprise more profits is not a new customer is retained by loyal customers, and make enterprise development continues to grow, gradually increase market share and strengthen its own competitive advantage. Through the study of the influence of customer retention, the main influencing factors are the research purpose of the transformation barrier, how to improve the retention of customers by setting the relevant dimensions of the transformation barrier. The impact of the conversion barrier on customer retention is of great significance to the marketing of enterprises in the real industry.

First of all, this paper determines the research background for the sports industry and tourism industry integration, secondly, based on the research of the domestic and foreign literature reading of this article focus on definition of switching barriers [2] and dimensions to comb, and focus on analyzing the characteristics of the industrial products marketing of dimension conversion barriers. Definition and dimensions of customer retention, and this article selects what measure the dimensions of customer retention and customer value to intermediary variable definition and dimension of the connotation of the theoretical research and empirical research is summarized.

Again, the influence factors of customer retention are reviewed, in the literature of the past, many scholars have impact on customer retention to do a lot of research and empirical analysis, in addition to this article to study the transformation of the barriers and customer satisfaction, customer loyalty and so on influence on customer retention is reviewed and summarized.

Finally, in order to describe the sports and switching barriers on customer retention in the travel industry, the influence of the consumer goods industry are reviewed and the study of switching barriers as well as industrial products industry related dimension measurement, the current study, the results of the study.

2.DEFINITION AND MEASUREMENT OF CONVERSION BARRIERS

2.1 Definition of conversion barriers

Switching barriers is generally interpreted as: customer from existing suppliers to other alternative suppliers of products and services the difficulties in the process of perception, it reflects the customer decide to convert or maintain existing supplier relations the influence factors of [3]. The important factor that customers choose to continue to maintain their trading relationship with the supplier is that the benefits obtained from the new trading relationships are less than the costs and risks caused by the conversion of existing relationships. If the customer give up existing relationships and use alternative suppliers to establish a new relationship, customers are more likely to take on the economy, mental state, time cost and risk, the cost and risk constitutes the perception of customer switching barriers, and make customers to maintain the existing trade relations.

When the benefits obtained from the alternative suppliers outweigh the losses from replacing the existing suppliers, the perception of conversion barriers is not strong. Conversely, when the benefits from alternative suppliers are not sufficient to compensate for the loss of replacement suppliers, the perception of conversion barriers will decrease accordingly; Of course, the risk factor can not be ignored here, and the higher the risk factor is, the higher the barrier perception is

2.2 Dimension measurement of conversion barriers

At present, it is widely accepted that the conversion barriers cannot be directly measured, and there are differences in the dimension and indirect measurement methods of different scholars. Different researchers will determine the different dimensionality and measurement methods from the perspective of their respective research directions. It is considered that the transformation barrier is the sum of all kinds of costs paid by the supplier, but the transformation barriers reflect their respective characteristics in different industries. The composition of conversion barriers is generally discussed from the end of the existing supplier relationship and the establishment of new supplier relations.

The impact of conversion barriers on customer retention is different, and some of the conversion barriers are positive, while others are negative. Positive factors can encourage customer resources to maintain existing relationships, while negative factors make customers involuntarily forced to maintain relationships. Conversion barriers are divided into two types: positive and negative, which can help the supplier to analyze whether the customer is voluntary or involuntary. This indicates that the core service quality of the supplier is not optimal when the customer is not voluntary. In addition, the voluntary maintenance relationship indicates that the customer's satisfaction is higher, so the relationship stability is stronger [4].

2.3 Analysis of conversion barriers

Especially in the monopoly industry, because the supplier occupies the advantage position, the high withdrawal cost is the customer's non-voluntary maintenance relationship. When a better supplier appears, the chances of a relationship change dramatically increase. Currently the theorists involuntary switching barriers due to the market and economic reasons. There are many scholars to switching cost as the important influence factors of switching barriers, consumer often because of the high cost of conversion was forced to maintain existing relationship, and these translation barriers belong to the same negative switching barriers. In addition, market monopoly and supplier rights are also negative conversion barriers, and relationship investment is a negative conversion barrier [41]. When the customer has already made the investment, the customer lock is more obvious, so the relationship investment as a negative conversion barrier is logical. Instead, the alternative attraction level is divided into the range of positive conversion barriers.

If consumers think that the current supplier is superior to the other alternatives offered by the market, then customer lock-in will occur. In other words instead of the less, attractive would lead to resources for the realization of the customer relationship, maintain the relationship is positive, and positive relationship between investments also is considered a positive switching barriers, the positive relationship between the most typical service industries. The supplier provides customer service to improve customer satisfaction and loyalty as an important consideration, so the positive relationship can be saved into voluntary maintenance and is a positive conversion barrier. In addition, social risk, psychological risk and financial risk are all positive conversion barriers.

3.DEFINITION AND MEASUREMENT OF CUSTOMER VALUE

3.1 Definition of customer value

In industrial products is put forward on the customer value, use value represents the use of products in the customer shows related in the process of value, value analysis only considers the value of use, such as what the purpose of the product reliability, rather than consider made in his presence as beautiful, cost value and exchange value.

Customer value is also called customer perceived value is the interests of the customers can perceive its

over access to the products and services, and paid the cost to weigh the overall evaluation of product and service utility after perception. Customer value is the full assessment of a product based on the perception of a product that is received and given. Perceived value is the ratio of perceived benefits relative to the perceived sacrifice, the value perception of the buyer on behalf of their perception of the quality and benefit in the product, and relative to the perception by paying the price in a trade-off between the pay.

A series of economies, technologies, services and interests that are acquired in the transaction of product payment prices for the supplier are perceived to be valued in currency terms. Customer value is the quality of the product perception that is relative to your product price adjustment. The combination of attributes is a trade-off between sacrificing attributes. Customer value refers to the emotional bonding between customers and suppliers when customers use the excellent products and services provided by the supplier and find that the product provides an added value.

Customer value is a relative experience of mutual influence. Customer value connotation in the use of a specific state, customers in a given all relevant interests and pay to supplier for their creation under the trade-off between value evaluation, value is the tradeoff between benefits and pay value is the customer in order to complete the purpose and the desire of the specific product. The value process is the beginning and end of relationship marketing, and relationship marketing should create more value for customers and other parties than pure transaction marketing

3.2 Definition and measurement of customer retention

Customer loyalty is the customer's standard for the retention of a brand. Through the choice of the next purchase possibility to explain customer loyalty to a particular brand, he explained to the customer in the past to purchase experience affect its future purchase behavior. Customer retention behavior reaction for customers to buy or use the product in the process of satisfaction, customer loyalty to define a point of view of customer retention behavior. Customer retention is the same as brand loyalty, whether customer retention or customer loyalty.

Customers who have a tendency to continue purchasing in the future will undoubtedly abandon the attitude of existing contracts and keep the relationship with the supplier to keep the customers. Emphasis on customer retention in the survey is a continuing act of customer and current supplier relationship and future willingness to consume. Customer retention is the result of the service management process. The essence of customer retention is to maintain customers' long-term purchase of the products and services of existing enterprises and the customers' principle competition. The concept of customer retention includes actual purchase behavior and future purchase tendency of loneliness. Customer retention is the long-term maintenance of customer and supplier trading relationships. There are two main forms, one is continuous purchase, and the other is the willingness to buy again.

3.3 Research on the influence factors reserved by customers

Customer satisfaction and customer retention are indirect effects. Customer satisfaction cannot be identified as a direct driving factor for customer retention. Through investigation and study of German car, industry found that, unhappy customers will still keep relationship with existing enterprise they further put forward the exclusiveness of investment customers keep relations of the important reasons. In the study, the customer satisfaction was not sufficient to maintain the existing relationship. 65%-85% of the lost customers expressed satisfaction with the original supplier, but still abandoned their relationship with existing suppliers and turned to alternative suppliers. Huge tourism market category, space expanding capability is strong, the sports industry of blood dynamic gets young people chase after hold in both hands and love, the existence of the gap in the market for the integration of tourism and sports industry development in the path of the found reality needs. The market integration of sports and tourism industry is realized mainly through integration of market demand and product integration.

3.3.1 Customer trust and customer retention

Customer trust is the basis of enterprise establish and maintain long-term relationships with customers, help to strengthen customer relationships. improve market share, lower transaction costs and improve customer retention, customer trust is important variables influencing customer relationship commitment and customer retention, help customer maintain a long-term relationship oriented to form, and maintain the relationship is stable and that customers tend to retain the existing trade relations. Customer retention affects relationship content, customer trust and customer loyalty. Relationship content is also called economic content, resource content and social content, customer loyalty and customer trust as intermediate variables. Fusion with the diversification of sports consumption demand in China, the demand has become consumers preferred conditions, led to the era demand diversity of sport and tourism industry. Consumer demand is bound to require physical education and tourism industry around this new consumption demand of fusion depth industry development, and thus drive sport and tourism industry caused by technical and business integration of the supply chain product integration.

3.3.2 Research on relationship between conversion barriers and customer retention

As the research continues to deepen, the academic

community begins to think about the transformation barrier as an independent variable that influences the retention of customers, and simply check the direct impact of the conversion barrier on customer retention. Against the United States more than 200 auto parts to study the relationship between enterprises and suppliers, study satisfaction, investment, and switching barriers, alternative attractiveness and loyalty. The relationship between the research results show that the switching barriers and the attractive alternative form relationship commitment have promoting effect on customer retention, but the relationship between customer satisfaction and customer loyalty is not supported. Found in commercial elevator industry switching costs, alternative attractiveness and interpersonal relationships of switching barriers perception between satisfaction and retention of regulation, not only has direct effect on customer retention, that is to say, even if not achieve expected satisfaction will also continue to maintain the existing relationships.

Interests in the relations, the positive correlation relationship between interests and customer retention, while research has suggested that this trust interests can affect customer retention decisions in the retail industry, but through the results of this paper as you can see, in the industrial environment, interests and the significant influence to the customer retention does not exist. Analysis its reason mainly because industrial supply relationship, enterprise's purchase decision will direct marketing enterprise of production performance, and even the whole enterprise finally returns, so enterprises of industrial products supplier of choice is more rational, objective. Supplier selection is often a result of a series of objective, comprehensive assessments, rather than a simple trust benefit result. Therefore, the high frequency of contact between suppliers and customers and the provision of non-standardized services can increase the interest of enterprises and suppliers. However, the simple relationship benefit cannot significantly affect the supplier selection. Therefore, there is no significant positive correlation between relationship benefit and customer retention. Fusion model of sports products to promote the evolution of sports and related industry development has very important influence, make the extension of sports resources continue to expand, sports resources type also more rich. Therefore, the innovation of product fusion or fusion product can be regarded as one of the important signs of the integration of sports and tourism industry.

4. ECONOMIC ANALYSIS OF THE FORMATION PRINCIPLES OF TECHNICAL TRADE BARRIERS

4.1 Properties of technical barriers to trade

Technical barriers to trade are dual attributes, and one is to solve the public property of market failure. Second, in order to protect the economic interests of the country, it belongs to the category of non-tariff barriers. Forms of technical barriers to trade is the social rules, Donna Roberts and Timothy Josling (1999) argues that "the surface of the codes and standards the purpose is to correct is associated with the production, distribution, and consumption of the products of the external effect of market failure". Set up reasonable moderate technical regulations and standards, conformity assessment procedures, and the health and quarantine measures can bring obvious benefits - importer information open, transparent, solved the problem of asymmetric information between the import and export countries, convenient trading, the market is helpful to maintain the normal order of international trade.

4.2 The game between government and enterprises

Although unorganized consumer interests play an important role in this model, they have a lower weight relative to the interests of organized corporate lobbyists. The politically balanced tariff option above the optimal tariff reflects the imbalance between the power of organized special interest groups and unorganized consumer groups. The key is not whether companies or consumers have a stronger influence on government trade policies, but whether they put informed consumers into existing government decision-making models. If consumers express their support for the existing government through the election, then the government will consider these unorganized consumer interests.

4.3 Trade effect of trade protectionism - trade damage in addition, trade transfer effect

Through the empirical analysis of the trade damage effect and the trade transfer effect of the technical trade barriers, the technical trade barrier has the effect and the transfer effect on China's export trade. Technical barriers to trade have become one of the main obstacles to China's export, and the impact of tariffs is not significant.

Although in the end, the implementation of technical measures can make between various trading nation standard transparent and approaching systematically, at the same time solve the problem of information asymmetry between producers and consumers. Reduce the negative external effect of protection of consumer rights and interests of the importer, at the same time the implementation of the technical standards in developed countries encourage other countries to develop similar standards, is conducive to the improvement of the whole world technology. However, even in the short term, there will be trade damage and trade transfer effects, even as technical measures to address market failure. In addition, for the implementation of the technical measures based on trade protectionism, both the long-term and short-term view of trade have a damaging effect, even a loss of world welfare. The empirical analysis of chapter 6 demonstrates the damage effect and transfer effect of technical measures on trade.

5. How to cross the industry barrier

(1) It should actively introduce foreign advanced technologies and strengthen the digestion and absorption of foreign technologies. Enterprises must attach importance to the introduction of advanced technology from abroad and strive for more international certification to obtain a pass to the international market. In addition, China's major trading partners - the eu, the United States and Japan some of the certification requirements, such as the eu's CE certification, American UL certification, etc., through the certification can promote the enterprise to improve product quality and technology.

(2) Can be seen from the previous analysis, as a result of the existence of technical barriers to trade, many countries can under the condition of the commitment to reduce tariffs can still through the technical barriers to trade for the rest of the trade barriers. Although unorganized consumer interests play an important role in this model, they have a lower weight relative to the interests of organized corporate lobbyists. The politically balanced tariff option above the optimal tariff reflects the imbalance between the power of organized special interest groups and unorganized consumer groups. The key is not whether companies or consumers have a stronger influence on government trade policies, but whether they put informed consumers into existing government decision-making models. If consumers express their support for the existing government through the election, then the government will consider these unorganized consumer interests. Therefore, the government in the trade with other countries in negotiations, not only care about the tariff reduction, also must focus on how to cooperate with other countries in the aspect of technical standards, as a successful across technical barriers.

(3) To avoid technical barriers to trade, to technical barriers to trade have a full understanding of trade partners, comprehensively to collect related information, establish the technical trade barrier warning and rapid response mechanisms. Is the best way to build a data information platform, using various legal channels, such as national enquiry point, embassies, overseas enterprise way, even if the collection especially the main technical measures of trade partners, global standards, and policy changes? The establishment of specialized agencies or organizations to translate standards and regulations into Chinese and provide detailed information services for enterprises. The government has carried out serious research on TBT and helped enterprises overcome technical barriers.

(4) The government should speed up the establishment of technical laws and regulations and standards, and improve management. For product quality inspection, our country should increase investment, purchase professional equipment, to detect the quality of export products, our product quality to meet international standards, to reduce the probability of encountering technical barriers to trade. Improve the ability to establish international standards. In terms of setting standards, we should learn from the United States and other developed countries and improve our ability to set standards. In the process of setting standards, it should be forward-looking that in the process of product development, the standard of this type of product can be drafted and promoted actively. When standards are adopted more, they can take a greater initiative in international trade and benefit from it.

(5) On the basis of advancing China's own technical regulations and standards, we will actively establish mutual recognition agreements with other countries and regions to sign technical regulations and standards. Promoting regional economic integration is an effective way to achieve mutual recognition of technical regulations and standards in other countries and regions.

6. CONCLUSION

Based on achievements of industrial integration theory, study of sports and related industrial convergence problem not only has important theoretical value, also has the important practical significance, can be made an important contribution to the development of sports tourism industry in China. Through the three paths of development of sports and related industry integration mechanism, the three reconstruction mode and a variety of typical sports fusion forms of theory combined with empirical research, can be right for the government to adjust and reform the sports related industry regulation framework. Make effective policies to promote the development of sports and related industry integration provides the theory basis.

From the perspective of the environment of tourism and sports industry development, the level of science and technology is not only one of the important elements, is also a tourist and play a new sport product characteristics necessary means. Therefore, it is also important to enhance the application of science and technology to ensure the integration of tourism and sports industry. The full use of Internet means to bring the static tourism and sports resources to life, and the integration of the two is positive.

The industry barriers between industry transformations still exist, and to make the combination of sports and tourism better, we must strengthen communication, promote cooperation and join hands. We will accelerate the reform of the property rights system of state-owned enterprises. Combined with the construction of market economy, in accordance with the norms of modern enterprise system to transform. The conversion of the enterprise to implement all separate ownership and enterprise as legal person property investors, and even with the legal person property rights of enterprises to get rid of the longitudinal dependence on government, and

make the government lifted the unlimited liability to the enterprise. Only with invested capital to undertake limited liability for the debts of the enterprise, without changing nature of public ownership under the premise of enterprise, the state-owned enterprises into the main body of market competition.

Finally, we should also understand the role of the government, the government's policy support is the extremely important for the integration of tourism and sports industry, is the guarantee of promoting tourism and sports industry integration. Government in the integration of tourism and sports industry in China plays a huge role, and play three roles: Portland, specification and coordinator, he not only can provide policy support for the industry, also can give money. However, we should note that law should ensure any favorable factors, so it is important to improve the legal system to ensure the development of the integrated industry.

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The Development Strategy of Competitive Tennis Reserve Talents in China Based on the School Training Model

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Abstract: Many sports events in our country are quite successful for a long time and are closely related to the cultivation of reserve talents. As one of the most advantageous projects in sports in our country, we should pay more attention to the cultivation of reserve talents for tennis. In recent years, due to the rapid development of tennis programs, many achievements has been made by "China Golden Flower" of Li Hua in major events in the world, and therefore tennis has been given more attention and its popularization has also been greatly improved, which is attracting a large number of young people to participate in tennis sport. However, the overall strength of tennis in China is still rather weak. Although the level of women's tennis project has been increasing rapidly, there is a lack of outstanding representatives of back power and lack of young players. Men's tennis project is lack of overall advantages. Therefore, in order to make our tennis career sustainable development, the training of reserve forces is a top priority. In view of this, based on the investigation and study of five representative tennis schools in our country, this paper discusses the strategies of our country's competitive tennis reserve strategy based on the model of tennis school training, and we hope that the discussion in this paper has certain reference value.
Keywords: Tennis; Training mode; Talent

1. INTRODUCTION

We have taken the tennis study in our country as the research object, and the research is conducted on the study with a certain scale and influence [1].

2. RESEARCH METHODS

2.1 Documentation method

Our documentation method is conducted through the knowledge database and library resources with access to a large number of sports training, sports management and related youth tennis related journals and books, and effective analysis and finishing. We have laid the solid theoretical foundation for the discussion of this paper [2].

2.2 Questionnaire Method

Our questionnaire design were made based on "expert interview outline", "tennis school coaches questionnaire" and "tennis school student questionnaire", and we have invited 10 experts to test the validity of our questionnaire [3].

2.3 Mathematical Statistics

Statistical analysis of the data is obtained by SPSS11.5, which is the statistical analysis software to provide real, detailed data support for this study [4].

3. RESULTS ANALYSIS

3.1 Some tennis school scale in our country

We have collected information through the Tennis Management Center and the National Sports Bureau and other units, and chosen the representative of the five tennis schools as the object, and have surveyed these school scales [5], and our results are shown in Table 1.

Table 1 Scale and settings of some tennis schools

School	Coach number	Student number	Settings
Hebei Yufeng Tennis School	22	172	Primary, Secondary, High School
Beijing Jiang Xin International Tennis School	7	41	Primary, Secondary, High School
Hubei Jingzhou Tennis School	6	54	Primary, Secondary, High School
Tianjin Binhai Tennis School	5	22	Primary, Secondary School
Guangdong Jiangmen Tennis School	5	21	Primary, Secondary, High School

It can be seen from the table that there is only one tennis school with student number exceeding 100, which is Yufeng Tennis Management School in Hebei Province, and the number of students in other tennis schools is less than 100. This shows that there exists a notable difference between the developments of tennis schools in China. The main reason for this status is the difference between teachers' ability and schooling ability in our country [6].

3.2 Training curriculum analysis of tennis school training model in our country

In tennis schools, students are the main body of tennis training and the participants in tennis training. The design of any tennis training must be student-centered. This paper surveys 200 students in five tennis schools in our country, which can help us to understand the current situation of the training of

students in tennis schools in our country [7].

(1) Training time

Training time is one of the main factors in sports training. Adequate training time can ensure good training effect. The mastery of tennis skills is a step-by-step process. As a result, the level of adolescent athletes is also a gradual process. Therefore, tennis training must have enough time to guarantee. The training time of some Chinese tennis school we have investigated is shown in Table 2 with corresponding results [8].

Table 2 Average daily training time table N = 5 in part tennis schools

Training time	Frequency	Percentage (%)
Less than 5 hours	0	0
5-7 hours	3	65.66%
7 hours or more	2	34.34%

(2) Student interest

The so-called attitude determines everything, which is also very applicable in the field of sports training, and therefore student interest in training courses directly affects the enthusiasm of their training. The above non-learning students are investigated with the interest in training courses, and the corresponding results are shown in Figure 1.

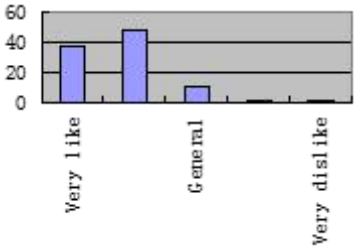

Figure 1 Motivation training statistics table with N = 200

3.3 Coaches management method

Coach is the direct organizer and manager of sports training. They play an important and decisive role in the training of elite athletes. It is a very important task for young coaches to hire, train and motivate young tennis players. This paper surveys the training and rewards of five tennis school coaches [9]. The results are shown in Table 3:

Table 3 Job Training and rewards questionnaire N = 5 for part tennis school coaches

--	Position training				Rewards			
--	Often	Occasional	Seldom	Never	Always	Occasional	Seldom	Never
Frequency	6	0	0	0	4	2	0	0
Percentage (%)	100	0	0	0	66.67	33.33	0	0

4. CONCLUSION AND RECOMMENDATION

4.1 Conclusion

At present, there are many kinds of training models for tennis reserve talents in our country. However, the students trained by the training system of the tennis school have a higher overall quality, a stronger athletic level and a better social adaptability. However, the development of most tennis schools in our country is just in its infancy, and the establishment time is relatively short. Although some achievements have been made and some market operation ability has been obtained, there is still a big gap compared with developed countries. They still do not have the ability to cultivate professional tennis players [10].

4.2 Tennis school development strategy and countermeasure for tennis reserve talents

First, the government should introduce related supportive policies, and supervise and manage it more effectively, and organize various high-level events, and conduct regular assessment of various types of tennis schools [11].

Second, tennis schools should strengthen their own internal management, and employ reasonable coaches hiring, training and incentive mechanisms, which can enable the school to continue a good sustainable development [12].

Thirdly, tennis schools should make reasonable arrangements for tennis training hours, to consider all factors and alleviate the contradictions in their studies and training, and students can acquire relevant knowledge and skills within an effective time [13].

Finally, financing funds should be provided through multiple channels to improve the conditions for running schools in tennis schools. Tennis schools should increase their schooling income through their own efforts and raise funds through loans and grants, and improve the conditions for running schools, and expand and re-invest the funds raised, and learn advanced foreign management philosophy of model, and therefore enhance the development of the school's road for China's young tennis talents to form a solid material foundation.

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Research on the Influence of the Evolution of Basketball Rules on the Development of Basketball Skills and Tactics

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Abstract: The rules of basketball and basketball spots are produced at the same time and promote each other. In this paper, with basketball rules and FIBI basketball tactics as the research object, through the method of literature, expert interviews, theoretical analysis. the impact of changes of basketball rules on basketball techniques and tactics is researched, in order to through the research on the influence of the basketball rules changes on the development of basketball tactics to achieve certain theoretical significance to improve the basketball technique level of our country.
Keywords: basketball rules; evolution; skills and tactics; development

1. INTRODUCTION

The basketball rules are produced with the appearance of basketball sports, and the two complement each other and develop together. Basketball rules are revised based on the impact outside basketball and needs of basketball competition. Since the appearance of basketball rules, they have been promoting the development of basketball to make it more meet the needs of competition and the society, become more ornamental and promote the development of sports spirit including initiative, solidarity and cooperation, and fair competition. Basketball rules are the regulations in basketball sports, so that to fully understand and grasp the influence of basketball rules on the development of basketball skills and techniques is of great practical significance to enrich the theoretical system of basketball and promote the healthy development of basketball in China.

2. RESEARCH OBJECTS AND METHODS

2.1 Research objects

This study selects the evolution of the rules of basketball rules and the related techniques and tactics as the research object.

2.2 Research methods

(1) Literature method

The author collects academic papers and monographs published in recent years on basketball rules through the HowNet database. The author has consulted some textbooks of the basketball major in China's professional sports schools, which lays a solid theoretical foundation for the writing of this article [1].

(2) Expert interview method

For the change of basketball rules and the present situation of basketball skills and tactics, this paper consults and interviews domestic basketball scholars, basketball coaches and basketball players [2].

(3) Theoretical analysis

Based on the related theories and methods of materialist dialectics, the law and development trend of basketball transformation are summarized. The influence of basketball rule changes on the development of basketball skills and tactics is analyzed by induction and deduction [3].

3. RESULT ANALYSIS

3.1The influence of the development of playing field on the technique and tactics

In the basketball rules, for the playing field, the following adjustments were made in 2008:

1) Expand the 3-pointer region from the original 6.25m to 6.75m;

2) Change the trapezoidal restricted area into a conical area under the basket;

3) With NBA as the reference, define a favorable area of attack with a radius of about 1.2m with the basket as the center.

The change of competition area makes the athletes with strong comprehensive qualities, such as height and bounce have more advantages in the air, thus enhancing the antagonism and ornamental value of the basketball match [4].

3.2 Influence of the change of the time limit on skills and tactics

(1) Regulation of the competition time

It can be seen from table 1 that though the time of each section is adjusted, the total time of normal game doesn't change. However, in order to insert ads and a variety of performances in the game and to ensure that the tactical arrangement of the team as well as the rest time of teammates, the game is divided into upper and lower sections.

(2) An increase of the rule of 8 seconds (10 seconds)

In 1932, the provisions of 10s rules and the backcourt ball were added; in 1961, it was canceled because of the cancellation of the middle line; in1968, the rules stipulated that in the final 3min of the second half of the game and all the decisive games, the offensive team must make the ball enter the front court within

10s after gaining possession of the ball; in 1972, the rule was changed into that when a team gets a ball in the backcourt, the team must get the ball into the front court within 10s after gaining possession of the ball; and in 1998, the time for the ball entering the front yard was changed to 8s.

The emergence of the 8s rule is to cope with the play of ball-control at that time, and to solve the inactivity of the game. The 8s rule adds the rhythm of the game compared with 10s, so that the press strategy in the whole area is well applied.

Table 1 Changes in the time of basketball games

Year	Section	Competition time	Rest time
Before 1940	Upper and lower sections	20minfor each	10min
1940-1948	Four sections	10minfor each	3min between the first and the second section and between the third and the fourth section, and 10min between the second and the third section
1949-1993	Upper and lower sections	20minfor each	10min
1995-1998	Four sections	12minfor each	3min between the first and the second section and between the third and the fourth section, and 10min between the second and the third section
2002-2008	Four sections	10minfor each	2min interval between the first and the second section, between the third and the fourth section, and before the runoff time; 15min between the second and the third section

3.3 Influence of the rules of dribble on skills and tactics

Before 1898, the rules stipulated that dribbling should be done by only one hand.

In 1898, a variety of new dribbling techniques was added in the rules, including turning after dribbling and cross-leg dribbling and so on.

In 1908, the rules stipulated that dribblers could shot at the basket, and before that, the dribblers cannot shoot the ball. After this, athletes started to use this rule to drive shot, which led to the production and development of shot while running, fadeaway shot, and dribble stop jump shot technology, and also made it possible to organically combine actions like dribbling, passing the ball, breaking and shooting action, so that the efficiency of attacking in the possession of the ball is greatly improved. In the tactics, this provision has promoted the emergence and development of break-and-pass and greatly improved the speed of the basketball game, which lays a solid foundation for the development of the tactic from standing attack to moving attack [5].

3.4 Restrictions and incentives for progress with the ball

A ball holder is not allowed to run with the ball in original rules, but must throw out the ball at the contact spot. In 1929, the rules stipulated that the ball holder could move with the ball, while in 1930, it be stipulated that the ball holder can keep his one foot at the same place, while the other foot can move in all directions. In catching the ball, the first landing foot is the pivot foot, and the action of moving with the ball was stipulated as well, in addition to the technology of sloppy movement while holding. Compared to the original rules, these new rules expand the range of movement of offensive players, which is conducive for breaking while holding and causing defensive pressure on others. Undoubtedly, this also requires athletes' technology to be more delicate with more swift and varied breakthrough ability, and the ability to control the violation of running with a ball. The improvement of single technology has promoted the development of basketball tactics.

4. CONCLUSION

(1) The change of basketball rule speeds up the development of basketball skill level. From the initial single hand dribbling to the modern varied superb dribbling ways, all these can be attributed to the revision of basketball rules.

(2) The development of basketball rules promotes the development of basketball tactical level. The original basketball game has simply ball throwing and shaped tactics, while due to changes in the rules, staircase tactics, converging attack tactics, and transposition attack tactics gradually appear, which leads to the new situation in basketball tactics.

(3) The development of basketball tactic level also contributes to the improvement of basketball rules. With the improvement of the overall level of world basketball, basketball tactics and techniques will promote the improvement of basketball rules in a certain extent, such as the appearance of dunk technology and alley-opp, and the corresponding modification of the interference ball and dunk action in rules.

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Investigation on the Current Situation of Da Ling Shan Middle School Campus Football in Dongguan City

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Abstract: This paper takes the development of secondary school football in Dongguan City Da Ling Shan, through the investigation and visit of the relevant personnel of the Sports Bureau and the Education Bureau of this Municipality, and through football questionnaire survey practice, grasps the current situation of Dongguan City Da Ling Shan middle school campus football. The factors restricting the development of Da Ling Shan high school football in Dongguan city are parents' and leaders' concerns about students' grades and enrollment rates, the campus football equipment is not perfect and so on, and put forward the corresponding countermeasures for this. Dongguan Football Association and education departments and schools should further strengthen the campus football work, and increase the campus football fund investment in Dongguan, do a good job of publicity, learn to communicate with parents, so that students in the movement at the same time keep a good learning situation.

Keywords: Dongguan city; Middle school students; Campus football; Training

1. INTRODUCTION

Football is the biggest sport in the world. It has a wide range of influence and is loved by the people. Football has hundreds of millions of fans around the world. The World Cup football tournament is held every four years, and the development of football indirectly reflects the development level of a country's sports [1-2]. China as a sports force, competitive sports team, the level of Chinese football has lagged behind the level of world development, at present, the foundation of Chinese football is weak, and the cultivation of football reserve talents is seriously insufficient. The urgent task of Chinese football development is to train football reserve talents and vigorously develop campus football. The development trend of football in Da ling town of Dongguan is not clear, because of this, and I investigate and study the development of football in Da ling town [3-4].

2. RESEARCH OBJECTS AND METHODS

2.1 Research objects

Da Ling Shan Middle School of 500 students and 500 parents of the students is the research object.

2.2 Research methods

(1) Documentation literature method

In order to study this article, we reviewed the 《Chinese excellent dissertations and dissertations full text database》 from 2000 to 2011 and Chinese academic journal full text database, and read relevant information about the situation and countermeasures of Chinese football [5].

(2) Questionnaire survey

According to the content and purpose of this study, the questionnaire was designed, and experts consulted the first draft of the questionnaire. After repeated modification, a small number of subjects were tested, and then a questionnaire was carefully revised.

(3) Mathematical statistics

The statistical test index of questionnaire survey was provided by SPSS 18.0 statistical software, which provided a basis for the study. We use Excel software to obtain the original data of statistical calculations, and make charts with Excel.

3. RESULTS AND ANALYSIS

3.1 Present situation of middle school campus football in Da Ling Shan

From Table 1, we can see that there are 12 surveyed schools have football courses as long-term sports courses, accounting for 8.33% of the total. There are 7 schools football classes as stage sports courses, accounting for 58.33% of the total. There are 4 schools taking soccer as an introductory course, accounting for 33.33%. Introductory course has already been established in other school.

Table 1 Football curriculum as a long term physical education course in schools

	Football as a long-term physical education curriculum	Football as the stage of Physical Education Curriculum	Football as the starting point of Physical Education Curriculum
School number	12	7	4
Percentage	8.33%	58.33%	33.33%

Participation status in Da Ling Shan middle school campus football

We can be seen from Table 2, only 18.8% of the parents of the students expressed willingness to support their children to participate in football; 27.5% of parents said neutral attitude to their children to participate in football; 36.7% of parents opposed their

children to take part in the football match; 17% of the parents are against.

Table 2 Table of parents' support for middle school football

Option	Very supportive	Neutral	Nonsupport	Very opposed	Total
Number of people	23	33	44	20	120
Percentage（%）	18.8	27.5	36.7	17	100

The investigation and analysis of middle school students in Da Ling Shan

We can be seen from Table 3, most of the students who participated in the Da Ling Shan High School Football Games had 457 students who trained for less than 3 to 4 times a week, accounted for about 84% of the total number.

Table 3 Training times per week

times	More than 6 times	5 times -6 times	5 times -6 times	5 times -6 times
Number of people	0	83	116	341
Percentage（%）	0	15.37	21.48	63.14

Analysis of parents' attitudes towards children's participation in football

Table 4 shows that the number of parents who support their children's participation in campus football is 18.1%, the proportion of support is 23.4%, and the proportion of parents who are not very supportive or unsupported is 27.5%.

Table 4 Analysis of parents' attitudes towards children's participation in football

attitude	Very supportive	Comparative support	commonly	Not very supportive	Nonsupport
Number of people	49	65	88	53	23
Percentage（%）	18.1	23.4	32.5	19.4	8.1

4. CONCLUSION

The students are very interested in participating in campus football, and the motivation of most students' participation is more rational. However, the head teacher for academic achievement, the school leaders' expectations for the rate of enrollment and the parents' worries ask the students about the injuries caused by the football games. There are about 63% of the trainees' training time every week. Ensure that students improve their skills.

Due to various social factors, such as Chinese traditional concept and the current examination results, both parents and class teachers and even school leaders will pay more attention to cultural study, and the attention of school football is not enough. Classroom teachers worry mainly from two aspects, the first is fear of learning, the second is afraid of injury, so about 77% of the students think the class teacher does not support them to participate in campus football training and competition.

Campus football organization system is not enough, the training time is not unified, so the development will certainly affect the future development of campus football; campus football league system is not perfect, unreasonable, the game is not enough time, they spend most of the time traveling. Da ling mountain town is a big city, a large area of the city, how to arrange the game site and time is a very important issue.

5. RECOMMENDATIONS

Each PE teacher participating in campus football should have more training and learning opportunities, improve the overall quality of football teachers, and improve the knowledge structure of teachers. The Sports management departments should give young teachers a good platform for learning and communication, so that they grow up as soon as possible to make their own contributions to the development of Da Ling Shan middle school campus football.

Dongguan City Football Association and the education departments and schools should further strengthen the work of the campus football. Bringing it into the Da Ling Shan high school football reserve personnel training system, and establish a good platform for students' training and competition, increase the daily training time and the number of weeks, let more soccer young athletes come out from the campus football family.

Lighten students' learning burden and change their parents' traditional ideas. Schools should integrate the knowledge structure, selection, set up special classes according to the actual situation, and it should incorporate teachers' mentoring activities into the teachers' classes. Strictly carry out the daily sunshine activities, let the students out of the classroom, and exercise themselves according to their own interests. Change the traditional concept of parents, and let parents know the importance of learning sports and learning football.

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The Broken Rings -- Reflections on the Chinese Men's Basketball Team After the Rio Olympics

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Abstract: In the thirty-first Rio Olympic Games, the men's basketball competition ended with the United States won the championship, the Chinese men's basketball team in the Olympic Games in 5 games total defeat in the group competition was eliminated, early end of the Olympic Games journey; according to the research object and research target, the author collected a large number of related data with the Internet and related research monographs, and then provided a solid theoretical basis for this study through analysis and collation. In addition, the author watched the whole video of the 5 groups matches of the Chinese men's basketball team in Rio Olympic Games, and recorded the technical statistics of each game in detail, which provided an objective empirical basis for the study.
Keywords: Chinese Men's Basketball Team; Olympic Games; Reflection

1. INTRODUCTION

The Olympic men's basketball team has brought together many excellent teams and players in the world. It is one of the most popular events in the Olympic Games, in the 31 Olympic Games men's basketball tournament, the U.S. men's basketball team with a great advantage over the Serbian team won the championship, defending success, other European teams also showed a high competitive level of basketball. The Chinese men's basketball team 5 games defeat, is the last in the group competition, this defeat is after the thirtieth London Olympic Games, the Chinese men's basketball team let the community disappointed again. We have to admit that after the 2008 Beijing Olympic Games, it was wrong to think that Chinese men's basketball team could compete with any strong team in the world [1]. The golden period of the Chinese men's basketball team led by Yao Ming was divided by the 2008 Beijing Olympic Games, from the peak to the fall, and the ring attached to the head of Chinese men's basketball team has been broken, therefore, in today's world basketball technology continues to develop, the Chinese men's basketball team not only did not progress, even appeared the retrogressive phenomena, what is the underlying reason, and why these problems have not been resolved, which has to be deeply reflected [2-3].

2. PERFORMANCE ANALYSIS OF CHINESE MEN'S BASKETBALL TEAM IN RIO OLYMPIC GAMES

The Chinese men's basketball team lost 29.6, averaging 63.6 points, 25 rebounds, 14.6 assists, hitting 41.7%, three points, 24.7% points, 70.5% points, and all technical statistics were at the bottom, in the 5 men's basketball team games of the Olympic Games, Chinese men's basketball team scores are as follows:

Tbale 1 List of results of Chinese men's basketball team in group competition

1	China 62	U.S.A 119
2	China 60	France 88
3	China 68	Venezuela 72
4	China 68	Australia 93
5	China 60	Serbia 91

From the table, we can see that the difference between the Chinese men's basketball team and the United States men's basketball team was 57 points, losing 22 points with France, losing 4 points with Venezuela, losing 25 points with Australia, losing 51 points with Serbia, ranking at the bottom of the group competition and having no chance to enter the knockout [4]. Only from the point of view, this gap is still an objective expression of strength, but the author watched the 5 men's basketball team video data found that the entire scene of the Chinese men's basketball performance is very poor, the average height of the Chinese men's basketball team is 2.04 meters, and the average height of the three big lines is 2.1 4 meters, but every game in rebounds we lose each other.

3. REFLECTIONS ON THE CHINESE MEN'S BASKETBALL TEAM AFTER THE RIO OLYMPICS

3.1 The traditional technical style has been lost, and the new style has not been established

In the 50s and 60s of last century, Chinese men's basketball team, with the characteristics of "fast, accurate and flexible", has made brilliant achievements and defeated many world strong teams, but the inside line was always the short board of Chinese men's basketball team, and it has become the main bottleneck of China's further development. Until the 90s of the last century, the maturity of the 3 main lines of the Chinese men's basketball team has

strengthened the inner strength of the Chinese men's basketball team, but the level of the outside players has not been improved accordingly, so that the entire team level has been limited, so that the new style has not yet formed, the old tradition has been lost. From this point of view of the Olympic Games, this shortcoming is particularly prominent [5].

3.2 Offensive and defensive level is poor

First of all, from the aspects of offensive efficiency, the men's basketball team averaged only 63.6 points, the lowest ranking in the group phase, two point shooting, three point shooting and shot rate are lower than the other, and on the other side of tight defense case, players passing accuracy and breakthrough ability are weak.

Secondly, the defense effectiveness of Chinese men's basketball team has a big gap with each other, which allowed 79.6 points per game, offensive rebounds less than the other 6.8 (per game), steals the number less than the other 5.4 times (per game), although China basketball athletes have a high height advantage, the offensive rebounds and defensive rebounds are not as good as opponents, which fully shows the players fighting consciousness are weak, the body for low technology and in the process of defense and combat capability are not strong.

3.3 The influence of CBA foreign aid policy on domestic players

Since the introduction of foreign players in the CBA League, it has played a positive role in its prosperity and development, at the beginning of 1995, the Zhejiang team introduced the first foreign aid in history. Since then, each team of the League continuously introduced foreign aid, and gradually increased. Although the introduction of foreign aid quantity and quality continues to improve, enhanced the CBA ornamental wonderful degree, drew more patronage, promoted its development, from the 2012 London Olympic Games and the Olympic Games national team's results, the gap between Chinese men's basketball team and the world's top national team is increasing, and the athletes in the CBA League is absolutely the best player, they entered the international competition and high-level team to compete with the performance is so unsatisfactory, which has to make people doubt the current CBA development model and people criticized the foreign aid system.

4. CONCLUSIONS AND COUNTERMEASURES

4.1 Conclusion

(1) In the Rio Olympic Games, Chinese men's basketball team has shown that the gap between its competitive level and world basketball is getting bigger and bigger, and has gradually deviated from the main track of world basketball development.

(2) There are some problems in the development model of domestic basketball, which are as follows: 1) lack of excellent coaches at the grassroots level; 2) lack of high-level competition in China; 3) CBA foreign aid system has a greater negative impact on domestic players;

4.2 Countermeasures

(1) We should correctly understand the gap between the Chinese men's basketball team and the world's top basketball teams, and make a deep reflection on the training mode of the Chinese basketball back talents, accurately grasp the main direction and inherent law of today's world basketball development, and learn the advanced training methods and tactics of international basketball, and send the players with relatively large development potential to the world high level professional league to exercise.

(2) We should reverse the bad situations that various friendlies invite the two or three teams held by the Chinese basketball association in China, and put an end to the men's basketball team as a tool to obtain economic benefits, hire high-level foreign teams and national team players to compete, through the competition with the world's high-level teams to improve their competitive level.

(3) We should correct the foreign aid policy of CBA professional league, change foreign aid to decide the winning and losing situation of the team, ensure the playing time of domestic players, and improve the ability of domestic players to deal with key ball, when necessary, we should restrict foreign aid to play in the last 5 minutes of the fourth quarter, and return the decision of the game to the domestic players.

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The Inheritance of Martial Culture Based on the Intercultural Communication Perspective

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Abstract: In the economic and political tide of globalization, intercultural communication is becoming more and more frequent, as a form of physical practice and unique cultural phenomenon for thousands of years, the Chinese martial must be actively involved in the intercultural communication in the world. Globalization is not only a challenge, but also a rare opportunity for the inheritance of Chinese martial culture. In the new century, the cultural heritage of Chinese martial wants to be successful in the context of globalization, and it is necessary to find the conjunction of internationalization and localization of Chinese martial. We should carry on the cultural reconstruction, with harmony but not uniformity as the inheritance goal, and create the Chinese martial arts cultural inheritance new situation.
Keywords: Intercultural; Communication; Martial; Inheritance

1. INTRODUCTION

The Chinese nation has a long history, and its Chinese culture is more extensive and profound. Martial culture as an important part of Chinese culture, at present, some of its projects have been included in the world cultural list, more and more experts and scholars at home and abroad began to pay attention to the inheritance and development of Chinese martial culture [1]. With the rapid development of economic globalization, the Chinese traditional culture is facing an unprecedented survival crisis. Therefore, awakening the cultural consciousness of the whole nation, making the culture become the value orientation and behavior of the whole nation identity, will greatly promote the development of the nation, as a classic representative of Chinese culture, martial culture needs to be inherited and developed [2-3]. Therefore, the author based on the intercultural perspective, put forward its own idea on the current cultural communication, and hope the relevant scholars and experts can criticize.

2. INTERNATIONALIZATION DEVELOPMENT OF CHINESE MARTIAL

In recent years, China's martial culture has made good achievements in the international cultural heritage. In foreign countries, Kung Fu, acupuncture, comedy, Confucius, wine has become China's international cultural image, and characteristic of martial has formed a kind of different from other cultural forms. These five kinds of cultural images have become the main windows for foreigners to understand Chinese culture. The achievement of the internationalization of Chinese martial culture is mainly due to the fact that after the founding of new China, Chinese martial, as a symbol of Chinese culture, has actively opened the road of international development [4]. For example, in 1987, the Asian Martial Federation was established in Japan. In 1990, the International Martial Federation was founded in Beijing. In 1994, Martial was accepted as a full member of the international individual sports association [5]. In 2002, it was officially recognized by the International Olympic Committee, Nowadays, the World Martial Federation has reached more than 140, which greatly improves the century influence of Chinese martial arts. The establishment of the Asian Martial Federation in 1987 is an important milestone in the development of Martial Culture in China. So far, the nine Asian Martial Championships have been held successfully (see Table 1):

Table 1 Previous Asian Wushu Championships

Championships	Competition place	Country	Time
1	Yokohama.	Japan	1987
2	Hong Kong	China	1989
3	Seoul	Korea	1992
4	Manila	Philippine Islands	1996
5	Hanoi	Vietnam	2000
6	Yangon	Myanmar	2004
7	Macao	China	2008
8	Ho Chi Minh	Vietnam	2012
9	Taiwan	China	2016

3.THE NECESSITY OF NATIONAL INHERITANCE OF CHINESE MARTIAL ARTS

The intercultural communication of Chinese martial is not a new attempt, but it has come into being since the beginning of human civilization, the condition was that at that time, when a tribe met another tribe, they found a certain difference between themselves. After the new technological revolution, the development of globalization and the growth of the world population make the national communication more frequent. This frequent communication leads to the communication and spread of the human group culture and characteristics, and promotes the world communication of the carrier form of cultural elements, in the twenty-first Century, the status of international exchanges has gradually improved, and it has become an important soft power in the process

of national competition. People's intercultural communication is not only the need of individual survival, but also the demand of world development. Therefore, the scientific application of martial to promote the international heritage and development of national culture is an important way to enhance the soft power of the Chinese nation.

4. INHERITANCE STRATEGY OF MARTIAL CULTURE BASED ON THE INTERCULTURAL COMMUNICATION PERSPECTIVE

4.1 Main body and audience strategy

In the main body, China should pay attention to training cross-cultural communicators who are proficient in eastern and Western culture. In the context of globalization, martial inheritance talents should have the vision of internationalization, abandon the local complex, and build the traditional culture of Chinese Martial with the vision of modernization and globalization. In the aspect of audience, Chinese Martial must cultivate its international audience to carry out cross culture communication. Foreign Martial lovers recognize and locate the image of Chinese Martial through the symbolic reality of Chinese culture. Therefore, we must use scientific and reasonable cultural communication strategy, and let foreign audiences in the understanding of Chinese martial arts culture at the same time has a strong interest in it, in a subtle way to let foreign audiences naturally accept Chinese martial, so as to produce cultural identity.

4.2 Strategy of localization and internationalization

Because of its distinctive regional characteristics, the Chinese martial arts are extremely full of tension and humanistic connotation, so there is a striking difference between the Chinese martial arts and other fighting cultures in the world. So, the regional Chinese martial arts want to inherit and develop well in the context of globalization, it must make use of modern various modes of communication and ways of transmission to make it move into a vast world. Chinese martial, as a kind of other culture, is a kind of relationship with the local culture in the process of cross-cultural communication, therefore, in the process of communication with other local cultures, it is necessary to fully tap the existing resources and spread to multi levels and multi directions.

4.3 The cultural appeal strategy of "harmony but not sameness

Harmony without uniformity is the cultural pursuit and cultural strategy of Chinese martial traditional culture in cross-cultural communication. It is also the ultimate goal of the world heritage of Chinese martial Culture under the background of globalization. Therefore, there is no need to worry that Chinese Martial Culture loses its individuality after blending with other fighting culture. On the contrary, in the process of intercultural communication, Chinese foreign culture will greatly enrich the content of local culture, culture is a process of multi race pursuit, and the fusion culture still belongs to the local culture, and it is also a new starting point for its continuous development and evolution. Therefore, when cross cultural communication occurs Chinese Wushu culture should deeply understand the conflict and interest pattern between Chinese and western competitive culture, we should communicate with each other on the basis of mutual understanding, understanding and respect, so as to achieve the important goal of the inheritance and development of Chinese martial culture globalization.

5. CONCLUSION

The inheritance and development of martial culture have a long way to go. Nowadays, with the increasing globalization and the disappearance of traditional culture, it is the best way to promote the development of Chinese martial and inherit martial culture by actively using the cross-cultural communication strategy of martial culture, vigorously developing the martial arts industry, and studying the inheritance theory of martial Culture.

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Strategy of Training And Developing Reserve Talents Of Competitive Basketball Sports In China

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Abstract: In the socialist market economy, China's traditional mode of personnel training and training methods have been difficult to build our country into a first-class basketball power, and therefore, to regard competitive sports as a starting point based on the clear understanding of the current situation of basketball talent cultivation in China and the personal advantages to analyze its shortcomings is the only road to explore the basketball talent cultivation system that can really rooted in the soil of our national basketball, and also to promote China to become a first-class basketball power.
Keywords: competitive sports; basketball; reverse talents; cultivation

1. INTRODUCTION

For a long time, our country's basketball has been in a leading position in Asia, but compared with Europe and other developed countries, there is a growing gap. At most, China's basketball is only the second in the world. After the 2008 Beijing Olympic Games, the achievements in the world cup and the Olympic Games became worse and worsev [1]. However, the United States, as for the first world basketball power, its superb basketball athletics level cannot do without the reverse talent training system construction, which is the best reference template for countries with less developed basketball [2]. Therefore, to promote the rapid development of China's basketball project system and change the current situation that China's basketball athletics level is relatively backward, it is necessary to strengthen the cultivation of reverse talents, and arrange it in the system of basketball development in China with a strategic vision, which lays a solid foundation for the promotion of basketball level in our country.

2. STATUS QUO OF BASKETBALL RESERVE TALENT TRAINING IN CHINA

To develop a basketball reserve personnel training system that is rooted in the soil of China, it is necessary to fully understand the basic situation of China's basketball development and with this as the basis to develop more targeted and scientific training strategies [3]. At present, our country's basketball occupation leagues are mainly CBA and NBL league match, where the number of CBA teams after several times of expansion has reached more than 20, and each team has set up second-level and third-level youth teams. BBL league' first-choice teams are 134, and its number of second-level teams has reached 14. The two major leagues play a significant role in China's basketball training. China's women's basketball professional league with WCBA as the main has a total of 12 adult teams, of which the construction of second-level young people is more perfect, while third-level youth team relatively lags behind. These data show that the situation of basketball reverse talent training in the tip of the Pyramid is not very optimistic.

3. DRAWBACKS OF RESERVE PERSONNEL TRAINING IN BASKETBALL PROJECT COMPETITIVE SPORTS IN CHINA

3.1 Lack of excellent grassroots coaches

In our country, some good coaches have entered the national team, and at the grassroots-level training system, there are many incompetent and inefficient coaches, which has caused the situation that some players after entering into the national team still need coaches to help them train basic skills. On the contrary, in the United States' basic basketball training system, there are many excellent coaches, and player after entering the national team are already out of basic training, and the coaches of the national team are tactical master hired for training tactics of players [4]. For example, the present coach of the United States team, Old K, is the famous tactician.

3.2 Relatively serious separation between physical training and physical education

At present, Chinese men's basketball development is faced with a bottleneck, and the separation between physical training and physical education has to be paid attention to. At present, Chinese basketball youth training system has formed a complete framework (construction of the national team, occupation league and college basketball), but leagues in the early junior and high school and the Youth League are still at the stage of separation with the existence of malignant competence. The junior and high school youth training system has a strong platform advantages and occupation advantages, while sports schools have a yield advantage. According to authoritative statistics, eighty percent of the sports talents are cultivated by professional sports schools and the two kinds system are completely separated currently [3]. Therefore, the cultivation of basketball reserve talents must solve the situation of

separation between physical training and physical education.

3.3 Narrow selection range of basketball reserve force

The current implementation of the physical education system leads to the deficiency of the athlete culture and education, and in the current society of our country, most of players are the single child of their family, so their parents always put the quality and culture education in the first place. Many parents in the consideration of the future of the children let the children participate in basketball training basically with promoting the health and interests development as the main purpose. In this case, some of the basketball gifted children are difficult to enter into the professional schools to accept systematic training. Thus, the selection range of basketball reserve talents in China is relatively narrow.

4. TRAINING AND DEVELOPMENT STRATEGY

4.1 Strengthen the construction of coaches at the grassroots level

The coach team construction is an important guarantee for the quality of basketball reserve talents. In view of the fact that currently our country's grass-roots coaches' knowledge structure and cultural quality are relatively low, coaches must enrich their knowledge level and enhance the ability of solving problems constantly. In addition, the coach team construction not only depends on the internal factors of personal efforts to study and improve, but also on external factors including learn and working, opportunities and challenges.

4.2 Establish a perfect talent training system

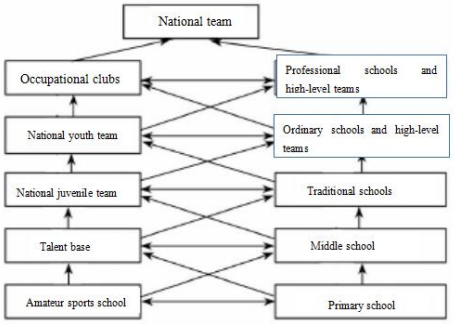

Figure 1 Idea of the youth basketball athlete selection and transport system

The sports department should cooperate closely with the education department and develop consensus on the athletes' education and cultivation, so as to give full play to the guiding role of the government, achieve the rational allocation of educational resources, and establish a perfect talent training system, so as to improve the quantity and quality of personnel training. In addition, it is needed to establish a national youth basketball athlete selection and transport platform, which can not only guarantee the reasonable flow of students with basketball talent, but also can expand the circulation channels, so as to cultivate a large number of outstanding basketball talent. The basic thinking of youth basketball athlete selection and transport system is shown in Figure 1:

4.3 Promote the market reform of basketball professional league

The basketball competitive project is quite different from the ordinary masses project, as it doesn't like the latter which can solve the problem of the cultivation of basketball reserve talents by simply relying on the government fiscal investment, but it is a systematic project with a large investment and a long return time. Therefore, it is necessary to take the marketization road to fully mobilize private capital and create a very fruitful occupation league talent cultivation system, so as to make various teams in the occupation league attach great importance to the building of reserve talents based on profits, and thus to provide adequate funding for all levels of youth team building.

5. CONCLUSION

To achieve the dream of becoming the world-class basketball power under the tide of marketization, China must break the shackles of traditional ideas, treat the cultivation of basketball reverse talents with the strategic vision, create the marketized occupation league with the unique population advantage, strengthen grassroots coaches and establish the perfect training system and the selection system. Only with this as a strategy can China establish a long-acting basketball reserve personnel training mechanism.

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Experimental Study on Comprehensive Performance of Full Tailings Paste Filling in Jiaojia Gold Mine

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Abstract: Filling mining method is the main method of modern underground mining. High concentration cementation is carried out using coarse tailing of +37 μm, and the mine has maturely used classified tailings paste filling technology. The gold mine studied on the performance of full tailings paste filling in order to maximize the use of tailings, reduce -37 μm fine tailings discharged into the tailing pond, reduce mining cost and eliminate security risks. The results show that: comprehensive index of full tailings paste filling is higher than that of classified tailings high concentration cementation filling, and the full tailings paste filling of 76% mass concentration has the best comprehensive index of slump, expansibility, yield stress and viscosity to meet the mining method requirements, which can effectively reduce the mining loss rate and dilution rate.
Key word: Filling; Full tailings; Paste filling; Experimental study

1.OVERVIEW OF MINE FILLING STATUS

Jiaojia Gold Mine is located in Jiaodong area of Shandong Province, and in the geotectonic it is located in the jiaodong uplift zone of the new Huaxia series second uplift zone. The northwestern of Jiaodong is to the west of Tanlu fault zone, and to the east of Mu-Ji fault zone. The Mine has a large ore reserve and high taste, which is one of the biggest gold mine inland. The shape of the ore body varies a lot, and the upper plate surrounding rock is broken [1-3]. In the upper part of the ore body, there are farmland and houses, which needs protection in the mining process. In order to prevent the subsidence and reduce ore loss and dilution, tailings consolidation and filling system is designed specially. Upward stratified approach filling is the main mining method, which has a high requirement of the strength of filling body [4,5]. With the increase of production capacity, filling system and process are improved continuously. As for filling material, ordinary 425 cement is first used as cementing material. Through the cooperation with related universities and designing institute, according to a large number of experiments and research, there is a new type of mine filling cementing materials developed which is of low cost, high water content, rapid hardening and high strength (modified C material). Aggregate mainly comes from the gold ore dressing plant tailing of processing classification desliming (i.e. +37 μm coarse tailing), and the remaining -37 μm fine particle tailing after cyclone classification is discharged to tailing pond.

Tailing classification desliming reduces the utilization rate of tailings (generally about 50%), and it is difficult to dam with fine clay backfilling. With the increase of tailing emissions, the economic costs and security costs of tailings are increasing. Graded tailings filling slurry in the stope after the process of dehydration will occur segregation and stratification, leading to low integrity and intensity of the filling body. What's more, in the process of dehydration it will take away a part of the slurry, pollute underground work environment, and indirectly increase ore dilution rate.

In order to use tailings effectively, reduce the burden and safety hazards of tailings, we explore the use of full tailings paste filling. Paste filling has great advantage in the field of environmental protection, security and economic, and it is also of great importance in solving the deep ground pressure and temperature, maintaining stope stability, managing old empty area, recovering the remain mining pillar, controlling subsidence and protecting the ecological environment. This can not only solve the problem of tailing, but also guarantee the strength of the filling body.

2.EXPERIMENT SCHEME

Combining with the new advanced filling technology at home and abroad, the paste filling technology is the best one with high technical level. It is composed of the preparation, conveying and consolidation of the filling paste, so that the application effect of the whole process is influenced by the flow performance of the paste filling material, the rate of water secretion and the strength. Therefore, preliminary experiments are needed to achieve optimal filling ratio and parameters.

(1) Determine the physical properties of Jiaojia Gold Mine backfilling and the composition of colloidal materials.

(2) Determine the composition of different grading tailings according to experience(full backfilling 、 +0.038μm +0.074μm),and determine slump, expansion, yield stress, viscosity, bleeding rate and other parameters.

(3) Combined with the mine's current production process, the strength of cemented filling should meet the conditions following: ① False bottom cementation filling at the age of 14d is not less than 5MPa; ②The strength of the stratified filling body was not less than 0.25MPa at the age of 3 days, and 0.7MPa at 14days; ③The strength of the glue filling body is not less than 0.45 MPa at the age of 3 days, and 1.2MPa at 14 days.

(4) Flow performance requirements of the full tailings paste filling: not settled, not isolated, not layered and not dehydrated; the slumping degree is 18 ~ 25cm; the content of -20μm is 15% ~ 20%; the bleeding rate is 1% ~ 5%; the slump is 18 ~ 25cm; Compression rate is less than 3%; yield stress is (200 ± 25) Pa above; stratification is less than 2cm.

3.THE PHYSICAL AND CHEMICAL PROPERTIES OF MATERIALS

3.1THE PHYSICAL PROPERTIES OF MATERIALS

Table 1. The physical properties of materials

Tailings	Full tailings	+0.038μm	+0.074μm
proportion(g/cm3)	2.67	2.64	2.65
volume-weight(g/cm3)	1.123	1.222	0.579
porosity(%)	57.9	53.7	77.5
permeability coefficient(%)	12.13	14.32	5.6

THE CHEMICAL PROPERTIES OF MATERIALS

Table 2. The chemical properties of materials

Composition	SiO2	Al2O3	K2O	CaO	Fe2O3	Na2O	SO3	MgO
Full tailings	64.83	14.72	4.723	2.31	2.208	1.95	0.574	0.479
Coarse tailing	64.64	14.23	5.294	2.40	1.18	1.88	0.195	0.14
Fine tailing	60.22	18.19	5.538	2.35	2.303	2.22	0.291	0.524

Combined with X-ray diffraction analysis, the results show that the main mineral composition in the tailing is quartz, illite, albite and potassium feldspar.

3.3 PHYSICAL PROPERTIES OF SLAG

The physical properties of slag: 2.83 g/cm3 of density; 452 m3/kg of specific surface area; 1.12 M of alkaline coefficient; 1.97 K of quality factor; 7d and 28d are 80.22% and 112.08% respectively of the active index.

3.4 CHEMICAL PROPERTIES OF SLAG

The slag powder has a potential hydraulic similarity to the cement: the higher the alkalinity of the slag, the stronger the potential activity. The chemical composition of the slag is analyzed by atomic absorption spectroscopy and the result is as following: the content of CaO is 43.1,SiO2 is 31.1,Al2O3 is 13.7,SO3 is 2.1,Fe2O3 is 0.5,TiO2 is 0.9,K2O is 0.5,Na2O is 0.3,MnO2 is 0.5.

4.COMPARISON EXPERIMENT OF FILLING PERFORMANCE OF DIFFERENT CONCENTRATION TAILINGS AT DIFFERENT CONCENTRATIONS

The strength of the filling body directly affects whether the ore body can be safely and continuously mined, so it is of great significance to analyze the factors that affect the strength of the filling body. There are many factors that affect the strength of the filling body, including the material factors, the preparation factors, the construction conditions and so on. The strength of the prepared gut strength is the result of the combined effect of various factors. The factors are determined by the parameters such as slump, expansion, yield stress, viscosity, bleeding rate and stratification. In order to determine the filling ratio, concentration and curing period of the cementing material produced by the mine, the whole tailings, the graded tailings (+0.038μm) and the fine mud (-0.074μm) are used to test the cementing material produced by the mine respectively.

Aggregate is the basic part of cementing filling body. Aggregate gradation and quality has a great influence not only on the workability of cemented material, but also on strength. Therefore, the particle size of aggregate is selected to study the strength. Under the condition of room temperature, the slurry is poured into the 7.07cm × 7.07cm × 7.07cm standard triple metal touch, and the test piece in the initial condensate after stripping is put into the conservation box for standard maintenance. When reaching the specified age, the uniaxial compressive strength test was carried out on a press.

Filling body ratio and the main parameters are as follows:

(1) Simulated filling ratio of 1:20 (refer to the main use of the filling ratio);

(2) The conservation period is 3d, 7 d, 14 d.

4.1 STRENGTH TEST OF VARIOUS GRADING FILLING

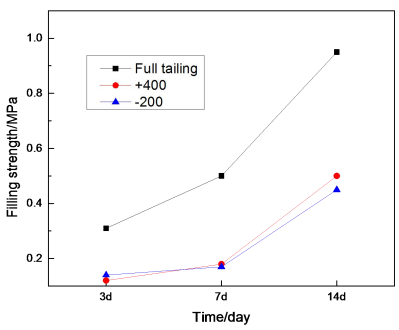

Figure 1. Filling strength of various grading

To find out the tailing gradation which meets the filling strength requirements, the optimum particle size is determined by measuring the filling strength at

different particle sizes (gray sand ratio is 1:20, and the same below). The test data is showed in Figure 1. We can see from figure 1 that Jiaojia gold tailing is filled with the highest strength.

4.2 PERFORMANCE PARAMETERS OF TAILINGS WITH DIFFERENT CONCENTRATIONS OF FILLING SLURRY

Prepare different concentrations of filling slurry according to gray sand ratio of 1:20 and determine the content of -20μm, slump, expansibility, yield stress, viscosity, bleeding rate and filling strength to determine the comprehensive performance index of whole tailing paste. The test data are as follows:

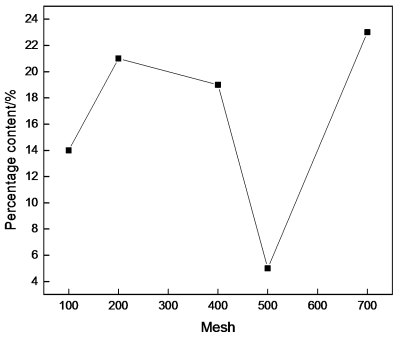

Figure 2 The content of each grain level (%)

Table 3. Performance parameters of tailings with different concentrations of filling slurry

grading	Concentration (%)	Filling strength (MPa)			Yield stress (Pa)	Viscosity (Pa·s)	Divergence (mm)	Slump(mm)	Bleeding rate (%)
		3d	7d	14d					
Full tailings	80	0.23	0.47	1.02	\	\	58	90	3.25
	78	0.28	0.50	1.11	1282	1262	61	150	3.33
	77	0.37	0.55	1.11	350	332	63	159	5.00
	76	0.42	0.58	1.34	300	249	65	195	6.00
	75	0.33	0.51	1.04	128	130	71	250	6.25
	70	0.31	0.50	0.95	67	103	193	277	19.84
	65	0.21	0.23	0.62	18	26	203	\	28.51
+400	76	0.26	0.44	0.82	85	111	134.5	277	15
	75	0.24	0.42	0.79	78	111	134.5	277	18
-200	76	0.07	0.21	0.56	\	\	\	\	\
	75	0.05	0.20	0.56	\	\	\	\	\

It can be clearly found from the table that the content of - 20μm full tailings is 18%. The concentration of 76% have the highest strength, and yield stress is 300 Pa, viscosity is 249 Pa·s, expansion is 63 mm, slump is 19.5 cm, bleeding rate is 12.2%. In addition to high bleeding rate indicators, the other performance indicators are in line with the requirements.

The mine mainly adopts the mechanization to the horizontal road cementing filling mining method, therefore in the process of mining the required strength of the filling body is higher, and the choice of full tailings filling can better meet the mining method requirements that both reduce the tailing dilution and ensure the safety of recovery.

5.CONCLUSION

Through the experiment, it is concluded that the grading of the full tailings of the Jiaojia Gold Mine is the best, and the comprehensive index of the full tailings paste filling is higher than graded tailings high concentration cementation filling. The full tailings paste filling of 76% mass concentration has the best comprehensive index of slump, expansibility, yield stress and viscosity to meet the mining method requirements, and can effectively reduce the mining loss rate and dilution rate.

The use of full tailings paste filling not only improves the strength of the filling body, reduces the rate of depletion of the production, but also reduces the emission of fine tailings, the burden of tailings, the cost of tailings construction and the security risks.

But the test is only laboratory data, due to conditions, no loop test and industrial test is taken. But there will be loop test and industrial test in the next step based on the specific circumstances of the mine or outside association, to service for the mine filling technology.

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Experimental Study on Preparation of Tailings Paste

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Abstract: It's universally acknowledged that paste filling is the best solution to solve the problem of filling slurry concentration and reduce the filling cost. The paper provides an experimental method to determine whether the mine has the basic conditions and the scientific basis for the feasibility of paste filling. Through this experiment, the main equipment, process parameters, economic and technical indexes of the new filling process are preliminarily determined.
Key word: Tailings; Paste; Parameters; Experimental study

1.INTRODUCTION

The paste filling is a brand-new mining model which is developed and promoted rapidly domestic and foreign. This filling method has high filling quality, rapid growth of filling body, low cost and high efficiency, and it is the main direction of the filling technology development. However, the paste definition is not clear, and there is no complete mining tail-paste test. Recently, domestic metal mines have gradually begun to promote the filling process of full tailings paste [1-3]. At present, there is a great disagreement between the knowledge of paste filling and high concentration filling. Through the study of tailings filling in recent years, some views and understanding of the paste, as well as parameters must be understood in the preparation of the paste system are clarified here.

2.KNOWLEDGE OF SOME PASTE CONCEPTS

The "high concentration" is a relative concept in the "high concentration filling" of tailings, and the paste concentration is 56-82 percent in actual production cases. This is mainly based on the flow state of the filling slurry. When the slurry concentration reaches a certain threshold, slurry turns from non-heterogeneous Newtonian into heterogeneous, which is the fundamental changes in the flow, and slurry is saturated to be treated as paste. The concentration of slurry near the limit can be considered as high concentration.

As the slurry concentration continues to increase, the yield stress of the slurry increases continuously, and the fluidity of the slurry gradually decreases until the flowability is lost. That is to say, paste is a special state of high concentration. For the mine, the paste must meet the liquidity requirement, so the yield stress must be at a certain range.

It is generally recognized that paste has three characteristics: non-segregation, non-settlement and non-bleeding. For the full tailings filling, it is required that slump is in the range of 15-25cm and degree of segregation is lower than 2cm. Combined with the views of scholar at home and abroad, the writer thinks the paste is the structural slurry that meets the maximum number of weights as well as the viscous force of the flow field is greater than the inertia force and reaches saturation.

3. THE DETERMINATION OF SEVERAL MAIN PARAMETERS OF THE PASTE TEST

Based on the paste knowledge above and the production practice, a set of test procedures is designed to determine the feasibility of the tailing paste preparation. Mainly through the determination of tail grain size composition, concentration, bulk density, bleeding, degree of segregation, slump, filling material properties and ratio, slurry modifier and the strength indicators of filling body to determine whether the slurry is fit to prepare paste, and whether paste characteristics can meet the requirements of mine filling [4, 5]. Since the strength requirement is the main target of filling, the experiment is carried out to meet the core target of mine filling strength after determining the basic filling parameters.

3.1 DETERMINATION OF THE RELATIONSHIP BETWEEN FILLING PARTICLE SIZE AND FILLING BODY STRENGTH

The test is to find the tailings gradation which meets the requirement of filling strength. The appropriate grade of granules is determined by measuring strength of different granule levels (grey sand ratio is 1:20, and the same below). The data is showed in table 1:

Because the tailings are gold ore flotation tailings, and the tailing productive rate is about 97%, it is appropriate to use tailings to determine the appropriate gradation but not external materials. All the following experiments are also based on a single variable. It can be seen from the experiment that the strength of full tailings body is the highest, while of others are lower. The next experiment will be carried on the filling body of full failings.

The result that the strength of full tailings filling is the highest can provide a basis for similar mine. Mainly the full tailings filling has problem in the operation process, and needs process improvement to meet the production requirements.

Table 1 Filling body strength of different tailings grade

Gradation	grey sand ratio	concentration (%)	Strength of 3 days (MPa)	Strength of 7 days (MPa)	Strength of 14 days (MPa)
classified tailings	1:20	70%	0.30	0.45	0.83
Full tailings	1:20	70%	0.31	0.50	0.95
+0.044μm	1:20	70%	0.15	0.24	0.32
+0.038μm	1:20	70%	0.12	0.18	0.21
-0.154μm	1:20	70%	0.27	0.35	0.31
-0.100μm	1:20	70%	0.26	0.25	0.22
-0.074μm	1:20	70%	0.14	0.17	0.45

3.2 DETERMINATION OF THE RELATIONSHIP BETWEEN FILLING BODY CONCENTRATION AND STRENGTH

To represent relationship between filling body concentration and strength directly, here is a relation curve in Figure 1.

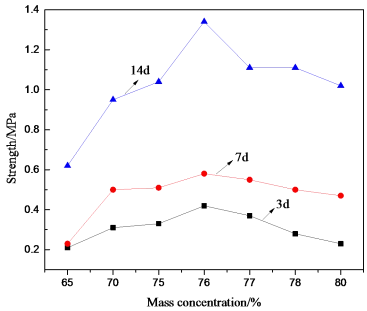

Figure 1. Relation curve between filling body concentration and strength

It can be seen from Figure 1 that the filling strength increases with the increase of filling body concentration, but the inflection point is present. It is indicated that the strength of the filling body is not rising after a certain value. The author thinks that there must be a certain proportion of reaction water in the filling body. But before reaching the inflection point, the filling strength and filling body concentration are positively correlated. It is important to note that different tailings inflection points are different.

The experiment data is as following:

Table 2 Filling body strength of different concentration

Mass concentration(%)	The usage of material C in 1m3 slurry /kg	The usage of tailings in 1m3 slurry /kg	Strength of 3d (MPa)	Strength of 7d (MPa)	Strength of 14d (MPa)
80%	75.66	1513.16	0.23	0.47	1.02
78%	73.24	1464.77	0.28	0.50	1.11
77%	70.67	1413.30	0.37	0.55	1.11
76%	68.73	1374.62	0.42	0.58	1.34
75%	67.21	1344.22	0.33	0.51	1.04
70%	59.25	1184.94	0.31	0.50	0.95
65%	52.12	1042.42	0.21	0.23	0.62

3.3 THE PARAMETERS DETERMINATION OF THE PASTE PREPARATION PROCESS

The experiment data is as following:

It can be concluded from Table 3 that the concentration of 76% is the best. Under this concentration, yield stress is higher, which result in high on-way resistance. But it can be solved by lowering concentration or adding rheological modified agents in practical production. Combined with the determination and data, the author thinks that yield stress, slump and degree of segregation must be determined to guide production. Therefore, after determining the composition of the material and above three parameters according to the downhole filling strength requirement, it is possible to determine whether the materials can be prepared into paste.

Table 3 The parameters of the paste preparation

Mass concentration (%)	Yield stress (Pa)	Viscosity (Pa·s)	Divergence (mm)	Bleeding rate (%)	Effective volume to the underground (%)	Degree of segregation (cm)	Slump (mm)
80%	\	\	58	3.25	98	0.4	90

3.4 THE INFLUENCE OF FILLING MATERIAL IN FILLING BODY

In the experiment of different filling body of different filling materials, the influence of the strength of tailings filling body is shown in Table 4.

From the table, the influence of filling materials on strength is great. Cement 1# is configured for graded tailings, and cement 2 # is tailored for the tail arrangement of the material. It is necessary to configure a specific binder according to the different tailings.

78%	1282	1262	61	3.33	98	0.4	150
77%	350	332	63	5.00	97	1	159
76%	300	249	65	6.00	96	1.2	195
75%	128	130	71	6.25	94	3	250
70%	67	103	193	19.84	84	12	277
65%	18	26	203	28.51	82	\	\

Table 4. Filling body strength of different additive

Binder type	solid concentration (%)	Height of filling body(mm)	Strength of 3d (MPa)	Strength of 7d (MPa)	Strength of 14d (MPa)
1#	77	70	0.45	0.64	1.35
2#	77	70	0.56	1.17	1.91

4. CONCLUSION

(1) The paste has “three no” features, which are more stable and easy to control in production, preparation, delivery and filling. In addition, it is more advantageous to maintain the stability of surrounding rock, reduce surface subsidence, improve recovery of mineral resources and protect the environment. The most important is that the integrated filling cost is more advantageous than other processes, and the paste filling is the most potential filling technology.

(2) The filling grade and concentration have a great influence on the filling strength, which is an important factor to determine whether the tailings of the mine can be used for paste filling. In the determination of the preparation parameters of the paste, the yield stress, slump and degree of segregation are parameters that must be determined. It is necessary to prepare cementing material according to material properties in the filling body.

(3) The design of the loop tube test and pipeline are the two necessary steps in the production.

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Prediction Of Silicon Content In Blast Furnace Hot Metal

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Abstract: BP neural network blast furnace temperature prediction model with double hidden layer is established by using MATLAB. The offline forecasting results of production data by this model show that BP neural network method has a good forecasting effect. Under the ideal condition of production data, When the errors were (± 0.10)% and (± 0.15)%, the hit rates reached 75.88% and 88.44% respectively.

Key words: Neural network; hidden layer; number model test; sample distribution; silicon content in hot metal.

1. INTRODUCTION

Because of the experimental data, BP neural network can obtain a set of parameters reflecting the inherent law of experimental data through finite number of iterations (especially for the production process whose regularity is not obvious and there are many parameters). In the iron and steel metallurgy production, BP neural network algorithm has been very good application[1]. In this paper, the intelligent neural network algorithm is applied to the prediction of the silicon content of the molten iron in the blast furnace in order to increase the prediction rate of the silicon content in the molten iron.

2. THEORETICAL BASIS

2.1 BP neural network algorithm

BP neural network is a multi-layer feedforward neural network. The main features of this network are forward signal transmission and error reverse transmission. In the forward pass, the input signal from the input layer by the hidden layer layer by layer, until the output layer. The neuronal status of each layer can only affect the next level of neuronal status[2]. If the output layer can not get the desired output, it will be backpropagated and the thresholds and weights of the network adjusted according to the prediction error, so that the BP neural network prediction output continuously approaches the expected output. BP neural network topology shown in Figure 1.

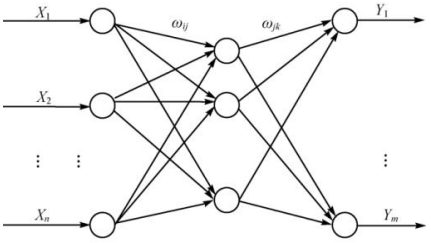

Figure 1 BP neural network topology

Figure 1, BP neural network model to deal with the basic principle of related information is: the input signal X_n through the network intermediate node (hidden layer point) on the output node, the nonlinear transformation process, can produce the output signal Y_m, Each sample in the network training includes the deviation of the input vector X and the expected output t, the network output Y and the expected output t. By changing the connection strength w_{ij} between the input node and the hidden node and the hidden node and output node The joint strength w_{jk} and the threshold[3], the error along the gradient direction down, and after repeated learning and training to determine the minimum error corresponding to the network parameters (ie weight and threshold), the training is stopped[4]. At this point, the already trained BP neural network model can input information to similar samples and carry out self-processing to output the non-linear transformation specific information with the smallest error.

Before the BP neural network prediction, we must first train the network and make the network associative memory and prediction through training. BP neural network training process includes the following steps.

Step 1: Network Initialization. According to the input and output sequence of the system (X , Y), the number of network input layer nodes n , the number of hidden layer nodes l , the number of output layer nodes m are initialized, and the connection

weights between input layer, hidden layer and output layer neuron w_{ij} , w_{jk} , initialize hidden layer threshold a , output layer threshold b , given neuron firing function and learning rate.

Step 2: Calculation of hidden layer output. The hidden layer output H is calculated from the input vector X , the input layer and hidden layer connection weights w_{ij} , and the hidden layer threshold a .

$$H_j = f(\sum_{i=1}^{n} w_{ij} x_i - a_j) \quad j = 1,2,\cdots, \quad (1)$$

f is a hidden layer excitation function, the function has a variety of expressions, the selected function in this chapter:

$$f(x) = \frac{1}{1+e^{-x}} \quad (2)$$

Step 3: Output Layer Output Calculation. According to hidden layer output H , connection weight w_{ij} and threshold b , BP neural network prediction output O is calculated.

$$O_k = \sum_{j=1}^{l} H_j w_{jk} - b_k \quad k = 1,2,\cdots, m \quad (3)$$

Step 4: Error Calculation. The network prediction error e is calculated from the network prediction output O and the expected output Y .

$$e_k = Y_k - O_k; \quad k = 1,2,\cdots, m \quad (4)$$

Step 5: Weight update. According to the network error e update network connection weight w_{ij} , w_{jk} .

$$w_{ij} = w_{ij} + \eta H_j (1 - H_j) x(i) \sum_{k=1}^{m} w_{jk} e_k$$

$$j = 1,2,\cdots, n; \quad j = 1,2,\cdots, l \quad (5)$$

$$w_{jk} = w_{jk} + \eta H_j e_k \quad j = 1,2,\cdots, l; \quad k = 1,2,\cdots, m \quad (6)$$

In the formula, η is the learning rate

Step 6: Threshold update. The network node thresholds and are updated according to the network prediction error.

$$a_j = a_j + \eta H_j (1 - H_j) \sum_{k=1}^{m} w_{jk} e_k; \quad j = 1,2,\cdots, l \quad (7)$$

$$b_k = b_k + e_k \quad k = 1,2,\cdots, m \quad (8)$$

Step 7: Judge the algorithm iteration is over, if not, then return to step 2.

2.2 BP neural network algorithm design

BP neural network nonlinear function fitting algorithm flow can be divided into BP neural network construction[5], BP neural network training and BP neural network prediction, shown in Figure 2.

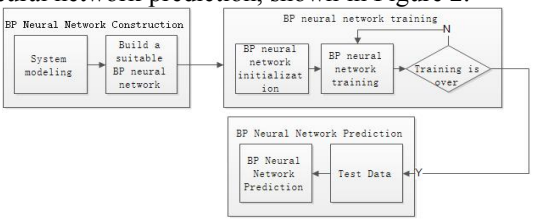

Figure 2 algorithm flow

The construction of BP neural network determines the structure of BP neural network according to the characteristics of fitting nonlinear function. The nonlinear function has three input parameters and one output parameter[6], so the structure of BP neural network is 3 - 8 -8 - 1, that is, the input layer has 3 There are 8 nodes in double hidden layer and 1 node in output layer. BP neural network training uses nonlinear functions to input and output data to train neural network, so the trained network can predict the nonlinear function output. From the actual production data obtained 999 sets of input and output data, randomly selected from 800 groups as training data for network training, 199 groups as test data for testing the network fitting performance.

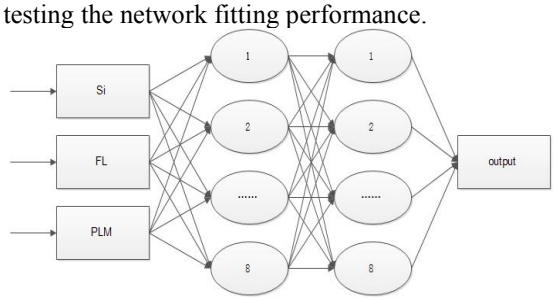

Figure 3 BP neural network structure

3. PREDICTION RESULTS AND ANALYSIS OF SILICON CONTENT IN HOT METAL

3.1 Experimental data collection and variable settings

The experimental data represent the current heat content of molten silicon and sulfur content, coal injection volume and air volume, and [Si] (n), [S] (n), PM n + 1) represents the value of the next furnace, [Si] (n + 2) represents the value of the variable in the next furnace, resulting in the production of three consecutive furnaces.

Where [Si] and [S] are the same as the chemical composition of molten iron, there is a negative correlation between them. However, [Si] and [S] can not control each other variables, which is the basic production of common sense.

Therefore, based on the serial number (n) of the variable in the data table, a function of the following form is established for one-step prediction:

$$[Si](n+1) = f([Si](n), PM(n), FL(n))$$

Establish the following functional relationship for the two-step prediction:

$[Si](n+2) = f([Si](n), [Si](n+1), PM(n), FL(n))$ The above function is a time series function

3.2 One-step forecast results and analysis

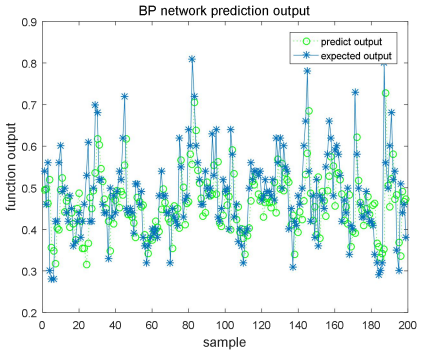

Figure 4 Step Predict Output and Expected Output

When the allowable error was (± 0.1)% in 199 hot metal, 151 furnaces were reported, the forecast hit rate was 75.88% and the (± 0.15)% hit rate was 88.44%. Therefore, the trend of one-step prediction is still relatively accurate, which basically reflects the change of silicon content in blast furnace hot metal.

Figure 7 shows the relationship between the target and the output of the relationship between the four charts each of the decision coefficients R are more than 0.6, in particular, the test coefficient reached 0.69, the figure can be seen Fit between the straight line and Y = T although There is a certain degree of deviation[7], but the corresponding relationship between input and output within the network is still relatively strong.

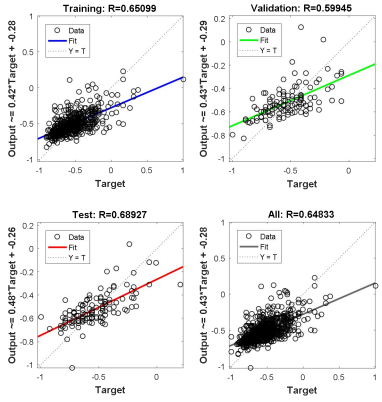

Figure 5 step by step to predict the relationship between the map

3.3 two-step forecast results and analysis

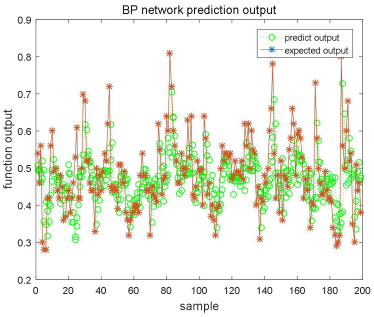

Figure 6 Two-step forecast output and expected outputIn the two-step prediction, a new input is obtained by replacing the first 198 groups of the 199 groups of silicon contents in the 199 groups of silicon contents obtained in one-step prediction with the last 198 groups of data in the previous 999 groups, and training and prediction are performed again to obtain new prediction data[8]. Its predicted output and expected output are shown in Figure 9.

In the correlation diagram of two-step prediction, the R value of the test coefficient is relatively low, only reaching 0.59, from which we can see that the effect of one-step prediction is better than the two-step prediction.

3.4 Based on the forecast results and analysis

199 sets of data are selected as the test sample to verify the prediction success rate of the established BP neural network model. Take the allowable error as (± 0.10)% and (± 0.15)%, one-step prediction, two-step prediction The numerical success rate is shown in Table 1

Table 1. numerical success rate

	The allowable error is (± 0.10)%	The allowable error is (± 0.15)%
One step forecast	75.88%	88.44%
Two-step forecast	69.84%	79.94%

It can be seen from the above table that the accuracy of one-step prediction is obviously higher than the accuracy of two-step prediction whether the allowable error is (± 0.10)% or (± 0.15)%, and thus the content of [Si] One-step [Si] -FL-PML content has a close relationship, one-step prediction error will lead to two-step prediction with greater error[9]. Therefore, it is recommended that this model be used primarily for one-step forecasting.

4. CONCLUSION

The BP neural network algorithm was introduced into the prediction model of the hot metal of molten iron. Under the premise of not using the molten iron sulfur [S] of the blast furnace as the predictive variable of the silicon content, the silicon content of the hot metal in 199 continuous hotplates was predicted. When the permissible error (± 0.10)% and (± 0.15)%, the predicted hit rates were 75.88% and 88.44%, respectively, with good results. This provides an example of the application of neural network in blast furnace.

In addition, the model does not need to consider the blast furnace reaction mechanism.As long as the required data is imported into the database and the data is self-learning by the neural network model, the internal rules of the database can be well grasped[10]. The method is simple and easy to operate and has Other forecasting methods incomparable advantages, has broad prospects for development.

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Chang'e III Landing Control Strategy

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Abstract: Under the condition of high-speed flight, "Chang'e-3", if it is guaranteed to achieve a soft landing accurately within the predetermined area of the moon, the key issue is the design of landing orbit and control strategy. In this paper, according to Kepler's second law and other related physical knowledge to determine the satellite near point and far point of the speed. Then establish the target programming model, find the optimal orbit and the movement process. Finally, the elliptical search algorithm is used to search for the safe landing area and the landing area assessment model is established to find the optimal landing site.
Keywords:Chang'e III;Soft landing;Goal planning;Spiral search

1. INTRODUCTION

After the "Chang'e III" arrives on lunar orbit, it needs to prepare for landing on the landing preparation track. The landing preparation track is an oval track with a point of 15km in recent months and a point of 100km in a long month. Landing track from the recent moon to the landing site, the soft landing process is divided into 6 phases: the main deceleration section, rapid adjustment stage, rough avoidance stage, fine obstacle avoidance stage, retarded stage and free fall stage. Need to run the "Chang'e III" main deceleration engine to adjust the deceleration. By designing the control adjustment model, Chang'e III reaches the scheduled landing point and minimizes the fuel consumption during the soft landing.

This article first discusses the "Chang'e III" landing preparation process impact factors. Then according to Kepler's second law, determine the speed of the landing preparation orbit at the near and far points of the moon. Then through the establishment of objective function to obtain the optimal orbit and the movement process. Finally, the elliptical search algorithm is used to search for the safe landing area, and the landing area evaluation model is established to find the optimal landing site.

2. THE DETERMINATION OF NEAR-MONTH AND FAR-MONTH POINT SPEED

2.1 THE IMPACT OF LANDING PREPARATION PROCESS

First of all, by the law of universal gravitation the sun, the earth and the moon on the "Chang'e III" universal gravitation. Then calculate the gravitational acceleration of the three celestial bodies on "Chang'e III" according to Newton's second law.

Table 1 The celestial body parameters

	Sun	Earth	Month
Quality(kg)	MS =1.989×1030	ME =5.98×1024	MM =7.35×1022
Center distance(m)	rs =1.496×1011	rE =3.844×108	rM =1.75×106

It can be seen from Table 2 that the gravitational acceleration generated by the sun and the earth on the "Chang'e III" is small. The gravitational acceleration relative to the moon is negligible, so the model only considers the effect of the lunar landing on the "Chang'e III" landing.

Table 2 The celestial bodies of "Chang'e III" gravitational acceleration

Sun	Earth	Month
g_S =0.0059 m/s^2	g_E =0.0027 m/s^2	g_M =1.6008 m/s^2

2.2 Determine the speed of near and far points

Without regard to the moon's autobiography, revolution and the gravitation of other celestial bodies. If the landing preparation trajectory and the lunar orbit are not in a plane, the main decelerating engine will need to provide more lateral thrust, resulting in increased fuel consumption. Therefore, in practice, it is reasonable to design the landing preparation track and the lunar orbit tracking in a plane.

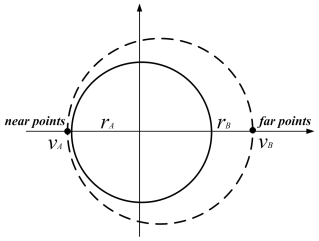

Figure 1 Landing preparation track diagram

It can be seen from the above, "Chang'e III" from the beginning of the recent moon whereabouts and meet the Kepler orbit law, the landing preparation track shown in Figure 1.

Set the distance from the nearest moon to the lunar heart distance rA, the distance from the moon to the lunar heart rB, unit time "Chang'e III" swept the area:

$$S_A = \frac{1}{2} r_A v_A, S_B = \frac{1}{2} r_B v_B$$

Among them,vA, vB is the "Chang'e III" in the near point and far point of the speed. According to Kepler's second law, there is SA = SB, so:

$$r_A v_A = r_B v_B$$

According to the law of conservation of mechanical energy, so:

$$\frac{1}{2}mv_A^2 - mg_A r_A = \frac{1}{2}mv_B^2 - mg_B r_B$$

Where m is the mass of "Chang'e III", gA and gB are the gravitational acceleration in the near month and the gravitational acceleration in the far moon respectively, that is,

$$g_A = \frac{GM_M}{r_A^2}, g_B = \frac{GM_M}{r_B^2}$$

From this point to find the monthly and far point of the month's speed,respectively,1692.7m/s and 1614.4m/s,the direction of speed is along the tangential direction of the track.

3.DETERMINATION OF LANDING TRAJECTORY

3.1 PRELIMINARY ANALYSIS OF THE MODEL

The model mainly analyzes the main deceleration phase and the rapid adjustment phase.

First analyze the "Chang'e III" force at this stage. Suppose the force and the vertical direction of the angle α, force analysis shown in Figure 2, Figure 3:

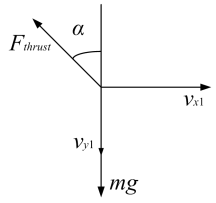

Figure 2 Main deceleration section stress analysis

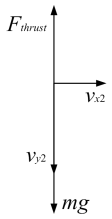

Figure 3 Rapid adjustment phase stress analysis

Using the law of conservation of momentum:

$$\int_0^{750} F_{thrust}\sin\alpha dt = m_1 v_{x1} - m_2 v_{x2} \quad (1)$$

$$\int_0^{750} (F_{thrust}\cos\alpha - (m_1 - \int_0^t \frac{F_{thrust}}{2940}dt)g)dt = m_1 \quad (2)$$

"Chang'e III" in the operation of fuel consumption. The model is divided into two cases to consider: one is to consider the quality change, and the other is to not consider the quality change. As the main deceleration phase fuel consumption is very large, so consider the quality changes; and rapid adjustment phase speed is small, the quality change is small, it does not consider the quality change.

The main deceleration phase (consider the quality changes), thrust size

$$\begin{cases} F_{thrust} = mv_e \\ m = \dfrac{F_{thrust}}{2940} \\ m_2 = m_1 - \displaystyle\int_0^{750} \frac{F_{thrust}}{2940}dt \end{cases} \quad (3)$$

The fuel consumption for this phase is m1-m2.

Quick adjustment phase (without regard to quality changes). Because vx2 value is smaller, you can fine-tune the engine through attitude adjustment. Assuming a small change in mass at this stage, one can assume that the mass remains essentially the same, so that the following equation can be obtained:

$$\begin{cases} F_{thrust} - m_2 g = m_2 a \\ t_2 = v_{y2}/a \end{cases} \quad (4)$$

The resulting fuel consumption is:

$$m_3 = \frac{F_{thrust}t_2}{v_e} = \frac{m_2(g+a)v_{y2}}{av_e} = \frac{m_2 v_{y2}(1+g/a}{v_e} \quad (5)$$

Establish a target programming function that calculates the minimum fuel consumption. The total fuel consumption can be calculated from the analysis stage:

$$M = m_1 - m_2 + m_3$$

$$= (m_1 - \int_0^{750} \frac{F_{thrust}}{2940}dt)v_{y2}(1+\frac{g}{a})/v_e + \int_0^{750} \frac{F_{thrust}}{2940}dt \quad (6)$$

3.2 OPTIMAL CONTROL STRATEGY

The model is an in-depth analysis of the optimal control strategy of each stage in the landing process of "Chang'e III" in stages.

Main deceleration phase

Considering the absence of atmosphere on the lunar surface and the short duration of the soft landing, the kinetic equations of the lander in the lunar gravitational field can be expressed as:

$$\begin{cases} v_r = -\dfrac{\mu}{r^2} + \dfrac{v_\theta}{r} + \dfrac{F}{m_0 - mt}\sin\omega \\ v_\theta = -\dfrac{v_r v_\theta}{r} + \dfrac{F}{m_0} - mt\cos\omega \\ r = v_r \\ \theta = \dfrac{v_\theta}{r} \end{cases} \quad (7)$$

Where μ is the gravitational constant of the moon; r is the moon's center distance of the lander; θ is the polar angle; vr is the normal speed of the lander; vθ is the tangential speed of the lander; ω is the thrust angle; F is the thrust of the engine ; m0 is the quality of the lander at the initial moment; m is the second consumption. The thrust direction is defined as shown in Figure 4.

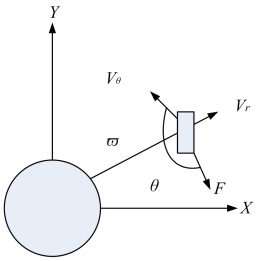

Figure 4 Definition of thrust direction

Define thrust direction to tangential velocity clockwise as positive.

The boundary conditions and the objective function to be optimized are as follows:

$$\begin{cases} v_{r_0} = 0 \\ v_{\theta_0} = \sqrt{\dfrac{\mu}{r_p}\left(\dfrac{2r_a}{r_a + r_p}\right)} \\ r_0 = r_a \end{cases} \tag{8}$$

Since the initial time lander is at the near point, the initial normal velocity vr0 is zero. Vθ0 is the tangential velocity of the lander at the point of recent months via the Hohmann shift. Where ra and rp are the radii of the near and far moon points of the Hohmann transfer orbit, respectively. The initial orbital radius r0 is the nearest point.

Terminal constraints are:

$$\begin{cases} v_{rf} = 0 \\ v_{\theta f} = 0 \\ v_f = R \end{cases} \tag{9}$$

R is the lunar radius, the physical meaning of which is that the lander landed on the surface of the moon with a normal velocity and a tangential velocity of zero.

The function to be optimized is:

$$M = \int_{t_0}^{t_f} m(t)dt \tag{10}$$

When the performance indicator function is minimum, the fuel consumed during the landing is the least.

3.3 ORBIT DISCRETIZATION

In this paper, the orbit of the landing zone is discretized into many small segments. Set the parameters to be optimized at the nodes of each segment. The initial values of these parameters are physically meaningful states and controls, bypassing the initial guess of variable values without physical meaning. Transform this optimization problem into a nonlinear programming problem.

In order to solve the above optimal control problem, we first discretize the lunar soft landing orbit, and the entire orbit can be divided into N small sections. Each node of the section has a thrust direction, as shown in Figure 5.

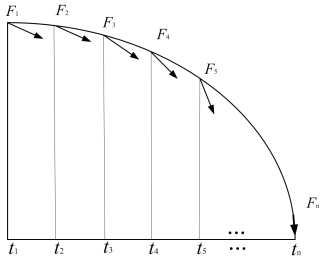

Figure 5 Soft landing orbit discretization

Determine the direction of thrust at a moment by linear interpolation between the various segments, the time series of each discrete point satisfies:

$$t_1 = t_1 < t_2 < t_3 < \cdots < t_N = t_F \tag{11}$$

The status of the system can be defined as:

$$X^T = [v_r \quad v_\theta \quad r \quad \theta] \tag{12}$$

The control variable is λ, the system's kinetic equation can be simply described as:

$$X = f(X, \lambda, t) \tag{13}$$

At each discrete point in time tk, the lander state variable is Xk=X(tk) and the control variable is λk=λ(tk). Since the state variables of the lander are continuous, the orbit is approximated by the Runge-Kutta quadrature formula at each short segment. The two adjacent discrete points should satisfy the following conditions:

$$\zeta_h = X_{k+1} - X_k - \frac{1}{6}(k_1 + 2k_2 + 2k_3 + k_4) = 0 \tag{14}$$

Where

$$\begin{cases} K_1 = h_k f(X_k, \lambda_k, t_k) \\ K_2 = h_k f(X_k + \dfrac{1}{2}K_1, \overline{\lambda}_{k+1}, \bar{t}) \\ K_3 = h_k f(X_k + \dfrac{1}{2}K_2, \overline{\lambda}_{k+1}, \bar{t}) \\ K_4 = h_k f(X_k + K_3, \overline{\lambda}_{k+1}, \bar{t}) \end{cases} \tag{15}$$

Where

$$h_k = t_{k+1} - t_k, t = \frac{1}{2}(t_k + t_{k+1}), \lambda_{k+1} = \lambda(\bar{t}) \tag{16}$$

4. QUICK ADJUSTMENT PHASE

4.1 MODEL ANALYSIS

As the final landing section, "Chang'e III" from the lunar surface distance of only about 2 km, which is far less than the radius of the moon 1738 km, so you can ignore the curvature of the moon in the modeling, the lunar surface approximation Look at the water level. Taking into account the final landing section, "Chang'e III" tangential speed of only tens of meters per second, set the tangential velocity to the "Chang'e III" brought by centrifugal acceleration am, moon radius Rm. Because "Chang'e III" tangential velocity vy, then calculate the tangential velocity to the "Chang'e III" centrifugal acceleration caused by the formula:

$$a_m = \frac{v_y^2}{R_m} \tag{17}$$

Calculated am= 0.0019m/s2, so you can ignore the "Chang'e III" centrifugal acceleration, only consider the acceleration of gravity.

4.2 MODEL ESTABLISHMENT

Suppose the trajectory of "Chang'e III" descends in a plane: Suppose the specific impulse of the engine is Isp; the second consumption is m; the vertical height of Chang'e III is h34;the tangential velocity is vy; the mass is m3 ; Brake engine thrust direction and the vertical angle between the angle φ. Under the above assumptions, the "Chang'e III" force analysis, the "Chang'e III" kinetic model is:

$$\begin{cases} h = -v\cos(\varphi) \\ v = -\dfrac{ml_{sp}}{m_3} + g\cos(\varphi) \\ \varphi = -\dfrac{g\sin(\varphi)}{v} \\ \dfrac{dm_3}{dt} = -m \end{cases} \tag{18}$$

4.3 THE OPTIMAL SOLUTION OF THE MODEL

In order to minimize the fuel consumption of "Chang'e III" in the final landing section, the soft landing fuel consumption of "Chang'e III":

$$M = \int_{t_0}^{t_f} mdt = m(t_0) - m(t_f) \tag{19}$$

For the soft landing model under the gravity turn guidance method, the optimal control of the thrust fuel consumption is on-off control, and the switching times can not exceed one time at most. To achieve the "Chang'e III" terminal status constraints, "Chang'e III" can only be free fall. When the switch function is zero, "Chang'e 3" brake deceleration, deceleration until reaching the lunar surface zero.

5. COARSE AVOIDANCE PHASE

The main purpose of the main obstacle avoidance is to remove large-scale obstacles that obviously endanger the safety of landing within a larger landing area. For the obstacle avoidance to provide a better choice of safe spots to avoid the risk of short-range avoidance avoidance inevitable risk, the overall system to improve the safety of landing probability, taking into account the larger detector speed, requiring fast calculation, but also Evaluate propellant consumption to choose the best location.

(1) Image Analysis

Image analysis of digital elevation map.Import the image into Matlab, and draw its grayscale. The K-means clustering analysis of the gray matrix shows that the craters less than 60m are craters and the slopes of more than 90m are hillsides. The two situations should be avoided when the landing points are selected.

To identify the darker obstacles and over-brightness obstacles and mark them as dangerous areas, mark them as one; mark the other areas as safe areas and mark them as zero; the expression is as follows:

$$\begin{cases} X_{ij} = 1 & X_{\text{ij}} \le 60 \text{或} X_{ij} \ge 90 \\ X_{ij} = 0 & 60 \le X_{ij} \le 90 \end{cases} \tag{20}$$

(2)Use the spiral search algorithm to determine the safety radius of each cell

Spiral search algorithm: the cell center as a starting point to a pixel length, square for the range, and gradually expand the scope of the square, met a safe area, then continue to move, meet the danger zone Xu will terminate, stop the search, export this unit Grid security radius. Algorithm diagram is as follows:

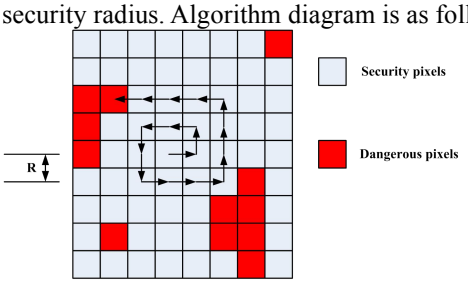

Figure 6 Safety radius spiral search method

(3)Calculate the required speed increment for safe landing point avoidance

In order to achieve a straight-line approach with a coarse obstacle course of 45 degrees to the horizontal, the acceleration and velocity of the lander must be opposite. Therefore, thrust, lunar gravitational acceleration and velocity need to satisfy a certain geometric relationship. After deduction, it is determined that the magnitude of thrust acceleration aF and the magnitude of lunar gravitational acceleration gm have the following relations:

$$a_F = \frac{g_m}{\cos\alpha - \tan\beta\sin\alpha} \tag{21}$$

Thus, the combined acceleration in the radial and heading components respectively:

$$a_x = a_F\cos\alpha - g_m \text{ ， } a_z = -a_F\sin\alpha \tag{22}$$

If you maintain the radial and heading acceleration unchanged, you can determine the descent height and range for:

$$s_x = \frac{v_{xf}^2 - v_{x0}^2}{2a_x}, s_z = \frac{v_{zf}^2 - v_{z0}^2}{2a_z} \tag{23}$$

Where vxf and vzf are the radial and heading velocities close to the segment ends respectively, and vx0 and vz0 are the radial and heading velocities close to the segment inlets, respectively. So the speed increment expression is:

$$\Delta v = \sqrt{\left(v_{xf} - v_{x0}\right)^2 + \left(v_{zf} - v_{z0}\right)^2} \tag{24}$$

Close to time:

$$T_a = \left(v_{xf} - v_{x0}\right)/a_x \tag{25}$$

Due to the use of descent trajectory close to the angle of 45 degrees with the straight line down, so β=45° . Taking into account the optical imaging sensor field of view, the size of the thrust, the height of the drop and close to the constraints such as time, you can take α=9.

(4)Evaluate candidate safety landing area

Evaluate the speed increments required for candidate safety landing points for obstacle avoidance and determine safety landing points based on safety radius and speed increment evaluation values.

The evaluation index is normalized.This paper uses the very bad formula to conduct the dimensionless processing of the index, the formula is as follows:

$$X^* = \frac{X_i - X_{\min}}{X_{\max} - X_{\min}} \quad (26)$$

Therefore, the weight of safety radius in landing area should be greater than the weight of speed increment index, and the distribution weight ratio is 6.5 to 3.5. So the comprehensive evaluation model is:

$$E_1 = 0.65 \cdot R^* + 0.35 \cdot \Delta v^* \quad (27)$$

Use Matlab to solve the above steps in turn, and get the optimal landing area.

6. FINE OBSTACLE AVOIDANCE STAGE

In order to ensure the accuracy of the final obstacle avoidance and save propellant, the lander accurately avoids obstacles and descends simultaneously. According to the determined safety landing point, descend from about 100m high and fall 30m above the landing point.

(1) Image analysis

Image analysis of digital elevation map. The image into Matlab, draw its grayscale. Divides the image into 25 by 25 cells, each 40 by 40 cell range. Divided by the scope of the "Chang'e III" lander diameter of about 4m, landing safety radius of 20m.

(2) Calculate height variance

Calculate the height variance d in each cell, and the height variance d reflects the cell's unevenness.

(3) Calculate the average slope

The slope is the percentage difference in elevation between two points and its horizontal distance, calculated as:

$$s = \frac{X_{i,j} - X_{i-1,j}}{\overline{X}} \quad (28)$$

(4) Establish a comprehensive evaluation model

The evaluation model is as follows:

$$E_2 = 0.5 \cdot d + 0.5 \cdot s \quad (29)$$

Evaluate 25 by 25 cells separately and select the smallest cell as the landing site. After solving, get the landing location coordinates (19.55W, 31.46N).

The movement status of Chang'e III at this stage is similar to that of the rough avoidance phase except that the location and height have changed. The formula is as follows: (21) ~ (25).

The above analysis of the various stages of landing orbital, the main deceleration phase of the satellite speed and mass changes the most, the orbit of the calculation is most important. For retarded and free fall stages, the analysis of the optimal control and orbit design need not be overdue since the engine is already off.

7. CONCLUSION

In this paper, the complexity of the problem is simplified first, and the problems are solved and optimized by using SQP target programming model, safety radius spiral search method, normalization and comprehensive evaluation model. By using the target programming model to limit the conditions, the fuel consumption can be minimized. The safety radius spiral search method can be used to find out the safe position in the process of rough obstacle avoidance and obstacle avoidance. The comprehensive evaluation model The results obtained are optimized, and the optimal control strategy and the optimal landing point are obtained.

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Evaluation of Wine Based on Principal Component Analysis

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Abstract: Wine and wine grape detection of physical and chemical indicators will be to a certain extent, reflect the quality of wine and grapes. In this paper, the evaluation of wine grape and wine was solved and analyzed. Using the relevant knowledge of statistics to analyze the evaluation results of the two groups of judges who have no significant differences, by observing the range of sig values to describe the difference. In addition, the standard deviation is used as a judge of the reliability of the evaluation result of the judges, as compared with the case where the mean values are substantially equal. The principal component analysis is used to obtain the principal component from the many indexes, and the evaluation function is obtained by using the eigenvector and the grape is graded.

Three principal component indexes were obtained, and 11 principal component indexes were obtained by principal component analysis.

The aroma was used as the twelfth principal component. On this basis, A total of 15 main components as input variables, to evaluate the average of the judges as an output variable, the multiple regression analysis, and re-obtained the results into the sample data and the original data were compared, the resulting R2=0.899, the goodness of fitting is high, and it has obvious linear relationship. Evaluating the quality of the wine with the physical and chemical indicators of grapes and wines within the limits allowed.

Keywords: Variance analysis; Principal component analysis; Multiple linear regression model standardization

INTRODUCTION

Analysis of significant differences based on principal component analysis

Screening indicators: Significant difference is a measure of probability assessment. For example, we say that the data of A and B have significant differences at 0.05 level, which means that the possibility of significant difference between the two groups is 95%. There is no difference between the two data and the 5% probability of the sample. This 5% difference is caused by random errors. To analyze the results of the evaluation of the two groups of judges there was no significant difference, the use of statistical knowledge, usually when the sig value of P> 0.05 that the difference was not significant; 0.01 <P<0.05 that significant difference: P<0.01 indicates that the difference is extremely significant. After importing the data with SPSS, the coefficient is compared with the previously set value. The first set of data is set to x, the second set of data is y, and after applying SPSS analysis, the regression residual model is shown in the table below, and the significance level of the regression is low.

Table 1 Analysis of variance tables

model	sum square	of df	Mean square	F	Sig
return	442.935	1	442.935	13.735	0.001a
Residual	1709.222	53	32.249		
total	2152.157	54			

And the non-normalized coefficients, the standard coefficients and the sig values of x are shown in the following table.

Table 2 coefficient table

model	Non standardized coefficient		-Standard coefficien t	t	Sig
	B	Standar d error	trial version		
(constant)	28.601	12.185		2.347	0.023
x	0.613	0.165	0.454	3.706	0.001

The sig value of x was 0.001, less than 0.05, the evaluation results of the two groups were significantly different.

Analysis of the credibility of the two groups

Through the above analysis of variance, we select the evaluation result with small difference, and the result of the evaluation of wine samples is higher than that of the wine. See Table 3:

The difference between the first group of red wine is mainly from the difference between the wine samples. The difference of the second group of red wine is mainly from the difference of the wine tasters. The difference of the white wine is mainly from the difference of the wine tasting, The difference is not very significant. According to Table 2, we can see that the second group is significantly smaller than the first group, and the second group is more reliable than the total variance of the total variance,

regardless of the total variance of the red grape or the white wine.

Table 3 Total variance analysis

The total variance of wine	First group	Second Group
Red	1414.743	821.11
White	2978.761	1411.69

Gives the red and white grape and wine physical and chemical indicators of data. The size of the physical and chemical indicators of wine grape grapes have their own decision, the wine is processed by wine grape, its physical and chemical indicators and wine grapes are closely related. As the number of physical and chemical indicators of grapes too much, more complex processing, for some of the two physical and chemical indicators, we will ignore the secondary physical and chemical indicators belong to the primary physical and chemical indicators as a secondary physical and chemical indicators of the overall response.

Therefore, the problem is simplified as the main component of grape and wine physical and chemical indicators of the link. Based on this, we can analyze the correlation of each index, and try to establish a multiple regression model to sort out the data, respectively, the red and white grapes after fermentation of wine, the physical and chemical indicators of the changes and changes in the range The We will be physical and chemical data associated with two, into the Pearson correlation coefficient formula as follows:

$$r=\frac{N\sum x_i y_i-\sum x_i\sum y_i}{\sqrt{N\sum x_i^2-(\sum x_i)^2}\sqrt{N\sum y_i^2-(\sum y_i)^2}} \quad (1)$$

Where xi and Yi represent the i-th data in the first data group and the i-th data in the second data group, respectively.

Compared to all the wine and wine grape after the physical and chemical indicators, get a matrix of correlation coefficient:

$$R=\begin{bmatrix} r_{11} & r_{12} & \cdots & r_{qj} \\ r_{21} & r_{22} & \cdots & r_{qj} \\ \cdots & \cdots & r_{ij} & \cdots \\ r_{p1} & r_{p2} & \cdots & r_{pq} \end{bmatrix} \quad (2)$$

Where i denotes the i-th group of physical and chemical indicators data in wine, j denotes the group i of the wine grape, and p denotes the total number of the physical and chemical indexes of the wine, q and the total number of the physical and chemical indexes of the wine grape considered. After obtaining the correlation coefficient, measure the linear relationship between the two sets of data. And then take the absolute value of the coefficient to observe the size of the value, classified as the value of the range, the coefficient range of the following table can be seen:

Table 4 Relevant strength tables

range	relativity
0.0-0.2	Very weakly related or unrelated
0.2-0.4	Weak correlation
0.4-0.6	Moderate correlation
0.6-0.8	Strong correlation
0.8-1.0	Extremely relevant

If the physical and chemical indicators of a wine, there are wine and grape physiochemical indicators and its strong correlation, then you can ignore other physical and chemical indicators to establish a linear relationship between the two equations, if the wine of a physical and chemical indicators in the wine grape all physical and chemical indicators And its strong and strong (strong and stronger) related to the physical and chemical indicators, then select all of its strong (moderate) related physical and chemical indicators, the establishment of a number of elements between the multiple linear equations. If you do not choose all the physical and chemical indicators associated with his level, the default is the wine and grape in the physical and chemical indicators and wine in this indicator does not have much relationship between the indicators. Through the study of the relationship between red and white wine and wine and grape physiochemical indicators, a comparative analysis of the relationship between indicators was obtained. The model idea has been given by the following figure:

The following analysis of the physical and chemical indicators of red wine and red grapes in the physical and chemical indicators of the linear relationship between the establishment of the sample process, for further elaboration of wine grape and wine ideal indicators of the relationship.

The physical and chemical indexes of red wine and the physical and chemical indexes in red grapes were analyzed by two - two relationship, and the indexes of physical and chemical indexes of all grapes with the greatest correlation strength with the physical and chemical indexes of wine were given. The correlation coefficients are shown in the following table.

For example, the anthracene index of wine physical and chemical indicators and wine and grape physiochemical indicators of anthocyanin in the Cartesian coordinate system to make the relationship, as shown below to get an approximate line,which is

$$y=2.3683x+14.335 \quad (3)$$

y is the anthocyanin data in the physical and chemical indicators of wine, and x is the anthocyanin in the physiochemical index of the wine grape. The linear equation describes the relationship between the two indicators.

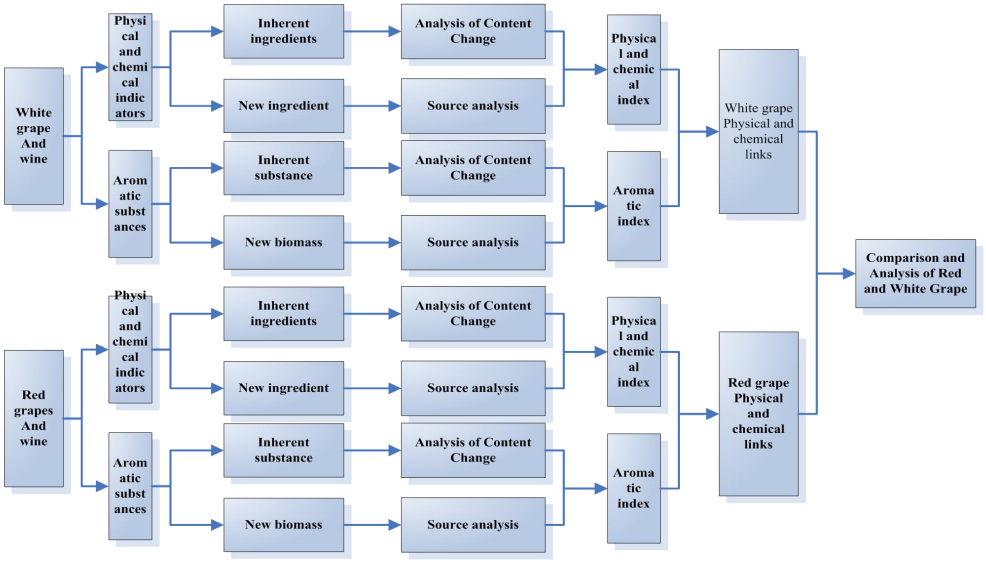

Figure 3 changes in physical and chemical indicators before and after the red grape

Table 5 red grape and wine physical and chemical indicators of the correlation table

Wine physical and chemical indicators	Wine and grape physical and chemical indicators (the number of parentheses for the correlation coefficient)			
Anthocyanins	Anthocyanins(0.922)			
Tannin	Anthocyanins(0.724)			
Total phenol	Anthocyanins(0.928)			
Total Flavonoids	Anthocyanins(0.910)			
Resveratrol	Cis-resveratrol(0.688)			
Trans-resveratrol	Fruit quality(0.682)			
Trans-resveratrol	Cis-resveratrol(0.784)		Grape flavonoids(0.731)	
Cis-resveratrol	Anthocyanins(0.520)			
Cisplatin	no			
DPPH semi-suppressed volume	Total phenol(0.981)		Grape flavonoids(0.965)	
Color	L(D65)	Anthocyanins(0.834)		
	a(D65)	Peel color b(0.626)		
	b(D65)	Reducing sugar(0.567)		tartaric acid(0.462)
	H(D65)	VC content(0.670)		Reducing sugar(0.622)
	c(D65)	Malic acid(0,587)	Threonine (0.515)	Glutamic acid(0.540)	Peel color b(0.532)

(D65), and x1, x2 represent the VC content of the brewing, reducing sugar, and the content of the sugar in the wine, For x1, x2 to find the optimal weight of two indicators, so that the curve is more smooth, so as to get the optimal solution. After repeated search to find the following formula:

$$y = -0.1758x_1 + 0.3665x_2 + 6.237 \quad (4)$$

Multiple regression analysis

In the principal component analysis method, when 11% of the principal component indexes are obtained when the cumulative contribution reaches more than 85%, the following 11 principal component indicators are used. It is also known from the literature that aromatic substances are important in the process of wine making Indicators, so take aromatic substances as the first 12 main components.

On the basis of this, we added the three principal components of physical and chemical indicators of wine, a total of 15 main components as input variables to assess the average of the judges as the output variables, multiple regression analysis .

Principal Component Analysis of Physical and Chemical Indicators of. The contribution of the physical and chemical indicators of the wine after the principal component analysis is shown in Table 6 below:

From the table we can see that when the cumulative contribution of more than 85%, you can choose the main components of the physical and chemical indicators of wine, wine and physical and chemical indicators of the main components of three, the expression is as follows:

Table 6 The characteristic value and contribution rate of wine

Principal component factor	Eigenvalues	Contribution rate	Cumulative contribution rate
1	3.79182604	0.49548306	0.49548306
2	2.23596397	0.22332675	0.71880980
3	1.63085575	0.15411913	0.87292893
4	1.01234414	0.06786370	0.94079264
5	0.97078914	0.02972296	0.97051560
6	0.65866646	0.01377974	0.98429534
7	0.22650102	0.00727151	0.99156685

8	0.16114741	0.00355730	0.99512415
9	0.15611455	0.00267958	0.99780373
10	0.09973434	0.00209639	0.99990012
11	0.05605720	0.00009988	1.00000000

$$T_1 = 0.419 \times tolle + 0.409 \times DPPH + 0.402 \times \text{Tannin} \quad (5)$$

$$T_2 = 0.511 \times a^*(D65) + 0.4574 \times b^*(D65) + 0.562 \times C(D65) \quad (6)$$

$$T_3 = 0.734 \times H(D65) + 0.33 \times a^*(D65) - 0.500 \times \text{total} \quad (7)$$

On the basis of the data normalization process, all the 15 principal component data are imported

Perform multiple linear regression analysis. Get the quality of wine Q and grape and wine physical and chemical indicators of the main component factor Y, T relationship is as follows:

$$Q = -0.36 \times Y_1 + 0.563 \times Y_2 + 0.955 \times Y_4 + 0.517 \times Y_9 - 0.807 \times T_1 \quad (8)$$

The obtained mathematical model is substituted into the sample data and the original data are compared and analyzed. The comparison result is shown in Fig2.

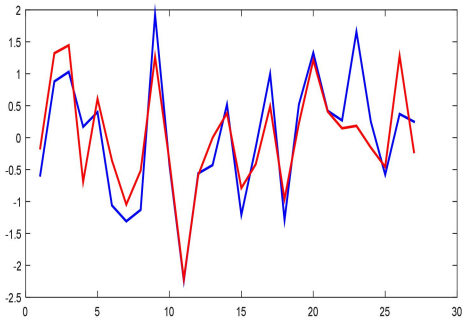

Figure 2 Comparative analysis

From the obtained data and its analysis above, we can see that the mathematical model = 0.899, its goodness of fit is high, with a significant linear relationship. Can be within the allowable range of error, better according to the grape and wine physical and chemical indicators of the main component factors to assess the quality of wine.

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Research on Tension Control of Cold Rolling Galvanizing Line

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Abstract: Cold galvanizing unit production process is continuous operation, the need for strip to maintain a certain tension to ensure that the production line operation. The production line is divided into multiple tension zones according to the process requirements. The tension set value of each tension zone is different according to the technological requirements. So that in the control of galvanized unit speed stability at the same time, also need to control the tension of each tension section of the stability. Tension and speed are ultimately achieved by controlling the torque of the motor, so that there is a problem of tension and velocity coupling. Tension in the galvanized production line plays an extremely important role, good tension control can ensure the continuous operation of the galvanizing unit to improve the productivity and product quality, increase corporate profits.
Keywords: Frequency converter; Torque control; Speed control; Tension setting

1. INTRODUCTION

Iron and steel industry in the field of national economy occupies an important position [1], with the development of market economy, the continuous expansion of their own enterprises, mergers and acquisitions between enterprises, making the enterprise scale and production capacity is growing, the attendant market Competition and make the enterprises face the scale of production, economic efficiency, product quality and environmental protection and other aspects of the severe challenges [2]. Enterprises in order to be invincible, we must improve their competitiveness, improve production efficiency, reduce costs and improve product quality to meet the rapidly changing market demand [3]. Cold-rolled galvanized steel strip is an important steel product [4], plays an important role in the national economy. In this paper, the tension control system of cold-rolled galvanizing unit is analyzed and digested, and the tension is realized for cold rolling mill Control to provide theoretical basis.

2. EXPERIMENTAL

2.1 Segmentation and setting of tension of galvanizing unit

Galvanized production line according to the requirements of different processes is divided into 16 tension zones [5-7]: uncoiler, 1 # tension roller group, entrance sets, 2 # tension roller group, cleaning section, 3 # tension roller group , The annealing furnace, the 4 # tension roller group, the light inlet 5 # tension roller group, the light straightening adjustment middle 6 # tension roller group, straightening machine, straightening machine export 7 # tension roller group, 8 # Tension roll set, export sets, 9 # tension roller group, coiler.

The main factors should be considered when setting the tension of each process section:

Uncoiler tension is generally less than half the curl tension of the raw material roll, so as not to open scratches;

The curl tension should be set to ensure that the coil is pleasing in appearance (marginally neatly) and to prevent unwinding;

Set the inlet and outlet sets of tension, it is necessary to consider to prevent strip deviation, but also consider the mechanical load of live sets;

The tension of the strip in the annealing furnace decreases with the increase of the furnace temperature.

In the cooling tower, because the air knife and cooling bellows strong air will blow to the strip surface, so the strip must have enough tension in order to ensure stable operation of the strip to obtain a uniform coating;

According to the process requirements, the finishing and drawing section need to set a large tension;

The passivation section is between the straightening machine and the outlet sleeve. As the transition section, the tension is also between the two.

The tension of the production line is set according to the tension formula shown in equation (1). In the application is usually in accordance with the strip material, thickness, cross-sectional area and other order, the specifications and mechanical properties of the strip with a group of uniform, set the tension, so as not to reduce Zhang Li fluctuations.

$$\begin{cases} Z_{SET} = (F_1 - F_{11} \times TH) \times CS \\ CS = TH \times W \end{cases} \quad (1)$$

In formula (1):

Z_{SET} indicates the tension of the tension zone (absolute tension) [N];

F_1, F_2 indicates the tension coefficient, which is affected by the tension section.

TH indicates the thickness of the strip [mm];

CS represents the cross-sectional area of the strip [mm2];

W indicates the width of the strip [mm].

2.2 METHOD

2.2.1 Inverter control mode

Galvanized wire tension control is controlled by the inverter to achieve the motor, there are two basic methods of inverter control [8]: speed control and torque control.

We use Figure 1 to analyze the two control methods. The entire control chart is a double closed loop adjustment system, the speed regulator output as the input of the current regulator, the current regulator output trigger pulse drive the main circuit to control the motor.

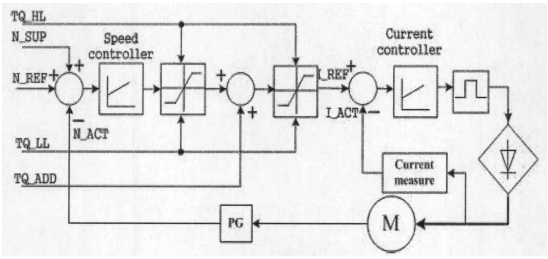

Figure 1 Double closed - loop control of the motor

In Figure 1:

TQ_HL represents the maximum torque limit;

TQ_LL represents the minimum torque limit;

TQ_ADD represents the additional torque value;

N_REF represents the acceleration setpoint;

N_SUP represents the additional angular velocity setting;

N_ACT represents the actual value of angular velocity;

I_REF represents the current reference value;

I_ACT represents the actual value of the current;

TQ_HL, TQ_LL, TQ_ADD, N_REF, N_SUP are the set values sent by the drive PLC to the inverter. The inverter will decide which mode of speed control mode and torque control is based on these values.

Galvanized production line tension control of the two main methods, open-loop control and closed-loop control, they are in the drive PLC to achieve, respectively, the equivalent of the aforementioned indirect tension control and direct tension control.

In the open-loop tension control, the appropriate motor torque is converted according to the information of the strip combined with the tension set value required by the tension calculation formula, and is transmitted as a torque limit value to the transmission device. Therefore, the transmission device operates in the torque control mode. The tension of the strip is adjusted by the torque limit, which does not have feedback of the actual strip tension, nor does the controller correct the deviation of the torque limit. In the galvanized production line, the uncoiler, the coiler and the individual tension rollers are operated in the open-loop tension control mode.

Therefore, open-loop tension control is a torque control. And closed-loop tension control can go to control the speed can also control the torque, so the closed-loop tension control mode is divided into speed control and torque control.

2.2.2 Tension meter

A complete tension meter consists of two indenter and a processing unit (including the control unit, isolation amplifier and terminal box), the pressure head is generally installed in the guide roller (sometimes called the test roll) bearing and mechanical frame between. When the strip through a certain angle through the guide roller, due to the tension of the strip two pressure head, respectively, will produce a pressure signal, the pressure signal sent to the processing unit after conversion to the tension of the strip, and then through the Profibus interface To the automation system for closed-loop control of strip tension.

The indenter is a welded steel device, generally of two types of indenter: horizontal type and vertical type. When the strip passes through the test roll at a certain angle, the tension T of the strip will produce two components, one for the vertical component FV and the other for the horizontal component FH. If we choose a horizontal type of indenter, you can measure the FH; if we use the vertical type of indenter, we can measure the FV. In addition, the measuring roll and strip angle can be obtained, so that we can calculate the tension of the strip. The following shows the measurement principle of the horizontal type and the vertical type indenter shown in Figure 2:

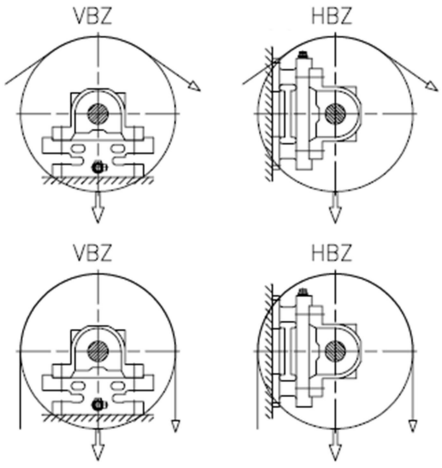

Figure 2 Tension of each angle pressure diagram

Horizontal type indenter measurement principle

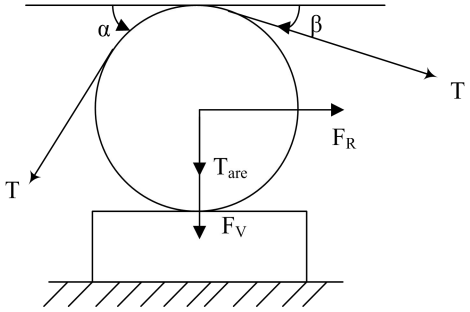

Figure 3 Tension meter measurement principle

As shown in Figure 3, the magnitude of the indenter measurement force depends in part on the tension T of the strip and the other depends on the angle of the strip, as determined by the following equation (2)

$$F_{Rtol} = F_R = T(\cos\beta - \cos\alpha)$$
$$F_{Vtol} = F_V + T_{are} = T(\sin\beta + \sin\alpha) + T_{are} \quad (2)$$

B. Vertical type indenter measurement principle

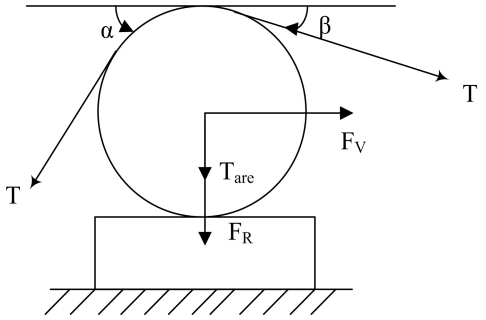

Figure 4 Vertical indenter measurement principle

As shown in Figure 4: Similar to the horizontal type of indenter, the measuring force depends on the strip tension T and the wrap angle. In addition, it differs from the horizontal type indenter in that the measuring force is also part of the weight from the guide roller and the bearing. Through the internal electronic compensation we can get a measurement signal proportional to the strip tension. The measured force is calculated by equation (3):

$$F_{Rtol} = F_R + T_{are} = T(\sin\beta + \sin\alpha) + T_{are}$$
$$F_{Vtol} = F_V = T(\cos\beta - \cos\alpha) \quad (3)$$

In the formulas (2) and (3) :

F_R represents the tension component in the measurement direction

F_{rtol} indicates the resultant force in the direction of measurement

F_V represents the tension component perpendicular to the measuring direction

F_{Vtol} represents the resultant force perpendicular to the measuring direction

T indicating strip tension

T_{are} indicates the weight of the roller and the bearing

α、β indicates the angle of the guide roll and strip

3. RESULTS AND DISCUSSION

Tension sensor wiring shown in Figure 5

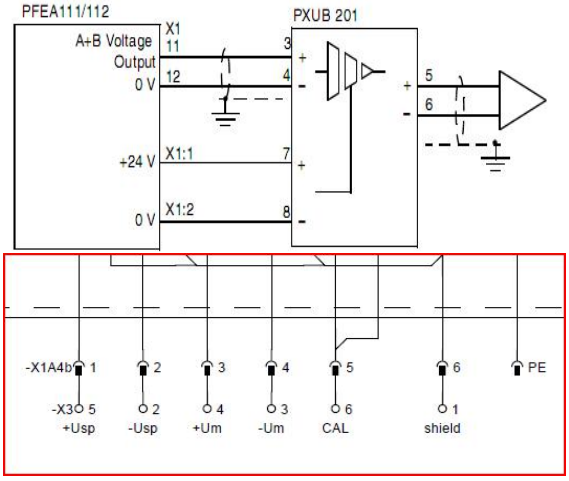

Figure 5 Tension sensor wiring

+ USP, -USP corresponds to the power supply is not the power of the dynamometer, but the sensor operating voltage. Set the corresponding parameters for the Set Excitation

+ UM, -UM is the signal voltage of the sensor.

The sensor circuit board shown in Figure 6, after opening can be welded in the zero resistance, welding position for the following two points AC. CD voltage between the two points for the output signal voltage, that is + UM, -UM voltage value.

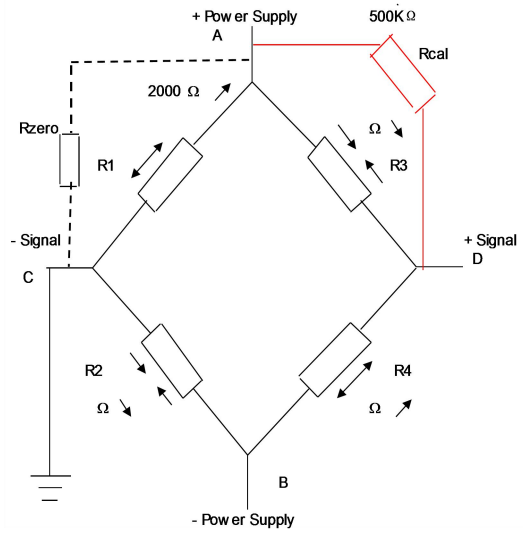

Figure 6 Sensor circuit board

XX cold-rolled galvanizing unit line tension settings as shown in Table 1, Table 1, the device number corresponding to the device name is as follows:

1 - unwinding machine; No. 1 tensioning roller group; 3 - entry sets; 4-2 tensioning roller group; 5 - cleaning section; 6-3 tensioning roller group; 7 - annealing furnace; No. 4 tensioning roller set; 9-light inlet 5 No. tensioning roller set; 10-light finishing the middle of the No. 6 tension roller; 11-straightening machine; 12-pull straightening mouth 7 tension roller

Group; 13-8 tension roll group; 14 - outlet sets; 15-9 tension roller group; 16 - coiler.

Table 1 A list of optimized tension settings across the board

Device ID	Maximum strip section(1.6×1520=2432mm2)				Minimum strip section(0.2×800=160mm2)			
	Entry		Exit		Entry		Exit	
	daN/mm2	DaN	daN/mm2	DaN	daN/mm2	DaN	daN/mm2	DaN
1	/	/	0.45	1095	/	/	1.5	240
2	0.45	1095	1.0	2432	1.5	240	1.8	288
3	1.0	2432	1.14(B)	2773(B)	1.8	288	1.8	288
4	1.14(B)	2773(B)	0.9	2189	1.8	288	1.1	176
5	0.9	2189	1.08(B)	2627(B)	1.1	176	1.1	176
6	1.08(B)	2627(B)	0.55	1338	1.1	176	0.6	96
7	0.55	1338	0.55	1338	0.6	96	0.6	96
8	0.55	1338	1.8	4378	0.6	96	2.0	320
9	1.8	4378	3.0	7296	2.0	320	9	1440
10	3.0	7296	5.72	13911	9	1440	9.75	1560
11	5.72	13911	8.08	19651	9.75	1560	10	1600
12	8.08	19651	2.10	5108	10	1600	2.1	336
13	2.10	5108	1.0	2432	2.1	336	1.8	288
14	1.0	2432	1.14(B)	2773(B)	1.8	288	1.8	288
15	1.14(B)	2773(B)	1.60	3892	1.8	288	3.5	560
16	1.60	3892	/	/	3.5	560	/	/

4. CONCLUSIONS

Tension control is divided into indirect tension control, direct tension control and compound tension control. Indirect tension control system, the tension control is through the tension system of the physical equation of static and dynamic analysis, from which to find out the impact of all the electrical physical volume, the control of these physical quantities, change the electrical parameters of the motor to achieve the purpose of constant tension The Direct tension control system, is through the tension detection element, the scene of the tension into the corresponding electrical signal, and as a feedback signal access to the input, with the set tension signal comparison, operation, adjust the tension to perform Components, thus forming a tension closed-loop control system. Composite tension control system, is based on the indirect tension control method, in the increase of a tension closed loop.

ACKNOWLEDGMENTS

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Software Crowdsourcing pricing model based on polynomial fitting

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Abstract:Mobile Internet self-service crowdsou-rcing is a new, convenient business inspection and information collection model which can greatly improve the efficiency of information collection. However unreasonable task pricing will lead to failure of commodity inspection. In view of this problem, this paper starts from the angle of enterprise benefit, the enterprise satisfaction is confirmed the principle that the more packaging and the price is lower. From the perspective of member satisfaction, the improved model after packaging is built by using polynomial fitting algorithm to analyze the relationship between task concentration density and price, the new pricing scheme is made.
Keyword: labor crowdsourcing; degree of satisfaction; empirical model

1. INTRODUCTION

"Take pictures and make money" which from the "internet plus" share the economic effects is not to be ignored, this also fully proves its market value[1]. However the task completion rate is not high because of a problem that include the spatial difference between the publishing position[2] of the task and the position of the member, pricing the members of their own reputation value and enterprise issued by the difference of satisfaction. In view of this problem, some companies pack tasks and make small tasks easy to accomplish as a big task what can improve completion rate. The domestic scholars put forward the centralized task be packaged, which will result the change of enterprise benefit and task completion rate[3]. therefore, we need to revise the model from two angles of enterprise satisfaction and membership satisfaction and coordinating transformation formula and mutually exclusive classification theory are used to formulate the principle of task centralized packaging[3]. From the perspective of enterprise cost, foreign scholars analyze the probability that the task will be completed after packaging and building the model by introducing the business satisfaction coefficient which is a number from 0 to 1, the number is smaller and the value enterprise satisfaction is higher[4].

The relationship between task price and membership participation is analysed by using mathematical statistics method, the model is built by introducing member satisfaction coefficient, the model is used to evaluate the task completion rate of a software.

2.PACKAGE POST TASK IMPROVE PRICING EMPIRICAL MODEL

2.1 Task packaging principle

In order to allocate resources rationally, the integration of geographically concentrated tasks, one-time release called packaging.

For easy observation, 100 sets of task point data are selected, drawing the scatter distribution with MATLAB and coordinating to determine the concentration of points by coordinate mean of scatter. When the task points satisfy 30 or more grids, these tasks can be called centralized[5]. The members of the position as the center, 30 tasks for batch tasks radius circle can be simulated by referring to the definition of task competition degree. In the packaging process, according to the location of the member spacing, two cases will be produced: one is that the distance between members is large, and the circle of batch tasks is separated from each other. This situation can be well packaged and released. The other is that the members are smaller and the batch task circles overlap, which is difficult to separate from package publishing, as shown in Figure 1.

When the task is chosen by the upper level member, this task is also in the next level of member selection, at this point, two members will choose the same task if no measures are taken.In order to solve the task assignment problem of overlapping tasks, the idea of introducing the principle of mutual exclusion in Applied Statistics[6]. When the task is in the overlap, membership at the next level is preferred, after the selection, the task cannot be acquired by the next level member which can only choose the non overlapping part of its batch task circle.

2.2 Determination of packing correction factor

(1)Enterprise satisfaction coefficient

When multiple tasks are centralized, which will attract many people choose to compete. Therefore, the method of task packaging can improve the efficiency of task completion and improve the completion rate of tasks to a certain extent. It is considered that the task price is most in line with the interests of the enterprise in the case of the completion of the task because people are more enthusiastic about packaging tasks. The more packaging tasks, the lower the price of packaging tasks. Based on this, the coefficient of price change is

constructed[7].

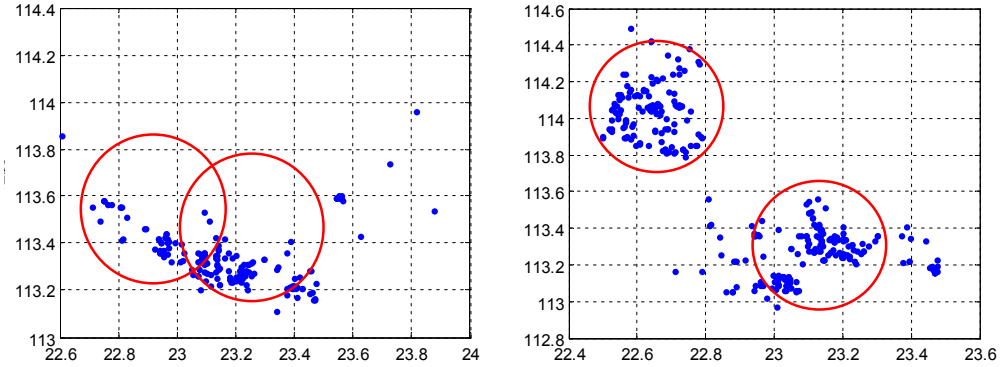

Figure 1. the two situations encountered in the packaging process

Supposing that the task price in the model of application problem two is C_i, that is the task tasks in the package price, any number of tasks in the package is n, so the original price of the task package:

$$C = \sum_{i=1}^{n} C_i \tag{1}$$

The biggest price of the task is $C_{\max}$, $C_{\max} - C_i$ is the difference between the task price of i and the maximum task price, the rate of price margin[8].

$$\eta_i = \frac{C_{\max} - C_i}{C_{\max}} \times 100\% \tag{2}$$

All the rate of price margin

$$\eta = \sum_{i=1}^{n} \frac{C_{\max} - C_i}{C_{\max}} \times 100\% \tag{3}$$

With the number of tasks increasing, membership participation increased, At this point the price is:

$$C' = C \cdot (1-\eta) = C(1 - \sum_{i=1}^{n} \frac{C_{\max} - C_i}{C_{\max}} \times 100\%) \tag{4}$$

(3)Member satisfaction coefficient

When the price is too low and the enthusiasm of members will drop, the task completion rate will be reduced. Therefore, it is necessary to introduce a coefficient to correct the model which can improve the completion rate of tasks for company. First, a task density is defined[9].

$$\rho = \frac{q}{q_{\max}} \tag{5}$$

In order to study the relationship between task density and price in task completion. The number of tasks in the package is confirmed by the coordinate transformation formula is adopted. A series of task densities are obtained by usinthe task density formula (5).

In order to understand the relationship between task density coefficient and price, Fitting image is drawn by using MATLAB[10].

When the task density is higher and the price will gradually decline. Initially, as the task density increases, prices fell at a faster rate. When the task density reaches 0.4, Price changes gradually slowed down, platform. Until the task density reached about 0.9, it began to decline again. The price fluctuation function:

$$C'' = -31\rho^3 + 59\rho^2 - 36\rho + 73 \quad (0 \le \rho \le 1) \tag{6}$$

the rate of difference between the price and the minimum

$$\alpha = \frac{C'' - C_{\min}}{C_{\max} - C_{\min}} \tag{7}$$

In order to increase the enthusiasm of members to participate in and improve the completion rate, The price is within this range.

$$\beta = \frac{1}{\alpha} = \frac{C_{\max} - C_{\min}}{C'' - C_{\min}} \tag{8}$$

Therefore, the coefficient of η and β substituted to equation. The pricing black box model after packing:

$$C = (w_1C_1 + w_2C_2 + w_3C_3)(1-\eta) \cdot \beta \tag{9}$$

$$C = \begin{cases} w_1C_1 + w_2C_2 + w_3C_3 \\ (w_1C_1 + w_2C_2 + w_3C_3)(1-\eta) \cdot \beta \end{cases} \tag{10}$$

2.3 Model checking and result influence

In order to test the quality of the model, a new pricing model is used to determine a pricing scheme. Based on $PSO-BP$ the application of network simulation model to get the new scheme is gotten by using the application of network simulation based on $PSO-BP$

Table 5 revised pricing model completion rate table

scheme	original scheme	New scheme (pricing model)	The new scheme (after the model is revised)
completion	62.59%	80.65%	89.74%

rate

As shown in Table 5, The task completion rate of the statistical scheme is 62.59% to 80.65% after the establishment of a new model. The completion rate of after the model is revised is 89.74%. This shows that New pricing model is reliable after Crowdsourcing measures according to the newly established tasks. The final correction model has a certain degree of improvement for the final completion rate of the enterprise issued task.

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Design of the pricing scheme of the service crowdsourcing platform in "Internet +" era

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Abstract: "Making money from photography" is a self-service model of "Internet +". How to design a reasonable pricing scheme is very important for the development planning of an enterprise. According to the distribution chart of the membership and the task location, the pricing of the task is negatively correlated with the membership density. In the same way, the pricing of the task, the location of the member and the distance between the tasks are positively correlated. Then quantize the radiation diameter of all the mission points according to the membership density, and establish the least squares fitting model of the comprehensive distance between the member and the task, and then calculate the member travel. Then, based on the basic salary and member travel Pricing model. Finally, we study the algorithm by overrun learning machine and classify the output results. obviously, Pricing program than the original plan by a higher task completion rate and lower labor costs.
Keywords: Ant Colony Algorithm; Least squares method; Overrun learning machine algorithm; Entropy method

1. INTRODUCTION

With the development of the mobile Internet, a self-service mode has begun to enter people's lives. Users can download the APP to receive tasks, complete the photographing and obtain the remuneration after uploading. This self-service mobile crowdsourcing platform for mobile Internet provides businesses with a variety of commercial inspection and information collection, which not only saves the investigation cost, but also effectively ensures the authenticity of survey data and shortens the investigation period. Task pricing is the core of platform operation, how to make reasonable pricing, so that the task of maximizing the success rate has become the focus of attention, With the development of the mobile Internet, a self-service mode has begun to enter people's lives. Users can download the APP to receive tasks, complete the photographing and obtain the remuneration after uploading. This self-service mobile crowdsourcing platform for mobile Internet provides businesses with a variety of commercial inspection and information collection, which not only saves the investigation cost, but also effectively ensures the authenticity of survey data and shortens the investigation period. Task pricing is the core of platform operation, how to make reasonable pricing, so that the task of maximizing the success rate has become the focus of attention

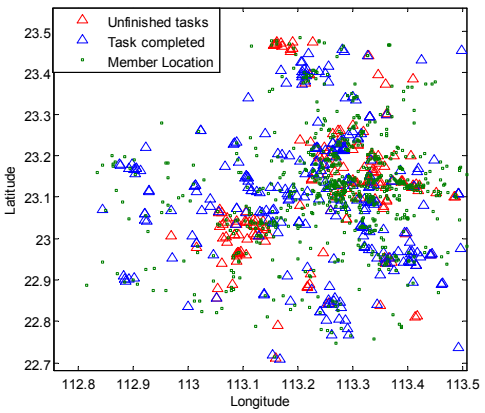
2. EXPERIMENTAL

2.1MODEL HYPOTHESIS

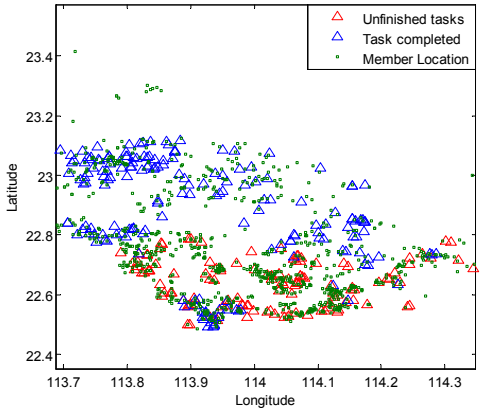
Assuming that the promotion of APP development is relatively stable in a short period of time, there will be no sudden change in the number of registered members and there is no major change in membership. Suppose the punishment mechanism is more fair, does not appear malicious debit credit member behavior; Assuming that the difficulty of the task is within the acceptable range of members' abilities, ignoring the unfinished task caused by lack of ability; Suppose the platform members choose the task, the priority to take the principle of proximity.

2.2 MODEL THEORY

In order to study the task pricing rules in Annex 1 and analyze the reasons for the unfinished tasks on this basis, the distribution of task points in Annex 1 is divided into two regions (112.8°-113.5°)E and (113.7°-114.4°)E analysis, through the data visualization, completed tasks, unfinished tasks and membership distribution as shown in (a), (b):



(a)



(b)

Fig.1 Tasks and members of the distribution map

As can be seen from Fig. 1, the unfinished task shows the characteristics of regional concentration in the spatial distribution. The unfinished points in Fig. (A) are concentrated in the range of (113.1°-113.4°) E and (23.0°-23.3°) W, In the graph (b), the unfinished points mainly lie in the range of (113.8°-114.3°) E, (22.5°-22.8°) W, however, the member distribution area is relatively wide, and there are radiation near completed missions and unfinished missions. This shows that the location of members and the distance between the members and the mission is not the decisive factor affecting the completion of the mission. The unfinished points in Fig.(a) are concentrated in the range of (113.1 ° -113.4 °) E and (23.0° -23.3°) W, where the distribution density of members is large. In Fig. (B), the unfinished points are mainly (113.8° -114.3°) E, (22.5° -22.8°) W, the impact of membership density, the greater the membership density, the corresponding task pricing will be reduced, the two are negatively correlated; membership density Large, the greater the number of members will have a competitive relationship, to achieve the purpose of managers to reduce labor costs. Member distribution near the task point is also relatively large, so membership density near the task point is not the cause of the task failure.

As can be seen from Fig. 1, the unfinished task shows the characteristics of regional concentration in the spatial distribution. The unfinished points in Fig. (a) are concentrated in the range of (113.1°-113.4°) E and (23.0°-23.3°) W, In the graph (b), the unfinished points mainly lie in the range of (113.8°-114.3°) E, (22.5° -22.8 °) W, however, the member distribution area is relatively wide, and there are radiation near completed missions and unfinished missions. This shows that the location of members and the distance between the members and the mission is not the decisive factor affecting the completion of the mission.

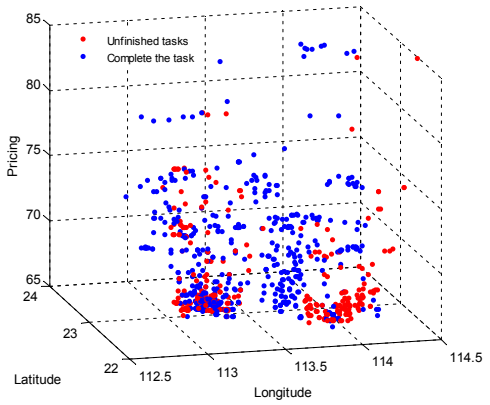


Fig.2 Task Pricing Distribution

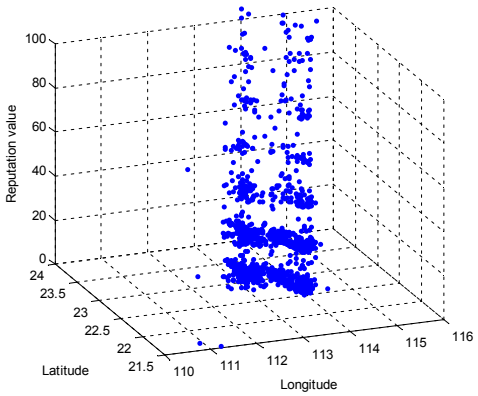


Fig.3 Member credit value distribution

As can be seen from Figure 2, the tasks that have been completed are located in the middle-upper region of the task price gradient with a greater number in the 75-80 price range. In contrast, the unfinished tasks are mainly concentrated in the middle and lower regions of the task price gradient, and 65-70 Most of the price range. Members of the task from the task of this point is also part of the need to consider the distance, spend more time and more natural remuneration; proximity, the remuneration can not be endless reduction, which will reduce the enthusiasm of members, so there is the concept of platform to introduce basic remuneration . Based on this, too low or unreasonable pricing is an important factor in the failure to complete the task. Unreasonable tasks are not attractive to nearby members, which in turn leads to the failure of such tasks.

In addition, it can be seen from Figures 1, 2 and 3 that in some areas, there is a situation that the member densities are higher and the price is higher around the task point, but the task fails to be completed. At the same time, Consider the existence of some members of negligent work, commitment to lower the surrounding tasks and other reasons.

To sum up, the main reason for the failure to complete the task is that the unreasonable pricing of the task causes the task to be less attractive to members; the creditworthiness of the nearby

members is too low, and the task of retiring after negligence or accepting the task Failed to complete and did not complete the task of centralized distribution. The membership density around the mission and the distance between the member and the mission have some impact on the task completion rate but are not the decisive factor.

2.3 MODEL IMPROVEMENT

2.3.1 Membership based on membership density to determine

Considering the problem of the distance in the same time and different space, we consider the membership density around the mission, the scope of task notification, the comprehensive distance and so on. With each mission as the center, we spread outwards. As the diameter of the scanning circle increases, Regional membership continues to increase, the concept of membership density.

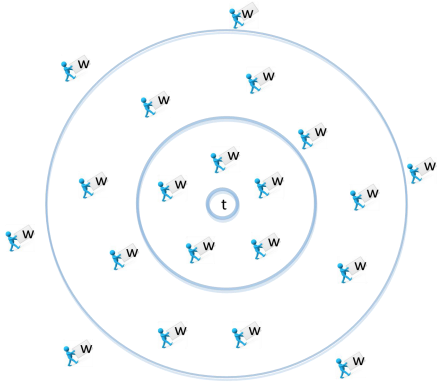


Fig.4 Mission area density near the schematic

φ is the region's membership density, N is the region's membership, d_{w} is the diameter of the circular area (km).

Define the maximum member density $\varphi_{\max}$, $\varphi \le \varphi_{\max}$, $\varphi_{\max}$ 、 $D_{\min}$ in the area.According to the workload and the total number of platform members is defined as a constant. A series of satisfactory results are obtained during scanning,Choose the smallest d_w as the optimal solution to determine the size of each area and membership.By scanning the model, each task as the center of the circle can be determined only the circle, the diameter of these circles vary in size, but members of the same density, are the same constant φ

In the determined circular area centered on the mission point, the European distance between the location of the member and the location of the mission point is $S_{w_i}(\mathrm{i}=1,2,\cdots,N_w)$:

$$S_{w_n}=\sqrt{w_n^{\,2}-t_n^{\,2}} \tag{5}$$

In the above formula, w_n is the coordinates of the position of the member, t_n are the coordinates of the position of the task point, and the exact numerical value determined by S_{w_n} finding the European distance of the two points.

On the basis of S_{w_n} ,the total distance between all the members and the task points in the round area with the member's trip on behalf of the task point, the formula is:

$$\begin{cases} S_w=\lambda_1 S_{w_1}+\lambda_2 S_{w_2}+\lambda_3 S_{w_3}+\cdots+\lambda_n S_{w_n} \\ S_{w_1}\le S_{w2}\le S_{w3}\le\cdots\le S_{w_n} \\ \lambda_1\ge\lambda_2\ge\lambda_3\ge\cdots\ge\lambda_n \end{cases} \tag{6}$$

In the above formula S_w is member travel,Members and mission in accordance with the distance from the near and far, respectively S_{w_1}, $S_{w_2}, S_{w_3}\cdots S_{w_n}$, λ_n determined by the method of entropy.

Within a certain range of mission distribution, the overall distance of all members from the mission point, that is, the membership journey and the comprehensive reputation of all members, will have a significant impact on the task pricing. Member travel and task pricing are positively correlated. The larger the member travel, the more difficult the task is, and the higher the natural task pricing is. The smaller the member travel is, the lower the task difficulty is, and the lower the corresponding pricing is. But the pricing is not unlimited low, which will damage the rights and interests of members close to the task, will also make members lose the motivation to do the task, so this article proposed the concept of basic salary.

Each task has a base salary, assuming that all personnel have a constant base salary C_w ,and the pricing is positively correlated with the membership itinerary, assume that both follow a linear relationship, So there are the following relations:

$$\begin{aligned} Q_w &= C_w+\mu_w\cdot S_w \\ &= C_w+\mu_w(\lambda_1 S_{w_1}+\lambda_2 S_{w_2}+\lambda_3 S_{w_3}+\cdots+\lambda_n S_{w_N}) \end{aligned}$$

In the upper form, Q_w is the task pricing, C_w is the task base salary, μ_w, λ_N is the least square regression coefficient, $N_w=\pi d_w^{\,2}\varphi/4$, and S_w is the member travel. The basic salary in C_w according to the definition of task difficulty and the actual situation of constant platform member.

In the process of task pricing for the first appendix, First of all, according to the amount of tasks and actual members of the platform and related literature, given the basic salary of the task $C_w=40$, and membership density $\varphi_{\max}=5$, therefore obtain the

total number of members in the circle area N and the minimum diameter of the region d_{w}.

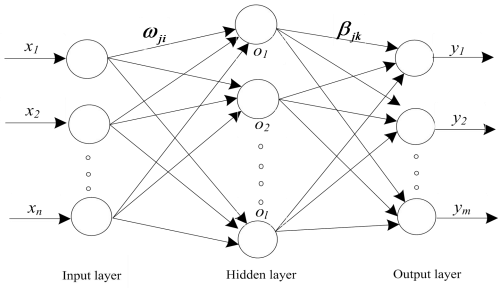
Secondly, according to the method of latitude and longitude conversion, the Euclidean distance between the position of the member and the task point in each task point area is calculated, and according to the formula (6), the member travel S_w of each task point are calculated.

2.3.2 Comparison of effect before and after scheme improvement

(1) Comparison of task success rate

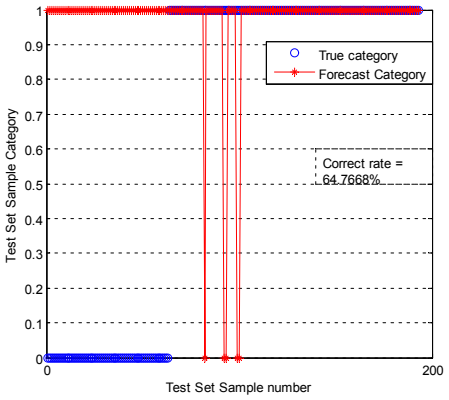
After the new pricing scheme is designed, in order to compare with the original scheme, this paper uses the super limit learning algorithm to classify the task completion and measure the quality and disadvantage of the two schemes according to the classification result and the precision.

The ultra-Limit Learning machine (ELM) is Huang and other people based on SLFNS, a new fast depth learning algorithm is proposed. Elm is a typical single implicit layer feedforward neural network structure (Fig 5), which can adaptively set the number of hidden layer nodes, and randomly assign the connection weights and biases between the input layer and hidden layer, then compute the weights of the output layer using the least squares method. The entire process of the ELM algorithm does not require iterations. Therefore, it has the advantages of fast training speed, strong generalization ability, and can obtain global optimal solution. Compared with the traditional reverse propagation algorithm, the neural network is easy to get into the local minima and the training time is long and the support vector machine is computationally complex, Elm has a stronger learning ability and faster learning speed. Therefore, it is widely used in classification, prediction and so on.

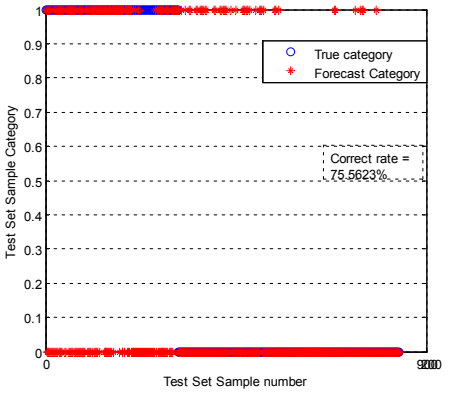


3. RESULTS AND DISCUSSION

Based on the task data in annex 1, the Elm model was simulated and tested, the member's schedule of each task and the task were priced as input, the task completed as output (completed as "1", not completed as "0"), in which training set 637 Group, test Group 200 group.



Original Scheme Classification effect chart



(b) New Scheme Classification effect chart

Fig. 6 Effect chart of two scheme classification

Fig.6 shows the results of the two types of scenarios where data is used for elm classification. The original scheme and the new scheme were 86% and 88% respectively, which showed that both models were well trained, and the correctness rate of the test samples was 64.7668% and 75.5623%, and the correctness of the original scheme was less than that of the new scheme. The task pricing of the new scheme makes the task completion rate higher than the original scheme.

(2)Task Pricing Comparison

The following Figure 7 shows the line chart of the original scheme pricing and the new scheme pricing, it can be seen that the unfinished task in project one has been improved accordingly, and for some easy task, the price is reduced correspondingly. From the point of view of mean value, the original task price value is 69.1107 yuan, the improved pricing scheme is 67.4867 yuan, which achieves the purpose of saving labor cost for the company, so the improved pricing scheme has more adaptability and popularization.

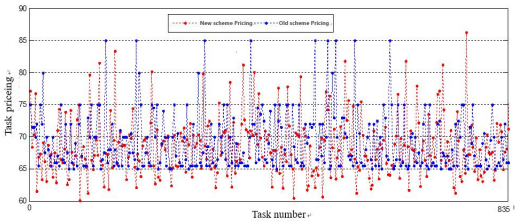


Fig.7 Original scheme pricing and new scheme pricing line chart

4. CONCLUSIONS

To sum up, the improved new pricing scheme has two advantages: on the one hand, improve the accuracy of the original scheme, that is, for the completion of the task, the completion rate has been improved, on the other hand, reduce the value of the price, that is, for crowdsourcing companies, reduce the cost of labor, improve economic Based on the above, the new scheme adapts to the development needs of crowdsourcing companies and is worth promoting

ACKNOWLEDGMENTS

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Optimization Algorithm of BP Neural Network Based on Genetic Algorithm

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Abstract: BP Neural Network has some advantages, such as a good nonlinear mapping ability, a high degree of self-learning and adaptive ability, which is widely used in voice analysis, digital prediction and other fields. With the application of the scope of the promotion, BP neural network exposes shortcomings and shortcomings, such as slow learning convergence, easy to fall into the local minimum point, difficult to determine the network structure. In this paper, genetic algorithm is used to optimize BP neural network. The optimized BP neural network is tested and its convergence speed and prediction accuracy are improved, and it can prevent it from falling into the local minimum point and achieve better training effect. Therefore, BP neural network optimization algorithm based on genetic algorithm is feasible and effective.

Key word: Genetic algorithm; BP neural network

1. INTRODUCTION

BP algorithm is one of the most mature and most mature training algorithms for neural network training because of its simplicity, easy operation, small computation and strong parallelism. Because BP algorithm is a gradient descent search method, it exists some disadvantages inevitably. For example, it is easy to fall into the local extreme point of the error function, can not effectively search the global minimum for the larger search space and multi-peak. While, Global Optimization Search Algorithm - Genetic algorithm is an effective solution to overcome this deficiency.

2. BP NEURAL NETWORK

2.1 The Composition and Design of BP Neural Network

1) The structure of BP neural network

The BP network is a neural network with three or more layers, containing the input layer, the middle layer (hidden layer) and the output layer.

The network topology is as follows:

The number of hidden layer units is affected by the requirements of the problem, the number of input / output units. It must exist the best number of hidden layer units. The following three formulas are usually used to select the optimal number of hidden units:

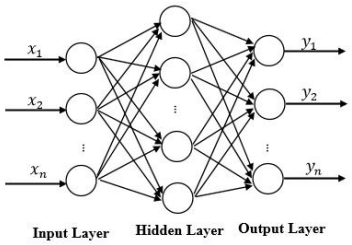

Figure.1 The topology of BP Network Model

$\sum_{i=0}^{n} C_{ni}^{j} > k$,where k is the number of samples and n is the number of input units.

$n_l = \sqrt{n+m} + a$, m is the number of output neurons, n is the number of input units, and a is a constant between [1, 10].

$n_l = log_2 n$, where n is the number of input units.

2) Training BP Network Neurons

The training of neural networks includes perceptron training, delta regular training and back propagation algorithms, among which the perceptron training is the foundation. The sensor inputs a real value vector and computes a linear combination of these inputs. If the result is greater than a certain threshold, output 1, otherwise -1, if x is from 1 to n.

The algorithm for back propagation of trained neurons is as follows:

3) BP neural network algorithm flow

The idea of the BP algorithm is to correct the connection weights and thresholds by calculating the mean square error of the actual output and the expected output so that the actual output is as close as possible to the desired output. The output of the i-th neuron in the hidden layer is:

$$\alpha_i = f\left(\sum_{j=1}^{n} x_j \theta_{ij} - \theta_j^{'}\right)$$

θ_{ij} is the connection weight of the input layer to the hidden layer, and $\theta_j^{'}$ is the threshold of the input layer neuron.

The output of the first k neuron in the output layer is:$y_m = f\left(\sum_{j=1}^{n} x_j \theta_{ji} - \theta_j^{''}\right)$

θ_{ji} is the connection weight of the hidden layer to the output layer, and $\theta_j^{''}$ is the threshold of neurons in the hidden layer.

The following is the calculation of the error

function: $E = \frac{1}{2}\sum_{k=1}^{n}(x_k - y_k)$

x_k is the desired output of the network and y_k is the actual output.

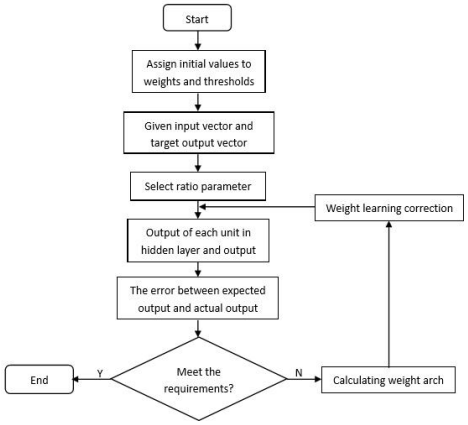

Figure.2 Neuron Reverse Propagation Training Chart

2.2 Genetic algorithm

The essence of the genetic algorithm is to search the optimal law of the search problem in the process of searching for the optimal solution of the Darwinian biological evolution theory. The individual satisfying the condition is genetically preserved, otherwise the abandonment, making the feasible solution of the feasible solution. The genetic algorithm's search process consists of three basic genetic operations: selection, crossover, mutation.

The purpose of the selection is to select the vitality of the chromosome from the current group.

The crossover is used to combine the information from the parent population to generate new individuals.

Variation increases the ability of the genetic algorithm of finding the optimal solution and maintaining the diversity of the population and prevents the premature phenomenon.

2.3 The main process of genetic algorithm is shown in the following figure:

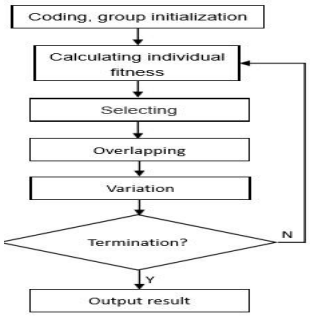

Figure.3 Genetic algorithm flow chart

3. OPTIMIZATION OF BP NEURAL NETWORK BASED ON GENETIC ALGORITHM

After the optimization of BP neural network by genetic algorithm, it can give full play to the generalization mapping ability of neural network, and make it have fast convergence ability and strong learning ability. The algorithm flow of BP neural network optimized by genetic algorithm is shown in the picture below:

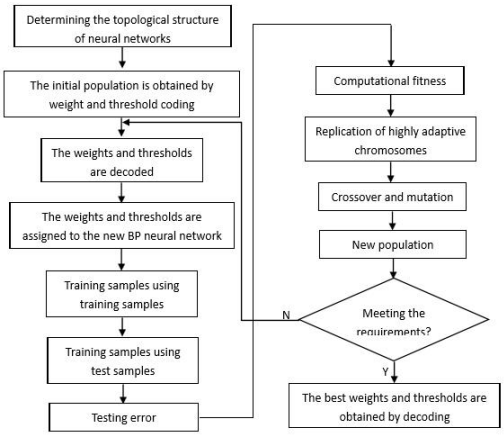

Fig.4 Flow Chart of Genetic Algorithm Optimizing BP Neural Network

3.1 Optimization of neural network by genetic algorithm

The research work mainly includes three aspects:

(1)Evolution of neural network connection weights using genetic algorithm.

(2)Evolution of neural network structure using genetic algorithm.

(3)Using genetic algorithm to evolve neural network learning rules.

3.2 Optimization process

(1)The weights and thresholds are initialized randomly, and the weights and thresholds are encoded by the encoding mechanism. Finally, the initial population is generated.

(2)The adaptive function is determined by calculating the error function of the network.

(3)Selecting individuals with larger fitness.

(4)Crossover operation was performed, and then two individuals were randomly selected from the population for cross gene interchange.

(5)Compile the operation, confirming the mutation position of the chromosome, and carry out the corresponding variation according to the different coding strategy. At this point, a new generation of groups emerge.

(6)Repeat step 5, evolve the initial weights and thresholds, until the training results meet the requirements or the number of iterations reaches the preset value.

4.DESIGN OF NEURAL NETWORK CONNECTION WEIGHT MODEL BASED ON GENETIC ALGORITHM

4.1 coding scheme

The BP neural network is trained by genetic algorithm, and the typical binary encoding is adopted. The accuracy can be improved by longer encoding. When encoding, the threshold can be viewed as a join weight. First, assume that all weights and thresholds are within a certain range, that is $\omega_{ij} \in (\omega_{min}, \omega_{max})$. l bit binary is used to represent weights and thresholds, The relationship between the actual

weight value or threshold value and the value represented by the binary string is:

$$\omega_{ij} = (\omega_{ij})_{min} + \frac{B(l)}{2^l}[(\omega_{max}) - (\omega_{min}) + 1]$$

4.2 Produce initial population

A population of X individuals with N individuals is generated randomly, each individual X_i in the population represents the initial weight and threshold distribution of a neural network. Each gene represents a link weight or a threshold of a neural network, the length of the individual is the sum of the weights of the neural network and the number of the threshold.

$$X = \{X_1, X_2, \cdots, X_n\}^T$$

$$X_i = \{x_1, x_2, \cdots, x_n\}$$

$$n = r \times s_1 + s_1 \times s_2 + s_1 + s_2$$

In the formula, r is the input layer, s_1 is the hidden layer, and s_2 is the output layer number.

4.3 Determination of the fitness function

According to fitness function to evaluate individuals, each individual is decoded to get the initial weights of a BP neural network, and the error value of the network is calculated, which makes the error of the neural network minimum. On the basis, the fitness function is constructed, and the following functions can be used for the minimum problem. $f(x) = \frac{1}{E+1}$

The output error of the neural network is E

$$E = \frac{1}{2}\sum_{K=1}^{N}(y_k - y_k^{'})^2$$

In the formula, y_k is the expected output of the network, $y_k^{'}$ is the actual output, and then the fitness value of each individual is calculated according to the fitness function, and the descending arrangement is carried out according to the size.

4.4 Selecting

After calculating the fitness of each individual, the individuals with greater fitness are inherited to the next generation, and the most commonly used method is the fitness ratio method. The selection probability of each individual is proportional to its fitness. If the fitness of the first i individuals is f_i, the probability of being selected is: $p_i = \frac{f_i}{\sum_{i=1}^{M} f_i}$

In the formula, M is the group size, and in the actual study, the individuals with the most value of fitness function are copied directly to the next generation.

4.5 Crossover and mutation

According to the crossover probability P, two weight individuals are selected randomly, then a crossover point is set randomly in the individual strings, and then the two individual parts are exchanged to generate new individuals. The individuals were randomly selected from the population by probability P, and the individuals were randomly selected to identify the variation points.

4.6 Optimization

Repeat steps 3.3 and 3.5, making the initial weights and the threshold distribution constantly modified evolution. The optimal individual is taken as the initial weight of the neural network, and then the BP neural network is trained to obtain the global optimal solution.

5. CONCLUSION

For the BP neural network in practical applications, the learning convergence speed is slow, easy to fall into local minima, the network structure is not easy to determine. This article aims at these shortcomings and shortcomings, using genetic algorithm global search ability to optimize BP neural network. Through the study of this paper, the following conclusions are obtained:

Genetic algorithm is used to optimize the weights and thresholds of BP neural network, which solves the problems of slow convergence speed and easy to fall into local minimum point of BP neural network.

The use of the combination of the two, and give full play to the advantages of both, the generalization mapping ability of neural network and the global convergence ability of genetic algorithm are integrated, and the problem of weak local regulation ability of genetic algorithm is overcome.

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Prediction and Analysis of Stock Price Trend Based on BP Neural Network

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Abstract: The algorithm and structure of BP neural network are introduced. Based on the toolbox of BP network of MATLAB, the data of Shanghai Pudong Development Bank in the past one year is trained and tested, and a certain prediction accuracy is obtained. Finally, the paper also discusses the difficulty of predicting stock price during volatility period, the difficulty of predicting stock price increase and the influence of input variables on the ability of BP network to forecast stock price.Based on the experimental results, it is concluded that the mathematical model based on BP neural network can achieve the conclusion of the trend of stock price to a certain extent.
Keywords: Financial Mathematics; Stock price forecast; BP neural network

1. INTRODUTION

Since the establishment of the stock market in the 19th century, investors have been paying attention as a high-risk and high-yield area of investment. Foreign researchers also put forward a series of stock pricing theory and portfolio model in succession. Although these theories have greatly broadened their ideas and motivations, they have further understanding of the risks and benefits. However, their short-term The operation can not explain, nor can it provide meaningful guidance. Subsequent researchers applied various statistical methods to stock market modeling, such as exponential smoothing, multiple regression, and isochronous forecasting models. However, there are some great difficulties in predicting the stock using the traditional forecasting techniques. For example, the assumptions of the model are far from the actual situation in the stock market, and the original data for stock price forecasting is very large. Therefore, the traditional forecasting technology forecasting effect is not satisfactory. Artificial neural network provides a new method in the field of prediction. In theory, it can achieve a good simulation within a certain accuracy range for any continuous function. Based on the above analysis and taking into account the defects of the traditional model, this paper uses neural network This processing tool carries on the forecast analysis to the stock market, in order to further expand the application of the neural network method in the stock market.

2.OVERVIEW OF STOCK PRICEFORECASTING

The stock market is a complex system of unstable nonlinear dynamics. The changes of stock prices are influenced by many factors. Factors affecting the stock price can be simply divided into two categories, one is the company's fundamentals, the other is the stock technical aspects.

Although the value of the stock is the discount of the future cash flow of the company, which is determined by the fundamentals of the company, due to the slow updating of company fundamentals data and in many cases does not objectively reflect the actual situation of the company, the data through the company fundamentals It's hard to predict the stock price, especially the company's short-term stock price forecast. However, the stock market has complex nonlinear dynamics, making it difficult to predict it. However, the neural network, as a nonlinear dynamical system, has the good characteristics that the dynamic characteristics agree well with the dynamic characteristics of the time series and can be well solved Environmental information is not very clear, the knowledge background is not clear application problems, therefore, for the stock market such as the trend of nonlinear economic system, the application of artificial neural network is a powerful non-linear tool for research and forecasting is of real value, Internal consistency and feasibility.

3. BP NEURAL NETWORK

(1) Overview of BP neural network

BP neural network model is one of the most successful and widely before the date of application.The model was independently proposed by Dabid Runelhart, GeoffreyHinton and Ronald Williams, David Parker and Yannn LeCun in the 80s of last century.Rumelhart and Mc Clelland (1986) the leadership of the group in the <Parallel Distributed Processing>, the error back-propagation algorithm of continuous transfer function of multilayer feedforward network with nonlinear are analyzed in detail.

The basic idea of BP algorithm.The learning process consists of two processes: the forward propagation of the signal and the reverse propagation of error.When the forward propagation, the input sample is imported

from the input layer, and then transmitted to the output layer after each hidden layer is processed. If the actual output of the output layer and the expected output difference do not meet the requirements, then the reverse propagation stage is transferred to the error.The error back-propagation is the output error in some form through the hidden layer to the input layer back propagation, and the error is allocated to each unit layer, so as to get the error signal of each layer unit, the error signal is modified as each unit basis.The process of adjusting the weights of the forward spread and the error back propagation of the signal goes round and round.The process of constant weight adjustment is the learning and training process of the network.This process has been carried out to reduce the error of the network output to an acceptable level or to the preset times of learning so far.

(2) The principle of BP neural network

A neural network is a parallel distributed system composed of a large number of simple processing units and connected by variable weights.Neuron is the basic processing unit of artificial neural network. It is a nonlinear device with multiple input and single output. According to the characteristics and functions of neuron, the neuron can be abstracted into a simple mathematical model as shown in the figure.1

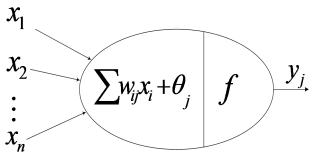

Figure 1 Mathematical model

In Fig.1, $x_1, x_2, \cdots, x_n$ is the input neurons,it comes from the neuron axon information. ω_{ij} is the weight of j neurons. θ_{ij} is the j neuron threshold. y_i is the output of j neurons. f is a transfer function, which determines how j neurons output when they are combined with input $x_1, x_2, \cdots, x_n$ to achieve the threshold.

(3) Algorithm flow of BP neural network

Determination of initial weights and threshold $\omega_{ij}^{(I)}[0], \theta_{ij}^{(I)}(I = 0,1,2,\cdots,L)$ is a random number between [0,1]

Input samples and expected outputs:The input training sample is $Y = (Y_1, Y_2, \cdots, Y_m)$.

Target output is $X = (X_1, X_2, \cdots, X_n)$.

Calculate the input of each layer:

$$X^{(0)} = f(s^{(1)}) = f(W^{(1)}X^{(I-1)}) \quad (1)$$

Computational training error:

output layer :

$$\delta_j^I = (d_{qi} - X_j^I) f'(s_j^I) \quad (2)$$

Hidden layer and input layer:

$$\delta_j^1 = f'(s_j^I) \sum(\mathrm{n})k = 1\delta j(I)wkj(I+1)$$

Correction weights and thresholds:

$$\omega_{ij}^{(I)}[k+1] = \omega_{ij}^I[k] + u\delta_j^{(I)}X_i^{(I-1)} + \eta(\omega_{ij}^{(1)}[k] - \omega_{ij}^{(1)}[k-1])$$

$$\theta_j^I[k+1] = \theta_j^I[k] + u\delta_j^{(I)} + \eta(\theta_{ij}^{(1)}[k] - \theta_{ij}^{(1)}[k-1])$$

The performance index and error are calculated until the accuracy is satisfied.As Figure 2.

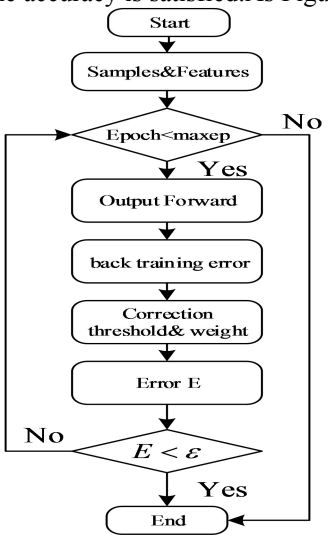

Figure 2 Alculated until the accuracy

4. CASE ANALYSIS

(1)Variable Determination

The experiment today's opening price, today's highest price, today's lowest price today's closing price, 5-day moving average, 10-day moving average, 15-day moving average, 30-day moving average, 50-day moving average, 250 days Moving average, today's trading volume, KDJ indicator, RSI indicator, PSY indicator, WR indicator, stage strong index, stage weak index, market index 20 variables as input variables, the second day closing price of stock as output variable. Input variables that contain the stock information also reflects the broader market information; that contains the price information also reflects the volume of information; that contains recent information also reflects long-term historical information; that contains the trend information also reflects the strong and weak potential information.

(2)Normalization

In order to eliminate the order of magnitude difference between the various dimension data and avoid the large variation of the order of magnitude of the dependent variable, the model predictive error is larger. In this paper, the maximum and minimum methods are used to normalize the input and output variables

(3)Determine the hidden layer node number

BP network the number of hidden layer node number and BP network prediction has great phase accuracy

between: the number of nodes is too small, the neural network training ability will become weak, unable to complete the accurate prediction; too many nodes, neural network training time becomes longer,and the network may be over fitting phenomenon. So select the appropriate number of nodes to maximize the performance of the BP network, but there is no uniform standard to determine the number of hidden layer nodes, so in this paper, after several tests, multiple comparison, and ultimately determine the number of hidden layer nodes were 8,14,10.

(4)Determination of BP network structure

In this paper, MATLBA 2010b BP network toolbox is used to carry out simulation test. Create a BP neural network with newff, set the 3 hidden layer, the network of neurons in the hidden layer and the output layer transfer function neural transfer function is Tansig, the training function is traingda, the maximum number of training for 5000 times, the learning rate is 0.15, the target accuracy is 0.005.

(5)Data selection

Without loss of generality, select the Shanghai stock exchange of Shanghai Pudong Development Bank (600000) as the experimental object, from September 27, 2010 to September 19, 2011 recorded a total of 240 trading days as the experimental basis, randomly selected 230 groups of transaction data in BP network, the remaining 10 sets of data for testing. In addition to the impact of canceling stock, this paper adopts data after the resumption of trading.

(6)Analysis and utilization of experimental results

The training error was reduced to 0.005 when MATLAB trained 230 randomly selected samples. From the predicted output and expected output, the BP network achieves the judgment of stock price to a certain extent, and the error is basically controlled within 2%, and the experimental accuracy is satisfactory. Results are as follows.

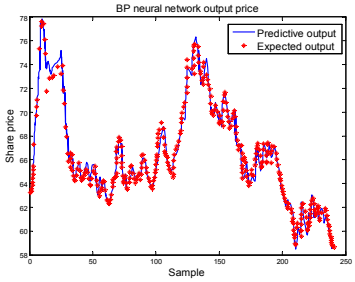

Figure 3 BP neural network output price

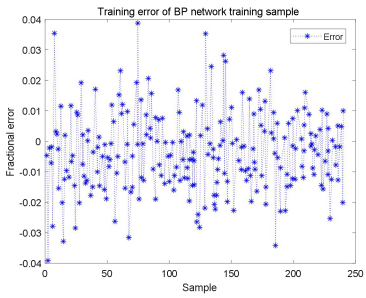

Figure 4 Training error of BP network training sample

The remaining 10 sets of data have been trained BP network testing, the following results.

Table 1 Output and error of BP network test sample

Test sample	Test output	Expected output	Relative error
2010.10.28	74.48	73.24	1.69%
2010.11.23	65.26	64.69	0.87%
2010.12.6	65.95	66.06	-0.16%
2011.2.24	64.15	63.09	0.26%
2011.3.2	67.70	68.03	-0.49%
2011.4.19	70.64	73.39	1.69%
2011.5.10	70.33	72.21	0.117%
2011.8.1	62.29	61.63	1.07%
2011.9.5	60.93	60.63	0.50%
2011.9.19	59.72	58.97	1.28%

From the test results, the BP neural network after training has a higher ability of forecasting, the BP neural network to judge the closing error of the stock is smaller, the network generalization ability is better, so through the BP network under certain conditions, certain The degree of realization of the stock price trend judgment.

(7)In-depth analysis

1)Fluctuations in the stock price forecast accuracy is not high

Judging from the forecast output of BP network training and the expectation output condition, the prediction output of BP network can well fit the actual fluctuation curve of stock when the stock price is in rising or falling period. When the stock price is in a period of volatility, The difference between the predicted output and the expected output of the BP network is large. So for some stocks that are in the ascending or descending period, using the BP network to forecast will yield good forecasts.

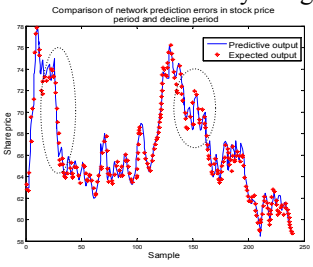

Figure 5 Comparison of network prediction errors in stock price period and decline period

2)Predict the price increase is difficult to predict the stock price

In practice, the prediction of the price change is more practical than the prediction of the stock price. Therefore, this article uses the same sample and also trains the BP network with the change of the stock price. However, due to the volatility of the stock price fluctuation, Relatively large, so with the BP network training accuracy of only about 0.05. Judging from the error of the training samples, the prediction of the

range of stock prices can not be realized simply by the BP network.

3)Input variables are not better

In general, with the increase of input variables, BP network forecasting accuracy will rise, and its stock price forecasting ability will also increase. However, if the newly added input variable is not highly correlated with the stock price, the newly added input variable is likely to become a disruptive factor in the stock price forecasting model. Based on the original input variables, this paper adds two new variables, the stock price increase yesterday and yesterday's volume increase, and got the following sample error. Therefore, in BP network based stock price prediction, the choice of input variables is very important. A reasonable choice of input variables will improve the network's predictive ability so that the network can accurately predict the stock price.

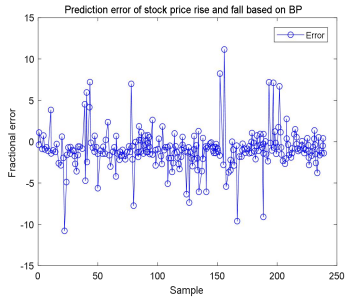

Figure 6 Prediction error of stock price rise and fall based on BP

5. CONCLUSION

Because BP neural network has strong self-learning ability, adaptive ability and fault-tolerant ability, it can under certain conditions, to a certain extent, to judge the stock price trend. However, because the stock market is a complex system with unstable and nonlinear dynamic changes, and the variables that affect the stock price can not be completely determined, the simple prediction of the stock price that can be realized by the BP network is limited. Other mathematical methods need to be incorporated to improve the prediction accuracy .

ACKNOWLEDGMENTS

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Based on filtered back projection CT imaging system

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Abstract: Filter back-projection algorithm is the use of analytical, transformation and reconstruction to build the reconstruction image. It features easy to implement, fast, and high-quality images that can be reconstructed, but requires high projection data integrity. This paper will analyze the algorithm from the perspective of principle and application, focusing on the research of the parallel beam projection from the filtered back-projection algorithm. Finally, the image is reconstructed by means of MATLAB software and the influence of each parameter on the reconstructed image is analyzed.
Keywords: CT technology; Image reconstruction; Filtering back projection algorithm; Parallel beam

1. INTRODUCTION

The so-called CT technique is X-ray computed tomography, which is an emerging technology developed in the 1980s that combines disciplines such as radiophotonics, information science, microelectronics, and computer science. We know that when X-rays irradiate different objects, each object has different absorption and transmissivities for such rays. Reconstruction uses this principle. After the rays are irradiated, they are received by the detector, so that we can calculate the attenuation according to attenuation The number of its distribution image, which is the basis of CT imaging technology. It is precisely because of this non-destructive testing technology that CT technology is used in the detection of objects without damaging the internal structure of the object, so it is widely used in many fields such as medicine, biology, aerospace and aviation.Image reconstruction is the process of reconstructing the cross-section from the projection of the object's projection to the plane.

2. FILTERING BACK PROJECTION RECONST-RUCTION ALGORITHM

Image reconstruction plays an important role in CT technology. In essence, it is in accordance with the collected data, the use of electronic computers to solve the image matrix of pixels, and then rebuild the image process.

(1) CT imaging principle

a) Projection

After the ray passes through the object, due to the absorption or scattering of the object, the intensity of the ray will be attenuated when we detect it. When X-rays pass through a material of uniform material, the decay rate of the intensity is proportional to the intensity itself, namely:

$$\frac{dI}{dl} = -\mu I \tag{1}$$

Where I is the ray intensity, l is the thickness of the material in the direction of the ray, and μ is the attenuation coefficient of the material to the ray, which gives:

$$I = I_0 e^{-\mu l} \tag{2}$$

Where I_0 is the incident intensity. When the energy of X-ray is constant, the attenuation coefficient μ varies with the material through which the ray passes. Equation (2) is called Beer-Lambert's law.

When X-rays pass through non-uniform objects composed of materials with different attenuation coefficients, (1) is a function of a plane coordinate x, y . When ray travels along L in the xy plane, Become:

$$I = I_0 e^{-\int_L \mu(x,y)dl} \tag{3}$$

Where $\int_L \mu(x,y)dl$ is the line integral of $\mu(x,y)$ along L, as shown in Figure 1:

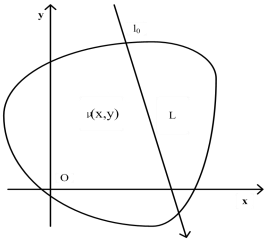

Figure 1 The x-ray passes along

The straight line L through the area where the attenuation coefficient is $\mu(x,y)$.

$$p(l)=\int_L \mu(x,y)dl=\ln\frac{I_0}{I} \tag{4}$$

The value at the right end of the above equation is obtained from the measurement data of the detector of the CT system. The set of $p(l)$ is the projection data, which can be derived from projection. If the ray is irradiated from different directions, it can be obtained from the projection data $p(l)$ on the corresponding path, thus forming a projection data set. Image reconstruction is the process of calculating $\mu(x,y)$ using projection data $p(l)$ sets.

b) Radon transform and its inverse transform

The expression of the inverse transformation of the following integral transformation given by the Austrian mathematician Radon in 1917 provided the theoretical basis for image reconstruction. As shown in Figure 2:

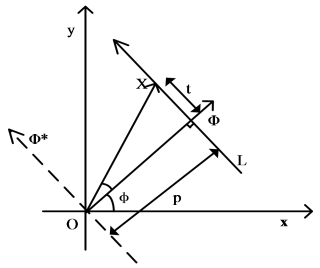

Figure 2 Radon transform diagram

Let L of the equation is:

$$p=x\cos\phi+y\sin\phi \tag{5}$$

Where p is the distance from the straight line to the source point, and is the angle between the positive direction of the x-axis and the perpendicular of the straight line, then (p,ϕ) and the straight line L on the oxy plane correspond to each other. Let $f(x,y)$ be the image function to be reconstructed. By the transformation as follows:

$$\bar{f}(p,\phi)=\int_L f(x,y)dl \tag{6}$$

The style is called the Radon transform $f(x,y)$ .In fact, this is equivalent to an operator, denoted by R, which associates the function in (x,y) -space with the function in (p,ϕ) -space. Since (p,ϕ) is the integral of f along L, it can be considered that a point on (p,ϕ) -space corresponds to a straight line L on (x,y) -space, $X=(x,y)$ in vector, or:

$$\begin{cases} x=p\cos\phi-t\sin\phi \\ y=p\sin\phi+t\cos\phi \end{cases} \tag{7}$$

After transformation, the above becomes:

$$\bar{f}(p,\phi)=\int_{-\infty}^{+\infty} f(p\cos\phi-t\sin\phi,\ p\sin\phi+t\cos\phi)dt \tag{8}$$

In this way, the corresponding reconstruction process is Radon inverse transform.

c) Fourier transform

A univariate continuous function Fourier transform is defined as:

$$F(\omega)=\int_{-\infty}^{+\infty} f(x)e^{-i2\pi\omega x}dx \tag{9}$$

Among them, $i=\sqrt{-1}$. If $F(\omega)$ is given as a continuous function, then the inverse function also exists, with the inverse Fourier transform to get the original function $f(x)$, namely:

$$f(x)=F_1^{-1}[F(\omega)]=\int_{-\infty}^{+\infty} F(\omega)e^{i2\pi\omega x}du \tag{10}$$

Constitute two equations Fourier transform.

The one-dimensional Fourier transform formula is extended to two-dimensional, and the binary continuous function is set to $f(x,y)$. The definition of the Fourier transform and its inverse transform is as follows:

$$\begin{aligned} F(\omega_1,\omega_2)&=\int_{-\infty}^{+\infty}\int_{-\infty}^{+\infty} f(x,y)e^{-i2\pi(\omega_1 x+\omega_2 y)}dxdy \\ f(x,y)&=F_2^{-1}[F(\omega_1,\omega_2)] \\ &=\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} F(\omega_1,\omega_2)e^{i2\pi(\omega_1 x+\omega_2 y)}d\omega_1 d\omega_2 \end{aligned} \tag{11}$$

For the Fourier transform, the convolution theorem is one of its important properties, as follows:

$$F(f(x,y)*h(x,y))=F(u,v)\cdot H(u,v) \tag{12}$$

d) Central slice theorem

The central slice theorem is the theoretical basis of tomography. The central slice theorem of two-dimensional image $f(x,y)$ points out that one-dimensional Fourier transform of the projection $P_\phi(x_r)$ of the two-dimensional function image at the angle of view ϕ , the two-dimensional Fourier transform $F(\omega_1,\omega_2)=\hat{F}(\rho,\phi)$ of $f(x,y)$ and the parallel direction of the detector, A slice. ϕ is the angle formed by the slice and the ω_1 -axis, the principle shown in Figure 3:

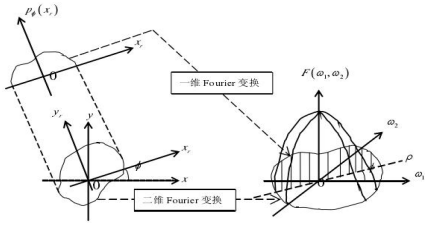

Figure 3 two-dimensional central slice schematic

When the detector is rotated 180 degrees around the object, the central segment of the detector direction corresponding to the two-dimensional Fourier transform $F(\omega_1,\omega_2)$ of the object can cover the entire Fourier space.

(2)Filtering Back Projection Reconstruction Algorithm

Filter back-projection reconstruction algorithm is to first filter the projection data, and then the data back-projection reconstruction, the resulting image is more clear and accurate. The most widely used FBP algorithm is the convolution back projection reconstruction algorithm, which is based on the central slicing theorem.

a)Convolution Backprojection Reconstruction Algorithm

The central slice theorem shows that the two-dimensional Fourier transform of the reconstructed image can be obtained from the projection $F(\omega_1,\omega_2)=\hat{F}(\rho,\phi)|_{\phi}=F_1[p_{\phi}(x_r)]=P(\rho,\phi)$ of $f(x,y)$ at different viewing angles ϕ, and the coordinate schematic of the FBP reconstruction algorithm is shown in FIG. 4:

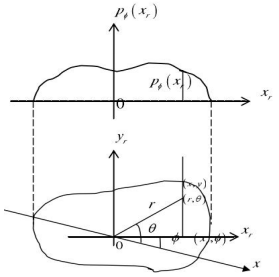

Figure 4 FBP algorithm coordinate system

The image to reconstruct is:

$$\begin{aligned}\hat{f}(r,\theta)&=f(x,y)\\&=F_2^{-1}[F(\omega_1,\omega_2)]\\&=\int_{-\infty}^{\infty}\int_{-\infty}^{\infty}F(\omega_1,\omega_2)e^{i2\pi(\omega_1x+\omega_2y)}d\omega_1d\omega_2\end{aligned}\tag{13}$$

ρ and ϕ as the picture shows, $\omega_1=2\pi\rho\cos\phi$, $\omega_2=2\pi\rho\sin\phi$, $x_r=r\cos(\theta-\phi)$ can get:

$$\omega_1x+\omega_2y=2\pi\rho r\cos(\theta-\phi)\tag{14}$$

After the above transformation can be obtained:

$$\begin{aligned}\hat{f}(r,\theta)&=f(x,y)=F_2^{-1}[F(\omega_1,\omega_2)]\\&=\int_0^{\pi}d\phi\int_{-\infty}^{\infty}|\rho|P(\rho,\phi)e^{i2\pi\rho r\cos(\theta-\phi)}d\rho\\&=\int_0^{\pi}d\phi\int_{-\infty}^{\infty}|\rho|P(\rho,\phi)e^{i2\pi\rho x_r}d\rho\\&=\int_0^{\pi}p(x_r,\phi)*h(x_r)d\phi\\&=\int_0^{\pi}g[r\cos(\theta=\phi),\phi]d\phi\end{aligned}\tag{15}$$

In the formula:

$$h(x_r)=F_1^{-1}(|\rho|)$$

$$p(x_r,\phi)=F_1^{-1}(P(\rho,\phi))$$

$$g[r\cos(\theta-\phi),\phi]=h(x_r)*p(x_r,\phi)$$

In fact, the process of image reconstruction can be seen as a series of coordinate transformations. Derived from the above, FBP algorithm is projected in a certain perspective, and then filter the projection, do the back projection, these anti-projection values can be accumulated to be reconstructed image.

b) Choice of filter function

The choice of filter function plays an important role in the FBP algorithm. The ideal filter function can make the reconstructed image more accurate and clear. The filter function in the above formula is ideal, not square integrable, so the filter function can not be achieved. The Ram-Lak filter function has a simple form and the reconstructed image has a clear outline. Therefore, the Ram-Lak filter function is selected. The formula is as follows:

$$H_{R-L}(w)rect(w/2B)\tag{16}$$

In the formula:

$$rect(\frac{w}{2B})=\begin{cases}1 & |w|<B=1/(2d)\\0 & |w|>B=1/(2d)\end{cases}$$

The corresponding airspace discrete form is:

$$h_{R-L}(nd)=\begin{cases}\dfrac{1}{4d^2}, n=0\\0, n=\text{even number}, |n|\le(M-1)/2\\-\dfrac{1}{n^2\pi^2d^2}, \quad n=\text{odd number}\end{cases}$$

Where d is the space in the interval, M is the number of samples, according to Nyquist sampling theorem, w maximum frequency $(1/2d)$.

(3) Software Implementation of Filtering Function Back Projection Reconstruction Algorithm.

This article chooses to use MATLAB software to reconstruct the image, because it has its own corresponding function, so it can be used to analyze the influence of parameters on the reconstructed image succinctly. Using the calibration parameters of the CT system obtained in Problem 1 and reading the data in Appendix 3, the projection data is filtered and back-projected with iradon function in MATLAB to obtain the position and geometry of the reconstructed image). After the image is processed, a 256 × 256 image matrix can be obtained, and the area with similar absorption rate is processed to obtain the average absorption rate in different areas (as shown in FIG. 5):

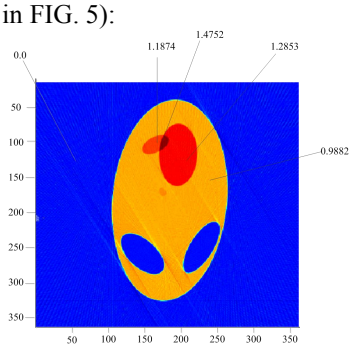

Figure 5 Annex 3 reconstruction image absorption rate distribution

This image is a 360×360 square, corresponding to a

100×100 square tray. The position of the medium relative to the tray and its geometry as shown in Figure 10, the medium is not uniform, the absorption rate is roughly distributed as shown in Figure over its absorption rate in the table below:

Table 1 Annex 3 Absorption rate table

	1	2	…	255	256
1	0.015686	0.015686	…	0.031373	0.023529
2	0.023529	0.007843	…	0.007843	0
3	0.023529	0.007843	…	0.007843	0
…	…	…	…	…	…
254	0.015686	0.031373	…	0.039216	0.054902
255	0.047059	0.039216	…	0.039216	0.031373
256	0.086275	0.007843	…	0.007843	0.015686

Cartesian coordinate system is established. Since the tray is 100×100 square, it can be corresponding to the absorption rate of the medium (matrix of 256× 256). By finding the position of ten points in the absorption matrix , Using the interpolation method to calculate the absorption rate corresponding to ten points, as shown in the following table:

Table 2 ten locations corresponding to the absorption rate

Position in the tray		Absorption rate
X coordinate	Y coordinate	
10.0000	18.0000	0.0172
34.5000	25.0000	0.9958
43.5000	33.0000	0.0138
45.0000	75.5000	1.1828
48.5000	55.5000	1.0510
50.0000	75.5000	1.4666
56.0000	76.5000	1.2840
65.5000	37.0000	0.0000
79.5000	18.0000	0.0160
98.5000	43.5000	0.0078

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The Sun Shadow Positioning Model Based On Genetic Algorithm

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Abstract: Determine the location and date of video capture is an important branch of video data analysis technology. First, the shadow length function is determined according to the solar declination angle, the hour angle and the solar elevation angle. Then, the variation law of solar shadow of the video is extracted and the change of solar shadow coordinates is obtained. A multi-objective optimization model is established. Using the 1st opt software of LM algorithm, the unknown parameters such as latitude, longitude, altitude and date of measurement are fitted to obtain the optimal Parameter fitting effect, to achieve the shooting date and place to determine.
Keywords: Least square method; LM algorithm; solar elevation angle

1. INTRODUCTION

With the development of computer technology and the era of big data, how to obtain useful information from a large amount of data in a short period of time has become a hot research topic [1]. Among them, the video data analysis technology has a certain representation. Determine the location and date of video capture is an important branch of video data analysis technology. Sun shadow positioning technology is through the analysis of video objects in the shadow of the sun over a period of time to determine the location and date of video capture. Determine the location and date of video capture has a wide range of applications in areas such as crime prevention, traffic management, aerospace and other fields.

This article is based on the 2015 "Higher Education Society Cup" National Undergraduate Mathematical Contest Modeling A solar shadow positioning changes the law of the object to establish the shadow of the sun to determine the geographical location of video shooting dates.

2. KNOWN DATE OF THE SUN SHADOW POSITIONING MODEL

RESEARCH IDEAS

In order to determine the geographical location and time of the object according to the change of the sun's shadow, we first need to clarify the relevant concepts and formulas of the solar declination angle, the hour angle, the solar elevation angle and the like.

(1) Declination of the Sun[2]: The angle between the Earth's equatorial plane and the line connecting the Sun and the Earth's center.

Calculation formula:

$$\delta = 0.3723 + 23.2567\sin\theta + 0.1149\sin 2\theta - 0.1712\sin 3\theta - 0.758\cos\theta + 0.3656\cos 2\theta + 0.0202\cos 3\theta \quad (1)$$

Including Japan, the formula is:

$$\theta = \frac{2\pi(n - N_0)}{365.2422} \quad (2)$$

(2)In the formula, n is the ordinal number, which means the serial number of the observation date in the current year on the premise of New Year's Day, January 1, And the formula is:

$$N_0 = 0.2422\ (nf - 1985) + 79.6704 - \mathrm{int}\left(\frac{nf - 1985}{4}\right) \quad (3)$$

Among them, nf is the current year。

(2) Horn[3]: The location of the sun and the declination of the local meridian.

Calculation formula:

$$T = 15\left(t - \frac{120^\circ - \eta}{15^\circ} - 12\right) \quad (4)$$

Where t is Beijing time and η is the longitude of the observation place.

(3) The solar elevation angle [4]: refers to the angle between the incident direction of sunlight and the ground plane. Professionally speaking, the solar elevation angle refers to the angle between the sun's rays and the earth's surface tangent connected to the earth's center.

Calculation formula:

$$\sin\alpha = \sin\delta\sin\phi + \cos\delta\cos\phi\cos T \quad (5)$$

(4) Shadow length:

$$l = h\cot\alpha \quad (6)$$

Where h said bar height, l said the film length.

Solar declination angle, solar angle, the sun's altitude

angle, the azimuth of the sun, the shadow length of the relationship between the four parameters shown in Figure 1.

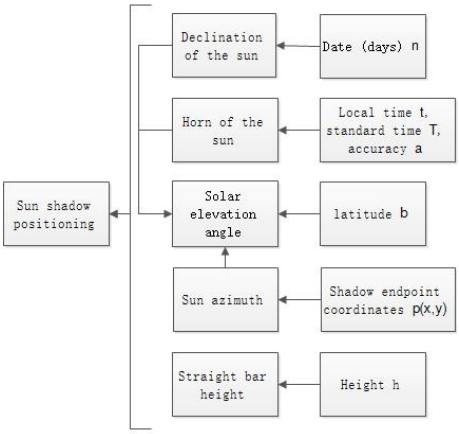

Figure 1 solar shadow positioning model

The simultaneous equations (1) ~ (6) show that the model of solar shadow length change is:

$$l = h\cot(\arcsin(\sin\delta\sin\phi + \cos\delta\cos\phi\cos T)) \tag{7}$$

3. DETERMINES THE SUN SHADOW POSITIONING MODEL FOR THE DATE AND PLACE OF THE VIDEO CAPTURE

3.1.Research ideas

$$l = \sqrt{x^2 + y^2} \tag{8}$$

Combining the above formula with the model formula (7), the model according to the location where the straight rod is located is:

$$l(t,n,nf,h,\varphi,\eta) = \sqrt{x^2+y^2} = h\cot(\arcsin(\sin\delta\sin\varphi + \cos\delta\cos\varphi\cos(\mathrm{T}))) \tag{9}$$

The known parameters are geographical latitude φ, longitude η and pole length h, observation year nf and ordinal number n of observation. To solve the longitude and latitude of the place where the straight rod is located, we mainly use the LM algorithm fitting nonlinear function parameters.

3.1.1 LM algorithm basic principle

LM algorithm: mainly used to solve the problem of nonlinear least squares, used to do curve fitting. According to the literature[7], the main principle is to use the iterative program to evaluate whether the best fitting result is obtained by calculating the sum of squared residuals. When the sum of squared residuals is the smallest, the iteration is finished and the optimal fitting result is obtained.

Which the objective function:

$$X^2(a) = \frac{1}{N-P}\times \sum_i\sum_j [\mathrm{y} - f_{ij}(x_{1i}x_{2i},\ldots,a1,a2,\ldots)]^2 \tag{10}$$

Where X^2 is the residual sum of squares; N is the total number of experimental points; P is the number of parameters.

Least square method shows that the objective function should meet the minimum sum of square error, namely:

$$y = \min X^2(a) \tag{11}$$

Expansion of X^2 into second order Taylor series, and omitted high-order items available:

$$X^2(a) = \gamma + \frac{\partial X^2}{\partial a_k} + \frac{1}{2}a\cdot D\cdot a \tag{12}$$

Where D is the Hessian matrix, a for the band seeking parameters, k = 1,2, ... m. The LM algorithm makes the parameter a_{cur} of this iteration infinitely close to the optimal parameter $a_{\min}$ through multiple iterations, that is:

$$a_{\min} = a_{\mathrm{cur}} + D^{-1}[-\bigtriangledown \mathrm{X}^2(a_{cur})] \tag{13}$$

The use of LM algorithm, is the minimum requirement of the following formula

$$X^2(\varphi,\eta,\ n,nf,h) = \frac{1}{21-5}\times \sum_i [l_i^{`} - l_i(\mathrm{t},n,nf,h,\varphi,\eta)]^2 \tag{14}$$

You can get the optimization problem:

$$l(t,n,nf,h,\varphi,\eta) = \sqrt{x^2+y^2} = h\cot(\arcsin(\sin\delta\sin\varphi + \cos\delta\cos\varphi\cos(\mathrm{T}))) \tag{15}$$

n, nf, h, φ, η are unknown

3.2 Video data extraction

Using MATLAB every two minutes to extract a picture, the first picture extracted as shown in Figure 2, and the extracted data binarization, the shadow of each moment to get 20 sets of data, the previous 10 sets of data as an example, such as Table 1.

Figure 2 extracted the first picture

The actual straight bar length of 2 meters, through the establishment of proportional relationship, can get the actual shadow length.

$$\frac{L}{h} = \frac{l_i^{'}}{l_i} \tag{16}$$

Wherein, L is the length of the straight rod in the

graph, h is the actual straight rod length, $l_i^{'}$ is the shadow length in the time picture, and l_i is the actual shadow length at the i th moment.

From (17) we can see that the corresponding moment of the first moment

$$l_i = \frac{hl_i^{'}}{L} = 0.186\, l_i^{'} \tag{17}$$

Table 1 the shadow of the first 10 moments is really long

Time	Shadow	Long rod	Shadow length
8:55:06	12.5	10.75	2.325581395
8:57:06	12.32	10.75	2.292093023
8:59:06	12.15	10.75	2.260465116
9:01:06	12	10.75	2.23255814
9:03:06	11.85	10.75	2.204651163
9:05:06	11.69	10.75	2.174883721
9:07:06	11.57	10.75	2.15255814
9:09:06	11.4	10.75	2.120930233
9:11:06	11.24	10.75	2.091162791
9:13:06	11.13	10.75	2.070697674

3.3 Solve the video shooting date and latitude and longitude

The use of LM algorithm, is the minimum requirement of the following formula

$$\chi^2(\varphi,\eta) = \frac{1}{20-2} \times \sum_i [l_i^{'} - l_i(t,n,nf,h,\varphi,\eta)]^2 \tag{18}$$

That is to get the optimization problem:

$$\min \chi^2(\varphi,\eta) \tag{19}$$

Solve using lstOpt to get straight rod position:

$\varphi = 41.32$, $\eta = 111.23$

The results of the global positioning, get the possible position of the straight rod may be located in Inner Mongolia, as shown in Figure 3

Figure 3 Straight position prediction

3.4 Error Analysis

From the results calculated by the 1stOpt software, the measured values and calculated values of the film length are extracted

Table 2 video straight shadow measured value and calculated value list

Measured value of shadow length l(i)	2.3455501	2.3101037
Shadow length calculation l' (i)	2.3483274	2.3177012
Measured value of shadow length l(i)	2.2007501	2.1712713
Shadow length calculation l' (i)	2.1996628	2.1712715
Measured value of shadow length l(i)	2.0708154	2.0560662
Shadow length calculation l' (i)	2.061833	2.0354571
Measured value of shadow length l(i)	1.9380531	1.8997073
Shadow length calculation l' (i)	1.9336323	1.9090422

From the result calculated by 1stopt software, the curve of parameter fitting is extracted, as shown in Figure 4, the value of shadow length error calculated by 1stopt software is:

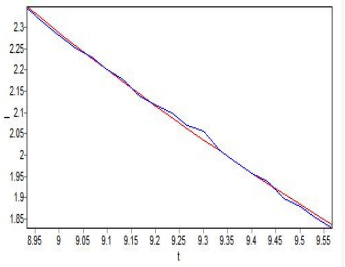

Figure 4 video straight rod parameter fitting diagram

$$r = \sqrt{(l(i) - l^{'}(i))^2} = 0.034022 \tag{20}$$

Therefore, the error between the measured value and the calculated value of the video length is controlled within 0.05, and the accuracy is high, and the correlation coefficient is obtained, which shows that the effect of the fitting parameter of the LM algorithm is good and the reliability is high.

Finally, the use of 1stOpt to get the location of straight rod and measurement date when the date is unknown:

$\varphi = 41.9549$

$\eta = 110.099$

$n = 170.48$

$nf = 2015.32$

The ordinal number 170, converted to the date of June 23, using Google Maps for global positioning to the possible location of the straight rod for Inner Mongolia, shown in Figure 5.

Figure 5 Straight position prediction

4.ACKNOWLEDGMENT

The solar shadow localization model established in this paper is abstracted and simplified, and deduced by using the related knowledge of elementary mathematics. The established model of the sun's shadow is also applicable to fields such as architecture and optics, and is more versatile. Using genetic algorithm to solve, convergence speed, to a certain extent, can avoid the local optimal solution.

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Application of Kalman Filtering Algorithm in Commodity Pricing Strategy

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Abstract: In order to improve the profit of commodity and reduce the loss of commodity, an improved extension based on the extended Kalman filtering algorithm is proposed. Commodity pricing methods of Kalman filtering algorithm. Firstly, through the collection of relevant information of the target, build mathematical model of Kalman filtering algorithm, then use the improved extended Kalman filter algorithm to estimate the target price, final get the data of simulation experiments. The results show that compared with the extended Kalman filtering algorithm, the improved extended Kalman filter can improve the pricing accuracy of commodities, and weaken the influence of abnormal errors on commodity pricing.
Keywords: Kalman filter algorithm; Commodity pricing; Matlab simulation experiment; Pricing forecast

1. INTRODUCTION

In 1960, Kalman published his most famous paper "A New Approach to Linear Filtering and Prediction Problems", which described a recursive solution to the linear filtering problem for discrete data. In this paper, a series of recursive mathematical formulas are given, and an efficient and computable method is proposed to estimate the state of the process and minimize the mean square error of the estimation. The biggest advantages of Kalman filter algorithm is adopted to solve the linear recursive filtering problem, it only needs to measure the current value and the estimated sampling period before a value to state estimation, because this recursive method does not require a lot of storage space, every step of the calculation amount is small, the calculation steps clear, very suitable for computer processing, so Kalman filter in popularity, and has wide application prospect in various fields. The Kalman filter belongs to a software filtering method, its basic idea is: Based on minimum mean square error as the best estimation criterion, the state space model using signal and noise, the observation is estimated by using the previous value and the current value to update the estimation of state variables, calculate the estimated current value, according to the algorithm the system of equations and observation equations are estimated to meet the minimum mean square error of signal processing. The original Kalman filtering algorithm is called the basic Kalman filtering algorithm, and it is suitable for solving the state or parameter estimation problem of stochastic linear discrete systems. Kalman filter includes two main stages: prediction and correction. Prediction process is mainly to establish a priori update equation on the current state estimation using time, timely forward projected current state variables and the error covariance of the estimated value for the next time state of constructing a priori estimates, the correction process responsible for feedback, using the measurement update equations based estimation value and the current measurement variables to establish to improve the current state of the posterior estimation in the prior prediction process. Such a process is called predictor corrector process, and the corresponding estimation algorithm is called predictor corrector algorithm

2. KALMAN FILTERING ALGORITHM

The core of the Kalman filtering algorithm[1] is composed of two sets of equations, namely the time update equation and the state update equation. The time update equation completes a priori estimate of the current state of the system, calculates the current state variable value, and calculates the covariate difference of the error. The state updating equation uses the time update equation to obtain a priori estimate of the system state and the measurement of the current state value of the system, and then completes the posterior estimation of the current state. The estimation process of the algorithm is shown in Figure 1

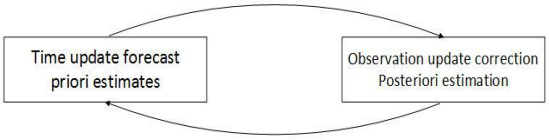

Figure 1 Discrete Kalman filter iterative loop

3.EXTENSION AND IMPROVEMENT OF KALMAN FILTERING

The basic Kalman filter is the optimal filter in the sense of minimum mean square error only when the target state equation and the sensor observation equation are all linear. In practice, the commodity pricing system is a nonlinear system, and it is a nonlinear filtering problem. The extended Kalman

filter (EKF) algorithm is a very widely used nonlinear filtering algorithm. EKF by Taylor of the nonlinear function of the expansion of the first-order linearization truncation, thus the nonlinear filtering problem into linear filtering problem, and then use the linear filtering theory to solve the nonlinear filtering problem, suboptimal filtering algorithm. The state equation and observation equation of nonlinear motion model can be described as:

$$X(k+1) = f[X(k), k] + W(k)$$

$$Z(k+1) = h[X(k+1), k+1] + V(k+1)$$

$$\begin{cases} F(k) = \dfrac{\partial f}{\partial X^T}\Big|_{X=\hat{X}(k+1|k)} \\ H(k+1) = \dfrac{\partial h}{\partial X^T}\Big|_{X=\hat{X}(k+1|k)} \\ f(k) = f[\hat{X}(k|k), k] - F(k)\hat{X}(k|k) \\ Y(k+1) = h[\hat{X}(k+1|k), k+1] - H(k+1)\hat{X}(k+1|k) \end{cases} \quad (1)$$

The extended Calman filter (EKF) algorithm uses Taylor formula to expand the nonlinear function according to its order, omitting the high and order terms. Therefore, the linear error is inevitably introduced in the filtering process. When the state of the system and the observation model are close to linear, the filtering results will be closer to the true value. When the linear model error is large, the filtering results will appear significant deviation, and even lead to filtering divergence. Aiming at the shortcomings of EKF, an improved extended Calman filtering algorithm (IEKF) is proposed in this paper, that is, multiple iterations are carried out when the observation matrix is calculated to improve the filtering accuracy. The IEKF iteration process is as follows:

$$X(k+1) = f[X(k), k] + W(k)$$

$$Z(k+1) = h[X(k+1), k+1] + V(k+1)$$

$$\begin{cases} F(k) = \dfrac{\partial f}{\partial X^T}\Big|_{X=\hat{X}(k+1|k)} \\ H(k+1) = \dfrac{\partial h}{\partial X^T}\Big|_{X=\hat{X}(k+1|k)} \\ f(k) = f[\hat{X}(k|k), k] - F(k)\hat{X}(k|k) \\ Y(k+1) = h[\hat{X}(k+1|k), k+1] - H(k+1)\hat{X}(k+1|k) \end{cases} \quad (2)$$

$$H_{k+1}^0 = \frac{\partial h}{\partial X}\Big|_{X=\hat{X}_{k+1,k}} \quad H_{k+1} = \frac{\partial h}{\partial X}\Big|_{X=\hat{X}_{k+1}}$$

4. CALMAN FILTERING SIMULATION

In this paper, Calman filtering algorithm is applied in the fourth questions of B contest of mathematical modeling in 2017. Through experiments, it is proved that the marketing scheme of "making money by taking photos" is superior to the existing economic model of App. According to the test data shows that, if the units in the region with abundant human resources, the corresponding region of the task better, the task should be appropriate to reduce the price; if the units in the region by members of the small number of the corresponding task completion is poor, the price should be appropriate to raise the standard task. Finally, the paper concludes that the unfinished task is due to the failure of pricing strategy, and the pricing is too low to attract more members.

The system model is linearized by Taylor expansion, and then the Calman filtering is performed. The recursive process of improved algorithm based on Calman filter as shown in figure 2:According to the Calman filter 2 improved recursive algorithm. The extended Calman filter algorithm correction effect on the transit time is verified using the Matlab[2] simulation software, the experimental model can be set to a known distance target using ultrasonic ranging module.

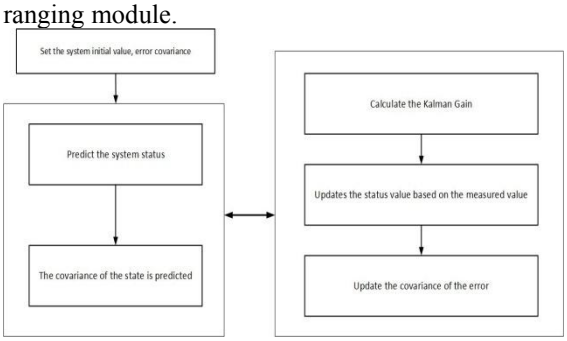

Figure 2 recursive process improved Kalman filter wave algorithm

After the initial value is obtained by the extended Calman filtering algorithm, the 50 iterative operation is combined with the ranging model, and the operation results are shown in figure 3:

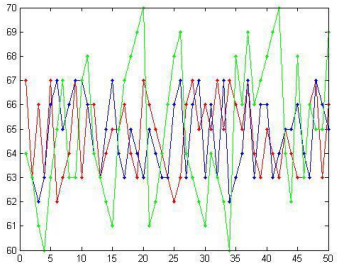

Figure 3 Calman filtering algorithm on task price

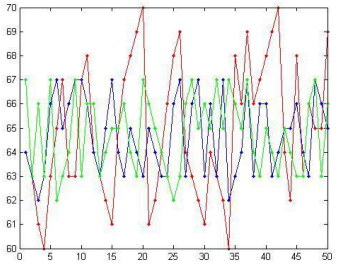

Figure 4 Effect of modified Calman filtering algorithm on task price

This is after the Matlab program operation curves. (this article refers to the annex from the 2017 Higher

Education Press Cup National Undergraduate Mathematical Modeling challenge) task has been completed ,the red line represents the attachment, in the price (not in accordance with the improved model prevail), the task has been completed ,the green line represents a price (in accordance with annex in the improved final model.) the line represents, Annex III purple have completed the task of the price (in accordance with the improved final model.).

Using the data from the annex to the best pricing scheme, you can get a green broken line chart, compared with the red line, this pricing scheme applies to "take pictures to make money" this business model. According to the hypothesis, when the data of annex three is taken into account, the pricing trend is close to the best pricing scheme adopted in Annex 1, and the revised pricing scheme can be applied to Annex 3 to reach the maximum profit.

It can be seen that using Calman filtering improved algorithm to predict the price is consistent with the actual situation, and has practical significance.

ACKNOWLEDGMENT

In order to obtain better results of commodity positioning, according to the shortcomings of the traditional Calman filtering algorithm, an improved method is proposed extended Calman filter algorithm of commodity pricing methods, and through simulation experiments to test its validity and superiority. The simulation results show that the improved extended Calman filter algorithm can not only resist the adverse effects of abnormal error, strong robustness, and improve the accuracy of commodity pricing, and has wide application prospect in many fields.

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Study on the task Pricing of Making Money By Taking Photos

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Abstract:"Taking photos and making money" is a mutual model for enterprises to obtain commodity information through the release of tasks, the reasonable pricing of tasks is the core factor that affects the efficiency of the model. In this paper, the prediction model of photo task pricing based on linear regression is constructed to solve the problem of how to reasonably assign tasks. Firstly, through statistical analysis of existing data, the two main indexes that affect mission pricing are obtained: task peripheral membership density and the credibility of the task. Secondly, using the method of multiple linear regression fitting, the data were repeatedly merged to obtain the inverse relationship between task price and the credibility of the task and task peripheral membership density. The prediction model of task pricing is obtained by modifying the model by introducing the limit rate of reservation task. Finally, on the basis of the training data set contains the pricing task and the corresponding test set, task pricing model is established based on ELM neural network, with the completion of the new pricing pricing forecast, get a new pricing standard.
Key words: Multiple linear regression; ELM neural network; Statistical analysis

1. INTRODUCTION

Nowadays, "Photo-taking" is a relatively easy way to make money, for example, go to the supermarket to check the shelves of some kind of goods, members will be able to complete the task and earn the corresponding profits."Photo-taking" is a do-it-yourself service model under the mobile Internet. Users download the APP, register as a member of the APP, and then collect the tasks that need to be completed on the APP to earn the payment for the task.The do-it-yourself service crowd sourcing platform based on mobile Internet, for the enterprise provides a variety of commercial inspection service and information gathering, compared with the traditional way of market research can greatly save manpower survey costs, and effectively guarantee the authenticity and reliability of the survey data, shorten the cycle of investigation. So APP become the core of the platform, and the task of pricing is the core elements in the APP, how to develop a more reasonable for a variety of different pricing has become the focus of each enterprise. Some factors may affect the completion of the task. If the task has not been completed for a long time, the usage rate of the APP will be reduced. Therefore, this article through the study of task completion rates higher pricing rule, find the key factors of complete task can be better, and at the same time make members get higher pay, achieve a win-win situation.

2. SIGNAL ACQUISITION

In real economic problems, a variable is often affected by multiple variables. For example, household consumption expenditure, in addition to the impact of household disposable income, is affected by a variety of factors such as household wealth, price level and interest rate of financial institutions. The multivariate linear regression model can be described by formula

$$y = a_1 x_1 + a_2 x_2 + a_3 x_3 + \ldots + a_n x_n + k$$

,

where k is a constant term, and a_1 is fixed by $x_2, x_3 \ldots x_n$,the partial regression coefficient of x_1 per unit for y ;Similarly, when b_2 is fixed for $x_1, x_3 \ldots x_n$, the effect of x_2 per unit on y . The partial regression coefficient of x_2 to y [1,2]. Based on this definition, the pricing rules are solved, and the model process is shown in figure 1:

(1)The credibility of the task

The credibility rate can affect the task pricing, the higher the credit rating, the higher the completion rate; On the contrary, the value of credibility is low, and the calculation method of reputation rate is the reciprocal product of credibility and task point to the distance of membership. The calculation formula is:

$$y = \frac{\alpha_i}{d_i} \quad (1)$$

y is credibility rate, α_i is credibility, d_i is the task points to the location of each member.

Each task has a reputation rate for each member, and a new index for each credit rating is given: mission credibility. The calculation formula of mission reliability is:

$$K = \sum_{i=1}^{n} \frac{\alpha_i}{d_i} \quad (2)$$

K is credibility rate. α_i and d_i definition as formula(1).

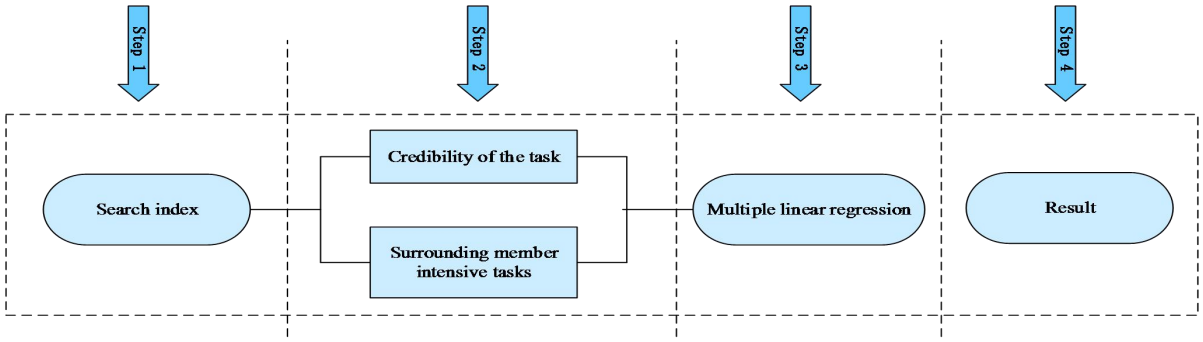

Figure 3 circuit scheme of AD9224

(2)Mission perimeter member intensity

Task between peripheral member density need through the task with the recent membership number calculation, first of all selected range, for within the scope of the member number, and then get it with the ratio of total number of members[3,4]. The calculation method is the ratio between the number of members and the total number of members in the task point range. The formula is:

$$G = \frac{h}{H} \quad (3)$$

G is mission perimeter membership density, h is number of members within the range of task points, H is total membership. Based on attachment 1 and attachment 2 in the data processing, and programming of the processed data code (see appendix 2), the obtained in table 1 (see some data in the following table, all data support material table 1) :

Table 1 task number and two main indicators

Task number	Mission credibility	Mission perimeter member intensity	Task number	Mission credibility	Mission perimeter member intensity
A0001	3550053.059	0.073482428	A0013	2874249.376	0.066027689
A0002	1675626.722	0.059637913	A0014	1691525.182	0.043663472
A0003	5647201.122	0.064962726	A0015	1622082.999	0.041001065
A0004	878887.9538	0.009584665	A0016	2390988.837	0.053780618
A0005	3745005.918	0.057507987	A0017	1979647.228	0.050053248
Task number	Mission credibility	Mission perimeter member intensity	Task number	Mission credibility	Mission perimeter member intensity
A0001	3550053.059	0.073482428	A0013	2874249.376	0.066027689

First, the model formula for task pricing is:

$$y = a_1 x_1 + a_2 x_2 + K \quad (4)$$

In order to find the relationship between task pricing and index, using SPSS to establish multiple linear regression pricing model through data of completed tasks, the index coefficient of table 2 is obtained:

The formula for task pricing is:

$$y_1 = -0.0064 x_1 + -0.023 x_2 + 72.863 \quad (5)$$

By formula (5), credibility and members around the task intensity negative correlation with the task of pricing, so members around task intensity, credibility and pricing task is the main reason for the task has been finished, and member intensity around the mission and task credibility is negatively related to the task pricing into [5]. Therefore, the conclusion is that the surrounding members are more densely populated, and the credibility of the task is high, resulting in lower pricing and lower pricing, which directly leads to the failure of the task to be completed. Through the analysis and treatment of the data, the location of the task and the map of the membership location are drawn, as shown in figure 2: Can be seen from the diagram of the unfinished task points are mainly distributed in both sides, and members of the intensity overlap part of the larger point is more, so from the diagram can be indirectly come to the conclusion: tasks around members intensity bigger impact on the completion of the task or not.

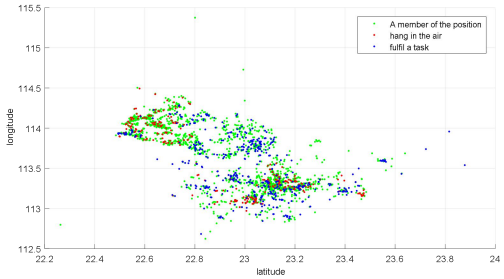

fig. 2 location and location map of the location of the mission

3. MODIFY TASK PRICING

ELM has three layers: input layer, hidden layer, and output layer, similar to traditional neural networks, such as BP neural network. However, it can randomly generate the connection weight between the input layer and the hidden layer and the threshold of the hidden layer neuron, as shown in figure 3.

On the basis of previous research, Huang et al. proposed the following two theorems[6]:

①Theorem 1

Given any Q (x_i, t_i), in which $x_i = [x_{i1}, x_{i2}, ..., x_{in}]$, $t_i = [t_{i1}, t_{i2}, ..., t_{im}]$, an arbitrary range infinitely differentiable activation function g: R→R, is to have a Q SLFN of hidden layer neurons, under the condition of any assignment of $w_i \in R^n$ and $b_i \in R$, the hidden layer output matrix H reversible and $\| \mathrm{H}\beta - \mathrm{T}' \| = 0$.

②Theorem 2

Theorem 2 gives random Q different samples (x_i, t_i), among them, $x_i = [x_{i1}, x_{i2}, \ldots, x_{in}]^T \in R^n, t_i = (t_{i1}, t_{i2}, \ldots, t_{in}) \in R^m$. given any small error $\varepsilon(\varepsilon > 0)$ and an arbitrary interval infinitely differentiable activation function g:R $\rightarrow$ R, there is always a SLFN containing $K(K \leq Q)$ hidden neurons, in the case of any assignment $W_i \in R^n$ and $b_i \in R$, has $\left\| H_{N\times M}\beta_{M\times m} - T' \right\| < \varepsilon$.

It can be seen from theorem 1that if the number of neurons in the hidden layer is equal to the number of training sets, then for any w and b[6], SLFN can approximate the training sample with zero error, as:

$$\sum_{j=1}^{Q} \left\| t_j - y_j \right\| = 0 \quad (6)$$

among them,

$$y_j = [y_{1,j}, y_{2,j}, \ldots, y_{mj}]^T, j = 1,2, \ldots, Q \quad (7)$$

However, when the number of training samples Q is large, the number of neurons in the hidden layer is usually smaller than Q in order to reduce the computational complexity. From the theorem 2, SLFN training error can be approximated to an arbitrary $\varepsilon > 0$, as:

$$\sum_{j=1}^{Q} \left\| t_j - y_j \right\| < \varepsilon \quad (8)$$

In addition, related studies have shown that not only many non-linear activation functions [7]can be used in ELM, such as S-type functions, sine functions and composite functions, and can also use nondifferentiable functions, and even use discontinuous functions as activation functions.

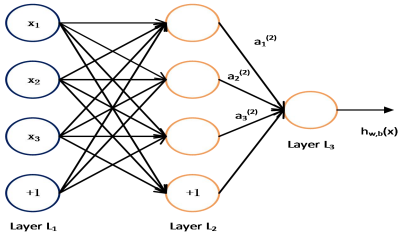

fig. 3 ELM structure

The main indicators affecting the pricing are: membership intensity around the task S, task reputation K and booking task rate P. The membership density and task credibility of the task are the same as above. The calculation method of the quota rate of the predetermined task is the result of the percentage of the reservation limit and the credibility of the task:

$$P = \frac{m}{d_i} \quad (9)$$

Among them, m represents the percentage of the reservation quota, and d_i represents the distance between the task point and the individual members.

From the topic given in the data, extract the member intensive, credibility and booking quest limit rate, put these data as input, the pricing as the output, selected the 400 groups of data as a training set, selected the 435 groups of data set as predicted, with ELM to predict, the results are as follows:

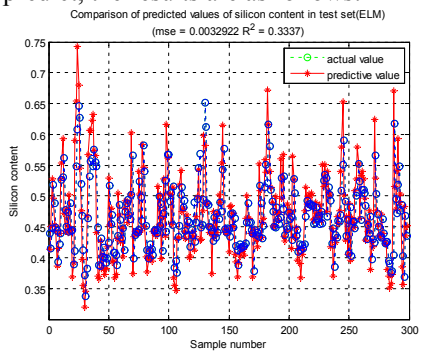

fig. 4 comparison of prediction results and real values

The predicted values of the ELM model were compared with the real values, and the results were shown in table 3:

Table 3 predictive value and real value

Predictive value	Real value	Difference value

64.9712	65.0	0.0288
65.5369	65.5	0.0369
65.5179	65.5	0.0179
65.5036	65.5	0.0036
67.4672	67.5	0.0328
66.5070	66.5	0.0070
66.0723	66.0	0.0723
65.4993	65.5	0.0007

Real value is to use the first question has completed the task in the task of data pricing, had already done a reasonable pricing, shows that using reasonable pricing to known and predicted values are compared, get difference is small, so that the pricing model based on the ELM neural network is reasonable. The model is used to predict failed pricing tasks, and the better pricing methods are shown in table 4:

Table 4 does not complete task pricing forecast

The longitude of task	The latitude of task	Original pricing (not completed)	Predictive value
22.68620526	113.9405252	65.5	69.50980555
22.55899906	114.2413174	75	64.35309632
22.62558348	114.1549664	69	75.54624869
22.72133411	114.0616196	67	71.26777596
23.159336	113.3387113	65.5	72.30174066
22.8100654	113.4141599	75	68.46809924

The predicted value is compared with the original price of the unfinished task, which can be concluded that the reason for the uncompleted task is unreasonable pricing.

4.CONCLUSION

This paper presents a task pricing law of the original pictures to make money, through the analysis of existing data, the data to make use of linear regression curve fitting, it is concluded that task pricing and credibility and peripheral members, based on the relationship between intensity task: $y_1 = -0.0064x_1 + -0.023x_2 + 72.863$, namely task pricing and credibility and peripheral members task is inversely proportional to the intensity. Through to the existing data mining and the comparison of gathering data, select the new factors affecting task of pricing, add it to the original rules, form new pricing rule, at last, by using the new pricing rule and rule of the original pricing compare, discover new task pricing can be increased completion of tasks.

ACKNOWLEDGMENTS

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Campus Football Monitoring System Based on Fuzzy Neural Network

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Abstract: An effective monitoring system of campus football activities have established based on fuzzy forward artificial neural network and put forward specific implementation plan for the administrative departments as well as pilot schools to better optimize the campus football environment and enhance the football atmosphere. Taking 5 campus football distribution schools in Kunming, China as the research object. Making standardization process of 6 evaluation indexes, and the result is taken as the input layer. With the improved back propagation algorithm, the maximum, minimum and average of each index are selected as the input layer of the neural network training samples, combined with the iterative fuzzification of the connection weights into the reasoning layer to get the results of the evaluation of five schools， which can avoid the subjective weight determination method of human factors on the results of the interference. For the campus football activities monitoring system, some suggestions have put forward: the designated schools and all relevant units shall implement the binding and guiding rules and regulations on school football issued by the administrative departments; the organization of activities shall be strictly hierarchical to form the organization of the organization of the activities; and the media of public opinion should strengthen the publicity and supervision and strengthen the Work summary and promotion.
Keywords: Public management; Supervision system; Fuzzy forward artificial neural network; Organizational network classification

1. INTRODUCTION

Youth football is the future and hope of football. Improving the system of campus football monitoring and establishing a complete campus football supervision mechanism is the only way to build a football power. China, for example, although committed to the development of football on campus, is still not widely recognized, the main reason is not formed an effective monitoring mechanism, so that there is a big gap between the expectations and the prospect of football on campus to carry out the status quo. Therefore, this paper establishes the monitoring system of football activities on campus, monitors relevant administrative departments and pilot schools, and puts forward corresponding implementation plans to solve the problems existing in the process of activities.

Fuzzy neural network is a proper combination of fuzzy logic and neural network, and its operation is not completely black box operation. It can make good use of expert experience, and fuzzy neural network is suitable for expressing fuzzy or qualitative knowledge. Its reference method is similar to human thinking mode. And it has the advantages of parallel computing, distributed information storage, fault tolerance and adaptive learning capabilities[1]. This paper applies fuzzy neural network to the field of performance evaluation and constructs a campus football supervision system based on fuzzy neural network. Taking the five campus football distribution schools in Kunming， China as the research object, the data is put into the monitoring system to evaluate the campus football performance. Aiming at the monitoring system of campus football activities, a specific implementation plan is put forward.

2. ESTABLISHMENT OF CAMPUS FOOTBALL SUPERVISION SYSTEM BASED ON FUZZY NEURAL NETWORK

Fuzzy neural network is the fuzzy logic and neural network properly combined to form a better performance than the single fuzzy system or a separate neural network system. Its operation is not a complete black box operation, and it can make good use of expert experience. Fuzzy neural network is suitable for expressing fuzzy or qualitative knowledge. Its inference method is similar to human thinking mode and can deal with uncertainties, nonlinearities and other uncertainties. It also has the advantages of parallel computing, distributed information storage, fault tolerance and adaptive learning capabilities[1]. Therefore, this paper applies fuzzy neural network to the field of performance evaluation, and constructs a campus football supervision system based on fuzzy neural network, then evaluates the campus football performance.

2.1 Fuzzy Forward Artificial Neural Network Structure

There are several forms of fuzzy forward artificial neural network, this paper constructs the network structure shown in Figure 1. The network input is $X=(x_1,x_2,\cdots,x_m)$, it means there are m inputs, n variable languages, and a single output. The entire network consists of four layers, namely the input layer, fuzzy layer, reasoning layer and output layer[2].

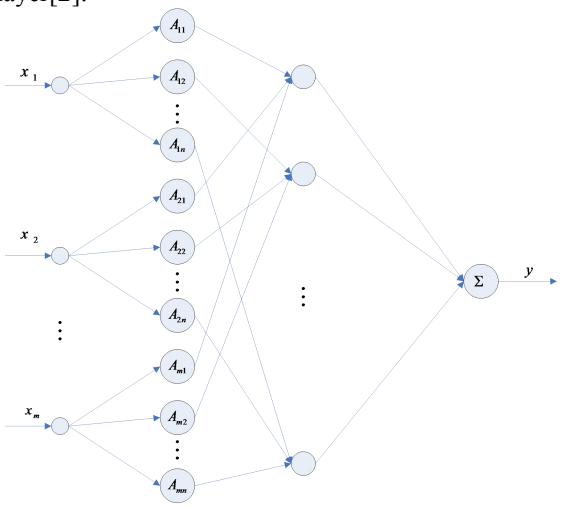

Fig.1 Fuzzy Forward Artificial Neural Network Structure

Input layer

The elements in the input layer are the values of each indicator of the monitoring system, but the different dimensions of the indicator values represent different meanings. Therefore, before the comprehensive evaluation, each indicator value can be converted into the dimensionless standardized data so that the unified Standard to measure. Non-dimensional methods are straight-line, polyline and curved line 3 kinds, generally apply the straight-line method, the use of extremely poor conversion formula to standardize various indicators. There are m neurons in this layer in Fig. 1, and the input and output of neurons in the input layer are:

$$I_j^1=x_j \quad (j=1,2,\cdots,m) \tag{1}$$

$$o_{ij}^1=x_j \quad (i=1,2,\cdots,n;j=1,2,\cdots m) \tag{2}$$

Blurry layer

Its role is to fuzzify the input, that is, according to the membership function we can obtain each input fuzzy variable value. The network fuzzy variable in Figure.1 has n language values, generally 3 to 9, and there are $(m\times n)$ neurons in this layer[3]. In general, trapezoidal function was chosen and the form of quaternion (a,b,c,d) can be used to express the membership function. When there are n fuzzy linguistic values, the fuzzy vector is $\{a_1,a_2,\cdots,a_{2n-2}\}$. If there is a range A, $\{A_{ij}\}=\{NB,NS,N,PS\}=$ {"brilliant", "good", "ordinary", "poor"}, it means $n=4$, there are 4 fuzzy subset, then a total of 6 parameters, which is $(2n-2)$. The schematic diagram shown in Figure.2 :

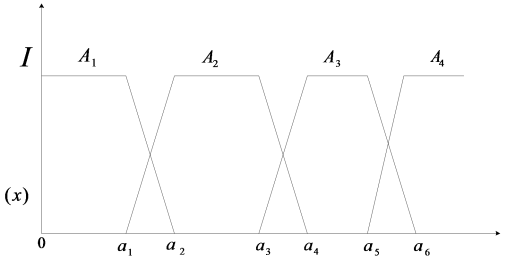

Fig.2 Fuzzy vector diagram

The membership function $\mu_i(x)$ is calculated as follows[4]:

When $i=1$, A_i corresponds to the parameters a_1 and a_2, the membership function is:

$$\mu_1(x)=\begin{cases}1 & x\le a_1\\ \dfrac{a_2-x}{a_2-a_1} & a_1<x<a_2\\ 0 & x\ge a_2\end{cases} \tag{3}$$

When $i=n$, A_i corresponds to the parameters a_{2n-3} and a_{2n-2}, the membership function is:

$$\mu_n(x)=\begin{cases}0 & x\le a_{2n-3}\\ \dfrac{x-a_{2n-3}}{a_{2n-2}-a_{2n-3}} & a_{2n-3}<x<a_{2n-3}\\ 1 & x\ge a_{2n-2}\end{cases} \tag{4}$$

When $1<i<n$, A_i corresponds to the parameters $a_{2i-3},a_{2i-2},a_{2i-1}$ and a_{2i}, the membership function is:

$$\mu_n(x)=\begin{cases}0 & x\le a_{2i-3}\\ \dfrac{x-a_{2i-3}}{a_{2i-2}-a_{2i-3}} & a_{2i-3}<x<a_{2i-3}\\ 1 & a_{2i-2}\le x\le a_{2i-1}\\ \dfrac{a_{2i}-x}{a_{2i}-a_{2i-1}} & a_{2i-1}\le x\le a_{2i}\\ 0 & x\ge a_{2i}\end{cases} \tag{5}$$

The input for this layer is:

$$I_{ij}^2=O_{ij}^1 \quad (i=1,2,\cdots,n;j=1,2,\cdots,m) \tag{6}$$

The output of this layer is the fuzzy variable value of each evaluation index under the membership function, that is:

$$O_{ij}^2=A_{ij}(x_j) \tag{7}$$

Where $A_{ij}(x)$ is the membership function of the i linguistic value of the linguistic variable. The output O_{ij}^2 is the value of the fuzzy variable, that is, the j indicator has a fuzzy relationship with the i

comment.

Fuzzy reasoning layer

This layer completes the comprehensive fuzzy evaluation of some input vector X. According to the discourse evaluation domain, the corresponding fuzzy evaluation vector is obtained, whose input and output are[5]:

$$I_{ij}^3 = O_{ij}^2 \quad (i = 1,2,\cdots,n; j = 1,2,\cdots,m) \tag{8}$$

$$O_i^3 = \sum_{j=1}^{m} w_j I_{ij}^3 \quad (i = 1,2,\cdots,n; j = 1,2,\cdots,m) \tag{9}$$

Output layer

Output layer fuzzy decision is based on certain fuzzy rules and algorithms to judge the input, the layer output is the final output of the network that fuzzy evaluation results. The layer input and output is:

$$I_i^4 = O_i^3 \tag{10}$$

$$O^4 = \Omega\left(I_1^4, I_2^4, \cdots, I_n^4\right) \tag{11}$$

Where $\Omega(x)$ is a fuzzy decision function.

2.2 Determination of connection weights in the network

Back propagation algorithm can get satisfactory results in the performance evaluation of mechanical products, but the back propagation algorithm still has some shortcomings such as slow convergence rate and possible local energy minima. Therefore, an improved back propagation algorithm can be used in the monitoring system.

The essence of the back propagation algorithm is to calculate the output value along the direction of network from input to output, and obtain the error of the output value and the sample value, and then pass the error information along the reverse direction of the forward training process to correct the connection weight value , To reduce the network output error. We can suppose there is a learning sample $(x_{1p}, x_{2p}, \cdots, x_{mp}; t_p)$ $\left(p = 1,2,\cdots,P; P \text{ is a number of samples}\right)$. For a certain sample $(x_{1p}, x_{2p}, \cdots, x_{mp}; t_p)$, after the network connection weight vector W is given randomly, the output value of the divider network according to the foregoing calculation process is y_p. For sample p, the output error of the network is[6]:

$$d_p = t_p - y_p \tag{12}$$

The error function is:

$$e_p = \frac{1}{2}\left(t_p - y_p\right)^2 \tag{13}$$

The learning process is to constantly adjust the value of the vector W, and gradually reduce the error d_p to improve network accuracy. The learning process uses the gradient descent method in optimization calculation, that is, along the direction of the negative gradient along the error function W with e_p changes. Suppose ΔW is the correction value of W, then:

$$\Delta W = -\eta \frac{\partial e_p}{\partial W} \tag{14}$$

In the formula, η is the learning efficiency, taking the number of 0 ~ 1.

When the error curve corresponding to the energy function is narrow and long, the algorithm jumps around the two walls of the valley and needs to add additional momentum terms. Then the iterative formula of the correction value ΔW is:

$$\Delta W = -\eta \frac{\partial e_p}{\partial W} + \alpha \Delta W^{(n-1)} \tag{15}$$

Where α is the momentum factor, generally take close to 1 number.

According to the above formula iterative, when the output error to meet the requirements, you can end network training.

2.3 Solving of the model

This article takes five primary and secondary schools in Kunming, China as an example to investigate the distribution schools and non-distribution schools to get the original data.

Tab. 1 The original data of Kunming 5 primary and secondary schools

	Kunming Teachers College attached elementary school	Cloud Copper primary school	Kunming First Middle School	PanLong primary school	Yunnan Nationalities High School
Organizational structure level	52.31	23.36	45.55	30.51	25.04
Campus football activities funding	438.58	143.45	354.61	134.31	218.55
Publications on campus football	154.68	78.26	177.66	54.86	146.95
Football Festival activities frequency	32	15	46	15	27
Training teaching evaluation	9.57	11.52	11.67	9.82	8.08
School participation in	10.84	8.13	12.21	8.33	10.82

competitions

This article takes four linguistic variables, then the evaluation of the range is A = {"brilliant", "good", "ordinary", "poor"}. According to the evaluation index project and evaluation domain, the network structure as mentioned above is constructed. There are 6 neurons in the input layer, 24 neurons in the fuzzification layer, 4 elements in the fuzzy reasoning and 1 element in the output layer.

Step1：Standardization of evaluation indicators

According to the data in the table to construct the evaluation index matrix, using the range difference transformation formula to standardize the data to get the matrix $R = \{r_{ij}\}$ as follows:

$$R = \begin{bmatrix} 1.0 & 0 & 0.76 & 0.24 & 0.05 \\ 1.0 & 0.03 & 0.72 & 0 & 0.27 \\ 0.81 & 0.19 & 1.0 & 0 & 0.74 \\ 0.54 & 0 & 1.0 & 0 & 0.38 \\ 0.41 & 0.95 & 1.0 & 0.84 & 0 \\ 0.66 & 0 & 1.0 & 0.04 & 0.65 \end{bmatrix} \quad (16)$$

The network evaluates one school each time, then the first layer of network input and output is:

$$I_i = O_{ip} = (r_{i1}, r_{i2}, \cdots, r_{i6}) \quad (i = 1,2,\cdots,5; p = 1,2,3) \quad (17)$$

Step2：Network training

Using the improved back propagation algorithm, the maximum value, the minimum value and the average value of each index are selected as part of neural network training samples input. Because the network mainly training the second layer and the third layer of the connection (that is, the weight of each evaluation index), then corresponding to the output of the third layer of training samples are {1,0,0}, {0,1,0}, {0,0,1} and other three vectors[7]. The connection weights are chosen randomly. In this paper, we choose {0.2,0.2,0.2,0.2,0.2} as the initial value. After 100 iterations of the network, the error value meets the accuracy requirements set by the program. At this time, the connection weight of the network is {0.260,0.265,0.075,0.274,0.126}.

Step3：Network output

The fourth layer of the network adopts the following judgment principle: the input vector has the largest component on a certain subset of the fuzzy evaluation domain (ie, compared with the output value of the third layer), then the product belongs to the fuzzy evaluation corresponding to the subset Language value. Enter the evaluation index into the above trained network, we get the results shown in Table.2:

Tab. 2 Network output results

Kunming primary and secondary schools	5	The third layer output value	Output the result
Kunming Teachers College attached elementary school		(0.1741,0.6999,0.1260)	Good
Cloud Copper primary school		(0.000,0.6360,0.3640)	General
Kunming First Middle School		(0.000,0.3502,0.6498)	Excellent
PanLong primary school		(0.4859,0.4096,0.1045)	Bad
Yunnan Nationalities High School		(0.2389,0.6351,0.1260)	General

In this paper, we use the improved back propagation algorithm to determine the connection weight (that is, the weight of each indicator) in the neural network and avoid the situation of being easily influenced by the personal subjective viewpoint when the weight is determined by mankind. At the same time, avoiding the weighting completely determined by the numerical value Prone to the actual situation does not match.

3. IMPLEMENTATION PLAN

The above set up a campus football activities carried out monitoring system. Based on the monitoring of administrative departments and pilot schools monitoring, two systems of implementation are put forward(implementation structure diagram is shown in Figure 3). The specific implementation plan is as follows:

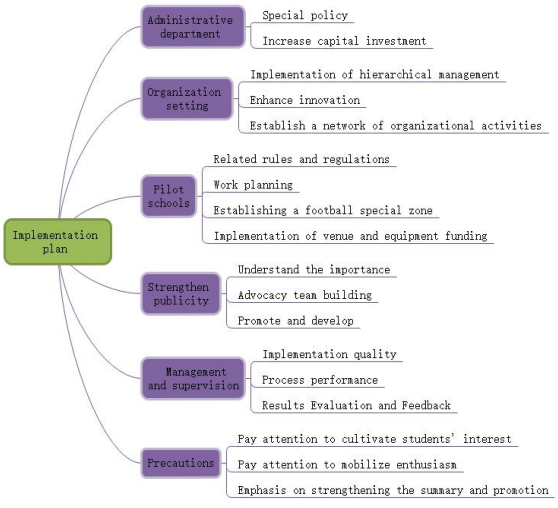

Fig.3 Schematic diagram of the implementation of the program

3.1 Relevant system construction of administrative departments

In order to protect the development of campus football, first of all, to ensure that administrative regulations issued by administrative departments on the implementation of campus football guidance policy, the particularity of the policy is mainly reflected in two aspects: First, these support policies specifically for the campus football, that is to say,

these policies are exclusive to football on campus rather than shared by all sporting events. Second, it refers to policies that are introduced not only to improve and complement existing policies, but to be groundbreaking and innovative. In addition, the central and local governments should promulgate public finance investment policies, establish long-term and stable campus football, allocate appropriate funds for sports training and equipment for campus soccer layout schools, and pay attention to the improvement of sports equipment and facilities [8].

3.2 Pilot school work planning

Fixed-point schools must formulate relevant rules and regulations. The system must have a certain binding, guiding, spurring and motivating, normative and procedural, so that in the development of campus football, students as well as teachers can know what to do, how to do, what kind of requirements do they need to meet and etc. At the same time, we should make a detailed and specific plan for the development of campus football, for example, the annual goals and tasks, the main activities, major sports competitions, job requirements, to improve the quality of football activities on campus. In addition, a large number of sports in the establishment of campus football " special zone". The core of the so-called "special zone" construction is to use campus football as a specific area for sports development, to attract parents, students and schools to participate actively in the development of campus football [9].

3.3 Organization settings

Establish an administrative system consisting mainly of administrative departments, pilot schools and the education sector coordinated with each other the organization and management system. The system consists of sports departments, academic departments, educational administration and other components. Organizations should strengthen coordination and cooperation in order to carry out a good campus football activities service. The activity organization network can be graded to form an activity organization network system as shown in Figure 4:

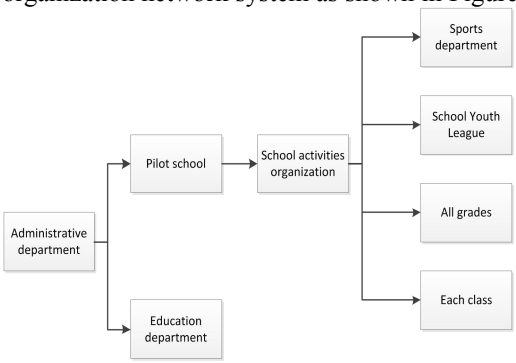

Fig.4 Activity organization network classification

Student activity organization network can be graded. The first level is organized by the school sports department, such as school track and field games, etc; the second level by the school Youth League organized by the individual sports activities; the third level by the grade organization; the fourth level by the class organization. Thus, forming a network from top to bottom, based on the school stratification, and the responsibility of each layer, every organization forms its own network system, therefore the smooth development of campus football activities can be promoted.

3.4 Strengthen propaganda

If campus football aims to develop smoothly, it is necessary to enhance publicity efforts. Various and vivid media reports on campus football in order to improve the effectiveness are needed. Enhancing the appeal of publicity so that the campus football players can fully understand the importance of campus football and actively participate in its promotion. We should pay attention to the development of campus football positioning, development ideas, training ideas and other core value system of publicity to raise public awareness of football on the campus, students, parents, etc; to achieve their greatest degree of recognition, support and participation. In this way, these efforts will be conducive to the realization of the campus football Sustainable development. Highlighting the comprehensive effects of all-round system of publicity to build a system of publicity and guidance and to strengthen the four main areas of work, namely, advocacy team building, content planning, publicity and diversification of propaganda platform.

3.5 Management and supervision

Carrying out campus football activities can not be separated from effective management and supervision. Management and supervision mainly consist of three aspects: First, the management and supervision of the quality of students each activity, the number of weekly activities; second, management and supervision of the annual development of the implementation of the campus football plan, monitoring can start from the following aspects, such as work plan management and supervision, rules and regulations management and supervision, inspection and evaluation management supervision, test analysis and management supervision. Third, the management and supervision of teachers in the development of football on campus. In carrying out football activities on campus, we must make most of all sports organizations. Students participating in a community activity can be regarded as one time of participating in a sunshine sports activities, it is supervised by the community leader who is responsible for attendance, and physical education teacher is responsible for supervision; Second, each school sports department should grade each community of their carrying out football activities on campus according to the specific circumstances. The main assessment indicators should be the number of community activities and the quality of activities, etc. Each outstanding member of those selected outstanding sports organizations, the

sports department of sports organizations will be awarded a certificate by the school sports department [10].

3.6 Precautions

In the process of carrying out activities, we must attach importance to and strengthen the and work propaganda: First, to carry out the campus football is not long, but just at the beginning; moreover, there are still some problems in the process of carrying out the plan, for example, experience summary needs to be urgently solved and mode promote advanced; Second, experience is the product of social practice, and it is the knowledge, methods, skills and lessons learned from the practice of sunshine sports, so it has direct reference and guidance to future practice. Thirdly, promotion can show the achievements and establish the typical and further explore ideas, sort out solutions to existing problems, and combine with the actual situations to determine more effective management and operation methods to promote the development of science in campus football. Due to many limitations such as research time, research effort, research funding and so on, the implementation plan needs to be tested at the right time so as to be modified and improved so that it can play a real monitoring role.

4. CONCLUSION

In this paper, we use neural network to determine the weight value in fuzzy comprehensive evaluation, and make the weight value more accord with the actual situation. We also use the improved back propagation algorithm to determine the connection weight in neural network, and avoid the influence of personal subjective point of view The situation, but also to avoid completely determined according to the value of the weight does not match with the actual situation. The training sample contains the composition of the endpoint value and the median of the membership functions, which can reflect the characteristics of the evaluation index value itself and fully take into account the variation of each factor. This method can be applied to the monitoring of campus football activity system to make it play a real monitoring role. Finally, in view of the established monitoring system of campus football activities, the implementation plan will be put into the monitoring system and satisfactory results have been obtained.

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The Price Strategy of Making Money via Taking Photos Task

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Abstract: As a composition of self-service model, " photo earning " has been accepted by more and more people. The rationality of task pricing will affect the success rate of commodity inspection, thus designing a reasonable pricing scheme is an essential part of planning the development of an enterprise. To construct decision model based on fuzzy multi-objective, a multi-objective function is built on membership income, business expense and completion rates. Combining the fuzzy statistical method and binary priority relation comparison principle, we'll obtain the pricing standard. Next, we built a multi-objective particle swarm optimization model. Combined with the idea of niche, the global optimal particle is obtained through the optimization of multi-objective function, which is packaged and merged with nearby particle swarm optimization algorithm arose. Then, we selected the development status of the region, the regional task density, the number of regional members, members of the predetermined limit and membership reputation as the five indicators as the evaluation indicators of the completion of the two kinds of pricing program tasks completion rate analysis. According to the line chart we can conclude that the improved pricing scheme based on Particle Swarm Optimization is more effective and the task distribution is more reasonable.
Keywords: Crowdsourcing; Pricing Strategy; Multi-objective function; Particle Swarm Optimization

1. INTRODUCTION

"Making Money via Taking Photo" is a self-service model under the mobile Internet. The user downloads the APP, registers as an APP member, and then takes certain tasks (such as going to the supermarkets to check the availability of a certain product). The user can get the reward from the APP after carrying out the task. This kind of self-service crowdsourcing platform based on mobile internet provides enterprises with a variety of business inspection and information collection. Compared with the traditional market research methods, it can greatly save the investigation cost, effectively ensure the authenticity of survey data and shorten the investigation cycle.

Crowdsourcing itself is a risk project operation. A successful operation is indeed rewarding, however, the cost of capital and time spent on an unsuccessful one may outweigh the traditional model. If the work is selected, a certain amount of profit will be given while if it fails, all efforts will be turned out in vain. The crux of all the questions is how to set a reasonable price so that the expected returns of the contractor and the crowdsourcing site are greater than the respective costs. Therefore, developing a reasonable pricing strategy by studying the influential factors that influence the crowdsourcing bidding behavior is of great practical significance for the task publishers to increase output and reduce the cost relatively.

2. PRICING SCHEME MODEL BASED ON FUZZY OBJECTIVE DECISION MAKING

2.1 Objective Functions and Constraints

The completion of project tasks is related to the city where the task is located, the density of tasks, the number of regional members, the reservation limit of members, the creditworthiness of members and so on. Therefore, these factors are selected as the pricing parameters and the optimization algorithm based on fuzzy multi-objective decision can be designed. We maximize the membership income, and maximize the interests of mission enterprises to establish multi-objective optimization model of the task pricing program [1]. (The data of this study comes from the question B of the " China Undergraduate Mathematical Contest in Modeling ")

We can assume that N total of members set up the entire region, M tasks , so that members of the booking task limit s_i , the credibility of the member value y_i , the total number of members in the region z_i , task density π_i , the number of tasks completed d_{ji} , the task is not completed number is α , then the member gets paid as :

$$c_i = y_i\left(\left(1-z_i\right)\left(\pi_i \times P\left(s_i\right)\times\alpha\right)\right)+P\left(s_i\right)\times\left(1-\pi\right) + z_i P\left(s_i\right)\times\alpha\right)+\left(1-y_i\right)P\left(s_i\right) \quad (1)$$

the average revenue of all members is expressed as:

$$\max f_1 = \frac{1}{N}\sum_{i=1}^{N} c_i \quad (2)$$

calculation of the expenditure of the mission enterprises:

$$r_j = \sum_{i=1}^{M} d_{ji}\left(y_i(\pi_i \times P\left(s_i\right)\times\alpha + P\left(s_i\right) \times\left(1-\pi\right)+\left(1-y_i\right)P\left(s_i\right)\right) \quad (3)$$

the task firm pricing is minimized as:

$$\min f_2 = \frac{1}{M}\sum_{j=1}^{M} r_i \quad (4)$$

the number of tasks to complete the maximum:

$$\max f_3 = \sum_{k=1}^{Q} q_i \quad (5)$$

In conclusion, the multi-objective optimization model of pricing system is as follows:

$$\begin{cases} \max f_1 = \frac{1}{N}\sum_{i=1}^{N} c_i \\ \min f_2 = \frac{1}{M}\sum_{j=1}^{M} r_i \\ \max f_3 = \sum_{k=1}^{Q} q_i \\ c_i = y_i\left(\left(1-z_i\right)\left(\pi_i \times P\left(s_i\right)\times\alpha\right)\right)+P\left(s_i\right)\times\left(1-\pi\right) \\ \quad + z_i P\left(s_i\right)\times\alpha\right)+\left(1-y_i\right)P\left(s_i\right) \\ r_j = \sum_{i=1}^{M} d_{ji}\left(y_i\pi_i \times P\left(s_i\right)\times\alpha + P\left(s_i\right)\times\left(1-\pi_i\right)\right) \\ \quad +\left(1-y_i\right)P\left(s_i\right) \end{cases} \quad (6)$$

$$s.t.\begin{cases} N>0, M>0 \\ s_i>0, y_i>0 \\ z_i>0, \pi_i>0 \\ d_{ji}>0, \alpha>0 \end{cases}$$

2.2 Establishment of pricing scheme model

From the above analysis we can see that the main factors affecting the completion of the mission are as follows: ① the economic development of the region where the task is located; ② the density of regional tasks; ③ the number of regional members; ④ the limit of membership reservation; ⑤ the value of member reputation. In order to obtain a reasonable pricing scheme, the above factors are used as pricing parameters to design an optimization algorithm based on fuzzy multi-objective decision-making. To maximize the membership income, maximize the interests of mission enterprises to establish multi-objective optimization model task pricing program, the specific algorithm process is as follows [2]:

Step1 Determination of pricing alternatives

The set of pricing alternatives can be divided into five levels, and the spread between adjacent levels can be discretized by steps and variable steps. We can conclude from the data that the lowest task pricing is 65 yuan, the highest price of 80 yuan, and take the stride length of 3 according to the price range with the principle of equal-step discrete. Then it appeared the alternative set $V=\{65,68,71,74,77,80\}$.

Step2 Determination of membership matrix

The correctness of the membership and membership functions have a direct influence on the credibility of the evaluation results [3]. We can get a weight expression:

$$\begin{bmatrix} 0.5 & 1.0 & 1.0 & 1.0 & 1.0 & 1.0 \\ 0 & 0.5 & 0.5 & 0.5 & 0 & 0.5 \\ 0 & 0.5 & 0.5 & 0 & 0 & 0 \\ 0 & 0.5 & 1.0 & 0.5 & 0 & 0 \\ 0 & 0.5 & 1.0 & 1.0 & 0.5 & 1.0 \\ 0 & 0.5 & 1.0 & 1.0 & 0 & 0.5 \end{bmatrix} \Rightarrow \begin{bmatrix} 4.5 & 2.5 & 0.5 & 2.0 & 5.5 & 3.0 \end{bmatrix} \quad (7)$$

The normalized weight vector is

$\omega_1 = [0.250 \quad 0.139 \quad 0.028 \quad 0.111 \quad 0.305 \quad 0.167]$

We can get a matrix by substituting the above five factors:

$$\begin{bmatrix} 0.5 & 0.5 & 0 & 0 & 0 \\ 0.5 & 0.5 & 0 & 0 & 0 \\ 1.0 & 1.0 & 0.5 & 0.5 & 0 \\ 1.0 & 1.0 & 0.5 & 0.5 & 0.5 \\ 1.0 & 1.0 & 1.0 & 0.5 & 0.5 \end{bmatrix} \quad (8)$$

The row vectors of each matrix above are summed and normalized, and the membership matrix is obtained after the combination, finally, the fuzzy operation $B=\omega\times R$ is performed.

According to the above method, five factors of fuzzy evaluation vectors can be obtained. From the fuzzy evaluation vector's membership degree, each factor can be graded, and the membership values from high to low correspond to 1,2,3,4,5 levels respectively. The results of grading into the model are shown in Table 1.

Table 1 Grading results of various factors

Grade	First	Second	Third	Fourth	Fifth
City	Guangdong	Shenzhen	Foshan	Dongguan	Conghua

Regional members	1-400	400-800	800-1200	1200-1600	1600-2000
Mission quotas	10-250	7-10	5-7	3-5	1-3
Reputation value	>5000	1000-5000	100-1000	50-100	0-50
Grade	First		Second	Third	
Mission density	<1		=1	>1	

Table 2 shows the pricing standards at all levels:

Table 2 rating results pricing standards

Grade	First	Second	Third	Fourth	Fifth
Pricing	77-80	74-77	71-74	68-71	65-68

Defining that the task completion rate v=completed mission/total amount of work. Take the data into the pricing program we can get the task completion rate $v_1 = \frac{734}{835} = 88.5\%$.

3. PRICING OPTIMIZATION BASED ON PARTICLE SWARM AND MULTI-OBJECTIVE FUNCTION

3.1 Multi-objective function of task package release

In order to maximize the membership income, maximize he interests of enterprises to establish a multi-objective optimization model and design a new task pricing program, but in reality, multiple tasks may be due to the location of more centralized, leading to competing choices, so consider these tasks are packaged and released jointly, forming a new objective function and modifying the previous pricing model.

We can assume that there are N members and M tasks in the whole region, and the center of each package release is w_i, the radius of the package region is r, the membership density is $\frac{N}{\pi r^2}$ and the task density is π_i, then the regional task is jointly packaged and published point w_i can be expressed as:

$$w_i = \frac{N}{\pi r^2} + \pi_i \tag{9}$$

The multi-objective optimization model of pricing system is as follows [4]:

$$\begin{cases} \max f_1 = \frac{1}{N}\sum_{i=1}^{N} c_i \\ \min f_2 = \frac{1}{M}\sum_{j=1}^{M} r_i \\ \max f_3 = \sum_{k=1}^{Q} q_i \\ \max f_4 = \frac{N}{\pi r^2} + \pi \\ c_i = y_i\left(\left(1-z_i\right)\left(\pi_i \times P(s_i)\times\alpha + P(s_i)\times(1-\pi)\right.\right. \\ \quad \left.\left. + z_i P(s_i)\times\alpha\right) + (1-y_i)P(s_i)\right) \\ r_j = \sum_{i=1}^{M} d_{ji}\left(y_i\left(\pi_i \times P(s_i)\times\alpha P(s_i)\times(1-\pi_i)\right)\right. \\ \quad \left. + (1-y_i)P(s_i)\right) \end{cases} \tag{10}$$

$$s.t.\begin{cases} N>0, M>0 \\ s_i>0, y_i>0 \\ z_i>0, \pi_i>0 \\ d_{ji}>0, \alpha>0 \end{cases}$$

3.2 Global optimal selection strategy based on niche

According to the concept of niche, the evolution of similar particles will gradually gather to form a number of niche sub-groups. In this paper, the Euclidean distance is used to represent to the particle distance, and a strategy is designed to divide the niche subgroups [5]:

The distance $D(x_a, x_b)$ between any two particles $x_a, x_b \in \Omega$ in the particle space is represented by the Euclidean distance as:

$$D(x_a, x_b) = \sqrt{\sum_{i=1}^{3}\left(x_a^i - x_b^i\right)^2} \tag{11}$$

Where: x_a^i, x_b^i are the i parameter values of x_a, x_b particles respectively.

Ω is the particle space, X is the subgroup of Ω, and the distance between particle $x_a \in \Omega$ and niche subgroup $X_s \in X$:

$$D(x_a, x_b) = \sqrt{\sum\left(x_a^i - \left(o(X_s)\right)^i\right)^2} \tag{12}$$

Where: $\left(o(X_s)\right)^i$ is the i parameter value of the center point of the niche subgroup X_s, and $o(X_s)$ is the center point of the niche subgroup X_s.

The central point of the niche subgroup X_s is defined as the central position of all the particles in

X_s. When the particle x_a is added to the niche subgroup X_s, the center point of X_s is transformed.

$$\left(o\left(X_s\right)\right)^i = \frac{x_a^i + \left(o\left(X_s\right)\right)^i}{2} \tag{13}$$

if the niche $x_a \in \Omega$ satisfies [6]:
$\min\left\{D\left(x_a, X_k\right) \mid X_k \subset X\right\} = D\left(x_a, X_s\right)$;
$D\left(x_a, X_s\right) < \varepsilon$,then the particles x_a and X_s are the same niche subgroups;
If the data only satisfy the condition ①, the particle x_a alone as a niche subgroup. Where: ε is the average distance between all the particles.
Based on the above analysis, all the particles are divided into several niche subgroups and the global optimal particle selection is done as follows: According to the multi-objective function, the optimal particle is selected as the optimal particle subset in each niche subgroup, and the size of each niche subgroup is calculated, that is the number of particles in each niche subgroup, and the optimal particle subordinate the smallest niche subgroups are considered as global optimal particles. The combination of multi-objective function and niche sub-group to obtain the optimal particle can not only select the target-optimized particle but also keep the particle diversity.

3.3 Particle update

According to the selected global optimally updated particle, the particle velocity and position update are as follows [7]:

$$v_{x_a^t}^{t+1} = w v_{x_a^t}^t + c_1 r_1 \left(p_{x_a^t}^t - s_{x_a^t}^t\right) + c_2 r_2 \left(g_i^t - s_{x_a^t}^t\right) \tag{14}$$

$$s_{x_a^i}^{t+1} = s_{x_a^i}^t + v_{x_a^i}^{t+1} \tag{15}$$

Where: w is the inertia weight; r_1, r_2 is the random number distributed uniformly between (0,1); c_1, c_2 is the learning factor; $v_{x_a^i}^t$, $s_{x_a^i}^t$ is the velocity and position of the particle at the time of the first generation; $p_{x_a^i}^t$ is the local optimum position of the particle; g_i^t is the global optimal position of the group.

3.4 Tasks package release utility solution

According to the package after the solution to solve the task of completing the number of each region and compared with the precious program, as shown in Figure 1, the figure shows that the number of tasks completed in all regions to further enhance the packaged program pricing results to complete the task before the two options are better.

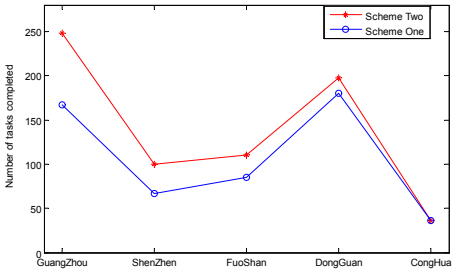

Figure 1 comparison of the number of the completed tasks

Put all the coordinate data into the improved pricing scheme based on Particle Swarm Optimization we get the task completion rate $v_2 = \frac{756}{835} = 90.35\% > 88.5\%$. It shows that task package delivery task completion rate is higher, business more efficient; task package post-release corporate spending lower cost, greater member benefits, so based on Particle Swarm Optimization pricing program better than the previous price programs.

4. CONCLUSION

Crowdsourcing approach to work, using the wisdom of workers to solve practical problems, so that task publishers and workers' benefits can be maximized. In this paper, the crowdsourcing pricing model based on fuzzy multi-objective decision-making and the multi-objective crowdsourcing pricing model based on particle swarm optimization are established. The comparison between the completion rates of the two pricing schemes and the line chart shows that the pricing scheme based on Particle Swarm Optimization is superior to the former pricing scheme. Therefore,the PSO model has certain reference value in product pricing. However, due to the diversity of society, it is expected that the PSO will be further developed and perfected in this industry and the model will be further improved after relevant statistics are further improved Refinement improvement.

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The Pricing Strategy of "Taking Money" Software and Determine and Explore

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Abstract: In this paper, the pricing strategy of "taking pictures and making money" software is used to preprocess the data of Guangzhou area and draw the three-dimensional surface map and contours of latitude and longitude. In order to solve the distribution of the task, the members compete to choose this problem, divide the area, adopt the distance principle, construct the packing optimization model based on the combined auction, package the easy task and the difficult task coefficient. By using the gray multi-level evaluation method to compare the model, it is found that the comprehensive evaluation value of the model is high, so the model is of great significance to solve the software pricing strategy.
Keywords: Package optimization model; Gray multi-level evaluation; Pricing strategy; Whitening right function

1. INTRODUCTION

"Take pictures to make money" is a mobile Internet under a self-service model. Users to download APP, registered as a member of APP, and then from the APP to take the need to take pictures of the task (such as the supermarket to check the situation of a commodity shelves), earn APP on the mission of the remuneration. This kind of mobile Internet-based self-service labor package platform provides enterprises with various business inspection and information collection. Compared with the traditional market survey method, the survey cost can be greatly saved, and the authenticity of the survey data can be effectively guaranteed and the investigation the cycle. APP is the core of the platform to run, and APP in the task pricing is its core elements. If the pricing is unreasonable, some tasks will be nobody cares, which led to the failure of commodity inspection.

In recent years, in order to balance the interests of the pricing strategy to become a hot spot. Life environment, the needs of users and a large number of uncertain factors to the pricing strategy has brought great challenges. In the micro-economics of the economy, an important model is the utility model. Utility is an evaluation indicator of user and service delivery or service effectiveness, revenue. Not only consider the needs of many users and their benefits, but also to minimize the waste of the task in the stage, so that the distribution of tasks and users to maximize the effective use of the win. Therefore, the study of software pricing strategy, and to explore the model, has important theoretical significance and practical value.

2. DATA PREPARATION AND PROCESSING

In this paper, we first analyze the latitude and longitude and the pricing, and get the data from the three dimensions and the lattice of the latitude and longitude and the price.

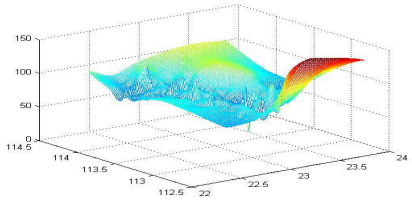

Figure 1 three-dimensional surface map

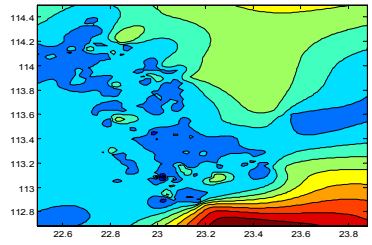

Figure 2 and other high potential map

Using Excel to sort the task price in descending order. The data are analyzed and the following price ranges are divided.

Table 1 Task Price and Quantity

TaskPrie (yuan)	85	80	75	74.5-70	69.5-65
The number	28	12	78	207	510

After sorting found,High mission price only85、80、75these three independent price,And the number of data is less than the overall data.65 afterwards,each 0.5 generates a task price,has continued to 75,And the number of its data is very large.So for the high price, the three different price were listed and calculated its number.In the range of 74.5-70,The positioning of the price, the number of data accounted for a quarter of the total data.In the range of 69.5-65, set it as a low price, the number of the total number of 62.5%.

3. THE MODEL OF PACKAGING OPTIMIZATION BASED ON COMBINATION AUCTION

In the task of the package issued in the process of setting up $M=\{1,2,\cdots,m\}$ for the collection of the subject matter, $N=\{1,2,\cdots, m\}$ for the collection of members,For any member $i\in N$,The selection of a combination of a number of $S_i\subseteq M$ tasks in M is issued with a price of $b(S_i)$.

When you choose a combination of several tenders, this combination covers all the subject matter and does not coincide, and make the bid price and reach a very small, but also to improve the completion of the task, packing good and bad judgments are as follows:

1)as far as possible will have the price complementarity, and the completion of the opposite of the standard task to fight together to improve the completion rate.

2)the results of the package as much as possible with the choice of more members of the combination of consistent.

Set the task was labeled as g package,Remember G_j , $j=1,2\cdots,g$,,Then the package is optimized for the model:

$$Z_1=\min\sum_{j=1}^{g} f(G_j)v(G_j) \tag{1}$$

$$Z_2=\max\sum_{k=1}^{n} d(S_k) \tag{2}$$

$$\forall G_j\cap G_k=\phi,\ \ \forall j,k=1,2,\cdots,g$$

$$G_j\subseteq M, j=1,2,\cdots,g$$

$$v(G_j)=\sum_{i\in G_j} v_i$$

Model, Publish the task company to estimate the pricing of bundle j

Goal 1 is the price complementarity indicator,Where $f(G_j)$ is the minimum value of the price complementarity of all the object pairs in G_j, as

$$f(G_j)=\min_{\forall(k,j\in G_j)}\{h_{kl}\}, j=1,2,\cdots,g \tag{3}$$

Where h_{kl} is the element in the price complementary matrix $H=\{h_{kl}\}\in R^{m*n}$

$$h_{kl}=\begin{cases}\min\limits_{(k,l)\in S_k}\left\{1-\dfrac{b(S_k)}{\sum\limits_{r\in S_k} v_r}\right\} & k<l\\ 0 & k\geq l\end{cases} \tag{4}$$

The meaning of the price complementarity factor: If the two items in the same tender, compared to the release of the company's valuation brought about by the maximum price reduction.due to $h_{ij}=h_{ji}$,For the sake of convenience, the formula (4) takes only the upper triangular part of H.

Goal 2 is the consistency index of the package, for the selection of the member j of the target task set S_j with all the package consistency indicators $d(S_j)$, $j=1,2,\cdots,n$ defined as

$$d(S_j)=\max_{k=1,2,\cdots g}\{2*|S_j\cap G_k|/(|S_j|+|G_j|)\} \tag{5}$$

Where $|S|$ is the number of elements in set S.

$$Y(x)=ae^{b\ (x_1+x_2)}+K(x_1+x_2) \tag{6}$$

Where K is the subsidy coefficient.

4. RESEARCH ON THE EFFECT OF GRAY MULTI - LEVEL EVALUATION METHOD

According to the above research, the evaluation index of the evaluation model with the bustling degree (population density) and the membership quota is the qualitative index, which is divided into excellent, good, medium and poor, 5 points, 4 points, 3 points, 2 points, 1 point.

In the pricing of the first x task on the pricing index scoring A_i score, and write down d_{ij} , according to the first x task evaluation sample matrix $D^{(x)}$

$$D^{(x)}=\begin{bmatrix} d_{11} & \cdots & d_{1j}\\ \vdots & \ddots & \vdots\\ d_{i1} & \cdots & d_{ij}\end{bmatrix} \tag{7}$$

Due to the level of people's limitations and differences in knowledge, can only give a whitening value of the number of gray.In order to truly reflect the degree of belonging to a certain class, it is necessary to determine the evaluation of gray class, that is, to determine the gray level of ash, ash gray and gray number of whitening weight function.Set the gray code e（$e=1,2,\cdots m$, that is, m evaluation of gray class）.

According to the specific research content will be evaluated gray class for different levels, such as taken as five(Excellent, good, medium, poor, poor),let m = 5.In order to describe the above gray class, it is necessary to determine the whitening weight function of the evaluation gray class.

1st gray class, poor $(e=1)$, set the number of gray $\otimes_1\in[0,1,2]$, whitening weight function f_1:

$$f_1(d_{ij}^{(x)})=\begin{cases}1 & d_{ij}^{(x)}\in[0,1]\\ (2-d_{ij})/1 & d_{ij}^{(x)}\in[1,2]\\ 0 & d_{ij}^{(x)}\notin[0,2]\end{cases} \tag{8}$$

2nd gray class,poor $(e=2)$ set the number of ash $\otimes_2\in[0,2,4]$whitening right function f_2:

$$f_2(d_{ij}^{(x)})=\begin{cases} d_{ij}/2 & d_{ij}^{(x)}\in[0,2] \\ (4-d_{ij})/2 & d_{ij}^{(x)}\in[2,4] \\ 0 & d_{ij}^{(x)}\notin[0,4] \end{cases} \tag{9}$$

3rd gray class,poor $(e=3)$ set the number of ash $\otimes_3\in[0,3,6]$ whitening right function f_3:

$$f_3(d_{ij}^{(x)})=\begin{cases} d_{ij}/3 & d_{ij}^{(x)}\in[0,3] \\ (6-d_{ij})/3 & d_{ij}^{(x)}\in[3,6] \\ 0 & d_{ij}^{(x)}\notin[0,6] \end{cases} \tag{10}$$

4th gray class,poor $(e=4)$ set the number of ash $\otimes_4\in[0,4,8]$ whitening right function f_4:

$$f_4(d_{ij}^{(x)})=\begin{cases} d_{ij}/4 & d_{ij}^{(x)}\in[0,4] \\ (8-d_{ij})/4 & d_{ij}^{(x)}\in[4,8] \\ 0 & d_{ij}^{(x)}\notin[0,8] \end{cases} \tag{11}$$

5th gray class,poor $(e=5)$ set the number of ash $\otimes_5\in[0,5,10]$ whitening right function f_5:

$$f_5(d_{ij}^{(x)})=\begin{cases} d_{ij}/5 & d_{ij}^{(x)}\in[0,5] \\ (10-d_{ij})/5 & d_{ij}^{(x)}\in[5,10] \\ 0 & d_{ij}^{(x)}\notin[0,10] \end{cases} \tag{12}$$

For the evaluation index A_{ij} ,the x task belongs to the gray evaluation coefficient of the e gray class ,remember M_{ije} ,then

$$M_{ije}^{(x)}=\sum_{k=1}^{n} f_e(d_{ije}^{(x)}) \tag{13}$$

For the evaluation index A_{ij} ,The x task belongs to the gray coefficient of each evaluation gray class,remember $M_{ij}^{(x)}$,then

$$M_{ij}^{(x)}=\sum_{k=1}^{n} M_{ije}^{(x)} \tag{14}$$

Multi-level comprehensive evaluation:

The evaluation index of the x task is evaluated synthetically, and the comprehensive evaluation result is recorded as $B_i^{(x)}$,then

$$B_i^{(x)}=A\cdot R_i^{(x)}=(b_{i1}^{(x)},b_{i2}^{(x)},b_{i3}^{(x)},b_{i4}^{(x)},b_{i5}^{(x)}) \tag{15}$$

By the A_{ij} comprehensive evaluation results $B_i^{(x)}$ The A_i index of the x task of the gray evaluation of the gray evaluation of the weight coefficient matrix $R^{(x)}$

$$R^{(x)}=\begin{bmatrix} B_1^{(x)} \\ B_2^{(x)} \\ B_3^{(x)} \\ \vdots \\ B_5^{(x)} \end{bmatrix}=\begin{bmatrix} b_{11}^{(x)} & b_{12}^{(x)} & b_{13}^{(x)} & b_{14}^{(x)} & b_{15}^{(x)} \\ b_{21}^{(x)} & b_{22}^{(x)} & b_{23}^{(x)} & b_{24}^{(x)} & b_{25}^{(x)} \\ b_{31}^{(x)} & b_{32}^{(x)} & b_{33}^{(x)} & b_{34}^{(x)} & b_{35}^{(x)} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ b_{51}^{(x)} & b_{52}^{(x)} & b_{53}^{(x)} & b_{54}^{(x)} & b_{55}^{(x)} \end{bmatrix} \tag{16}$$

Thus,the evaluation of the rationality of the x task of a comprehensive evaluation of U_i the indicators, the comprehensive evaluation results recorded as $B^{(x)}$,then

$$B^{(x)}=A\cdot R^{(x)}=(b_1^{(x)},b_2^{(x)},b_3^{(x)},b_4^{(x)},b_5^{(x)})$$

Set the evaluation of gray class by "gray level" assignment,Then the evaluation gray class level value vector $C=(1,2,3,4,5)$,Thus, the comprehensive evaluation of the rationality $Z^{(x)}$ of the x task pricing is calculated as follows:

$$Z^{(x)}=B^{(x)}\cdot C^T \tag{17}$$

Solve:

Because the pricing of different tasks to the program, and evaluate the implementation of the program effect, the price of the problem has been given in comparison with the pricing we have to compare which program pricing is more reasonable, the evaluation of gray equivalence vector $C=(1,2,3,4,5)$,The comprehensive evaluation of the rationality of the pricing of the problem is $Z^{(1)}$ and $Z^{(2)}$.

$$Z^{(1)}=B^{(1)}*C^T=3.5614$$

$$Z^{(2)}=B^{(2)}*C^T=4.0354$$

According to the calculation results $Z^{(1)}<Z^{(2)}$,So the pricing of this article is better.

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A Recognition System Based on LSD Algorithm

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Abstract: The traditional book management system needs to manage books manually, and the efficiency is low, which can not meet the needs of modern people. Therefore, the establishment of a set of book recognition system, the robot to complete the daily management of books, has become the focus of research in this field. In this paper, through analyzing the visual feature of spine profile, combined with the LSD algorithm, proposed a contour extraction algorithm based on visual features of spine. According to the visual features, selected feature contour by parallel lines detection, construct rectangle detection and screening algorithm. The experimental results show that, in the spine neatly when compared with the traditional algorithm has better segmentation effect, and can solve the defects of the spine can not be placed clutter the correct segmentation in the spine, placed clutter, has reached a higher rate of effective segmentation.
Keywords: LSD algorithm; Identification of the spine; Line detection; Visual features

1. INTRODUCTION

At present, with the increase of people's book collection, the management of books becomes more difficult. Manual management of books on shelves is a tedious task for human beings. If you can put this part of the work in the hands of the robot, it will greatly reduce the workload of mankind. But the computer in the book positioning and search accuracy rate, compared with human, the gap is larger. The spine
recognition technology currently used mainly two-dimensional code scanning[1], and RFID[2]. But the efficiency of two-dimensional code scanning is low, and the maintenance cost of RFID technology is higher. With the continuous development of computer technology, the advantages of low cost, simple operation based on spine visual feature recognition technology has become a research hotspot. This article from the perspective of computer vision, the research of spine recognition algorithm based on LSD, compared to the above two kinds of recognition technology, spine recognition algorithm LSD based on low cost and efficient accurate complete recognition based on image book spine has high application value.

2. STRAIGHT LINE EXTRACTION BASED ON SEGMENTATION PRINCIPLE OF SPINE

In the spine localization and recognition process, first of all, the bookshelf in the image carved out of the spine. The spine of the outline of the image can be approximated as rectangular, so commonly used algorithm to identify the two long edges of the spine straight line extraction, to determine the position of the spine through the two long edge parallel line. At present, LSD (Line Segment Detector) line detection algorithm is mainly used.

LSD algorithm[3] mainly includes three parts: region growing rectangle region approximation and region validity detection. The algorithm mainly by finding the pixel region in the image have the same gradient, LSD line detection algorithm of the image area called the line support region, also known as Level-line, to detect a line's direction is approximately in the direction of the regional average line support. The main process is as follows:

Step 1：Calculation of the gradient image pixel, detect the larger regional gradient intensity image. As shown in figure 1. Because the gradient image edge region is larger, so the preferred selection of pixel point of the gradient value. In accordance with the gradient of pixel intensity screening and detection of these neighborhood pixels. According to the gradient direction of neighborhood pixels, the pixels in the neighborhood are approximately the same as those of pixels, and the pixels are added to the line support area. In the search area in the iterative process, according to the average gradient update line support region direction. The final area for candidate line support region.

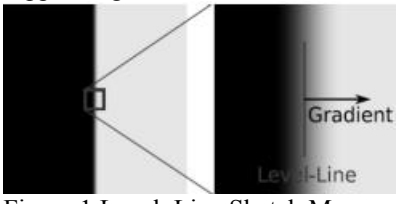

Figure 1 Level_Line Sketch Map

Step 2 ： As shown in Figure 2, the image characteristics of the region has certain pixel width In order to extract the line segment accurately, the edge region is approximated as a rectangle, and the best

direction of the line segment is selected according to the direction of the rectangle region.

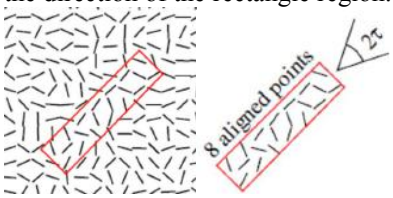

Figure 2 Schematic diagram of rectangular fitting

Step 3: The candidate line support region will appear in the error detection line, the need for removal. The LSD algorithm selects the supporting area of the alternate line according to the length, width and alignment of the gradient direction of the pixels in the rectangle region.

3. LSD LINE DETECTION AND VISUAL FEATURE ANALYSIS

3.1 LSD Line detection

LSD can obtain sub-pixel precision[4] in linear time. The LSD algorithm first calculates the gradient near each pixel in the image, and then generates a unit vector domain, where all vectors are tangent to the gradient through the reference point. Therefore, the region is divided into several connected parts, and they have the same gradient within a certain tolerance R. These regions serve as a candidate region for straight line segmentation. The gradient of pixel value in the region is equivalent to the quality, obtained by calculating the coordinates of regional gravity center, as the center point of the smallest rectangle structure surrounded the area, the regional angle in the direction of long axis as a rectangular, rectangular structure obtained was identified as line segment detection results.

3.2 Visual feature analysis

Literature review[5], spine profile has the following five characteristics.

Characteristic 1：The spine edge can be approximated as rectangular, i.e. there are two long edges and two short edges of the spine profiles, two long and 22 parallel edges, while long edge and the short edge vertical approximation.

Characteristic 2：The length of the rectangular shape of the spine in a certain range, the length of not less than 65 pixels (the input height of standard image is 640 pixels).

Characteristic 3：The width of the rectangular shape of the spine in a certain range, the width of not less than 10 pixels (the input height of standard image is 640 pixels).

Characteristic 4：The spine length is usually greater than 2 times the width of the spine.

Characteristic 5：The middle of the spine area often includes complex texture information, texture information and less the gap between the spine.

4. PARALLEL LINE DETECTION

According to the characteristics of the 1, known as the main visual features of the spine parallel long edge. According to this feature, this screening algorithm of parallel lines of spine rectangle based on contour features, the algorithm is shown in figure 3.

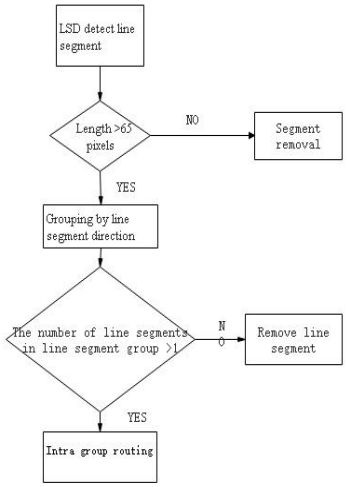

Figure 3 Parallel lines detection flow chart

After sorting each group of parallel lines, the two adjacent parallel lines are the closest two parallel segments in the image. First, the first line segment in the parallel line segment is removed, and then the adjacent candidate line segment is shown in Figure 4, which is the three case.

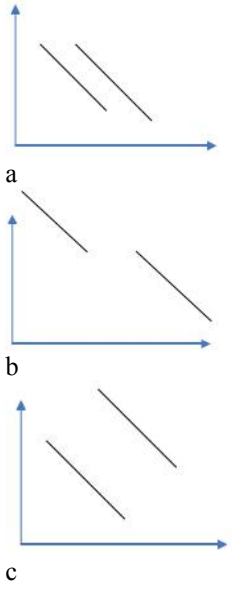

Figure 4 a,b,cSchematic diagram of parallel lines in three cases

According to the above three cases, a parallel line pair selection algorithm is designed in this paper:

In Figure 3 (a) shows a situation, normal distance is less than the threshold (the threshold is 10 pixels), that the two parallel segments in the same line, then the two segments fused into one.

In Fig. 3 (b), the normal distance is greater than the threshold value, but the projection lengths of the two parallel lines are 0. Think the two are not the same segment of the spine is to traverse the edge, a group

of adjacent segments.

In Figure 3 (c) in three, normal distance is greater than the threshold and the two parallel segments each projection length is greater than 0, is that the two lines for the two long edge of the same spine, tied for the candidate parallel lines.

4.1 The spine rectangle detection and screening

According to the visual characteristics of spine 1, spine contour can be approximated as rectangular, short edge contour is nearly perpendicular to the long side of the contour. Due to the short edge of the spine when growth, growth gradient direction of each pixel on a segment should be approximately 90 degrees angle and tangent line growth of [6]. So according to the characteristics of judgment, when the short edge growth to the minimum and the gradient gradient direction and spine long edge direction angle approximate to 0, stop growing. The four vertices after the growth are taken as the four vertices of the candidate rectangle box, and the algorithm flow is as follows:

S1：Determine initial vertices. As the projection line L1 to line L2, select two points near the center as the initial vertex, the rectangle hypothesis L1, L2 as shown in Figure 4, it can be seen from the figure of P3, P11 in P4, P21, P3 is selected for two P11, the initial growth point.

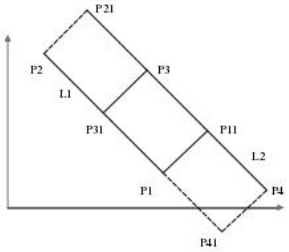

Figure 5 Sketch map of line segment projection

S2：Determine the growth line and direction. L1 and L2 along the tangential direction to the ends of the growth, short-term P3P31 and P1P11 growth is the spine of short edge candidate.

S3：Determination of growth arrest conditions. According to the characteristics of the spine visual features 5, this type (1) to determine the growth conditions of[7] stop.

$$E(e)=\frac{\sum\left|\arccos\left(\left|I(p)\bullet\hat{n}(e)\right|\right)-90\right|}{N} \quad (1)$$

In the formula, $\hat{n}(e)$ is the gradient direction of each pixel candidate short edge of the spine, spine of $I(p)$ long edge of the tangential direction, $E(e)$ and tangent angle on each growth gradient direction of each pixel on a segment of the cumulative mean and absolute difference of 90. N is the number of pixels in the line of growth, e pixels.

4.2 Rectangular box screening based on visual features

After rectangle rectangle detection algorithm, can get a series of spine fitting, called a candidate rectangle. DetectedThe candidate rectangle often has the following error segmentation problem.

Problem 1：The candidate rectangle does not meet the characteristics of the visual features of spine in 4, that is 2 times less than the length of the rectangle candidate long short axis.

Problem 2：The candidate rectangle for back clearance.

In Problem 1, according to the visual characteristics of spine 4, when 2 times the candidate rectangular frame length is less than the length of the long axis of the short axis, the candidate rectangle filter.In 2, according to the visual characteristics of spine 5 shows that when the image texture features less candidate rectangular box, is that the candidate rectangle for the spine clearance, and filtering.

4.3 Analysis of experimental results

Requirements for spine edge detection of the visual inspection system for books:

⑴Can detect the external contour of the spine intact.

⑵All of the spine can well separate area profile.

1）Experiment one

In order to test the performance of the algorithm in this paper, we take the following three sets of experiments.In experiment one neat picture of the spine.In the library books because of the convenient searching and borrowing are neatly arranged. In order to validate the performance of this algorithm in the library in the scene, this paper chooses 500 pieces of photos back in the library. In the experiment, the experimental results are shown in figure 6.

Figure 6 Experiment 1 image group

According to the results of the experiment can be

seen that the accuracy of the algorithm proposed in this paper in the library scene reached 91.2%, has a better extraction effect of spine profile.

2）Experiment two: according to the image of the gap of the spine.

The book is not always neat, there is often a gap exists between the book and the book. In order to cut the gap to the spine image to further verify the algorithm, this paper selects the multi gap back photo experiment, experimental results shown in figure 7.

Figure 7 Experiment 2 image group

From Figure 7, the experimental results show that this algorithm for spine gap situation can still achieve accurate contour extraction of the spine.

3）Experiment 3：According to the book randomly placed spine image.

The spine image books randomly placed in life is to see the scene, in order to verify the practicability of the algorithm, cutting effect test algorithm of multi row image cluttered the spine, spine image selected pieces of randomly placed test books. The experimental results are shown in Figure 8:

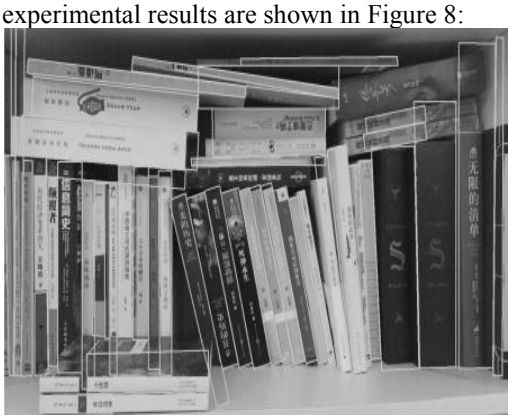

Figure 8 Experiment 3 image group

Through the experiment three experiment results show that this algorithm on the book spine images cluttered still have better cutting effect. After the statistics, this algorithm in cluttered, accurate rate is still 80%.

Through the above three experiments, the method proposed in this paper for the spine recognition experiment, when the spine arranged, this algorithm has better recognition effect, achieve the correct recognition rate of 91.2%. In this paper, and the algorithm for cluttered situations and cracks were better accuracy.

5.CONCLUSION

A recognition algorithm is proposed in this paper, a straight line detection using LSD algorithm, and analyzes the contour extraction algorithm based on visual features of spine. The experimental results show that, in the spine neatly when compared with the traditional algorithm has better segmentation effect, and can solve the defects of the spine can not be placed clutter the correct segmentation in the spine, placed clutter, have reached a higherEffective segmentation rate.

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The Application of Input and Output Hypothesis in Audio-lingual Class

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Abstract: Audio-lingual class is a kind of common class in English teaching activities, and it is also an important part of English classroom teaching. This paper first introduces the basic teaching mode of English audio-lingual class, that is, listening, speaking, reading and writing. In the process of teaching,led by the teacher, students serve as the main body. By creating the situation, the listening and speaking training of the students is continuously increased, so that their abilities of listening and language expressing are gradually strengthened, so as to their comprehensive ability to use the language. This paper analyzes the relationship between input and output in audio-lingual class by using Hamer's viewpoint. As for audio-lingual class, listening is the process of input and absorption,while saying is the process of expression and the process of output, which two are closely related and inseparable. And then the related theoretical basis of audio-lingual teaching mode is analysed, namely two key theories of the field of second language acquisition -- Krashen's input hypothesis and Swain's output hypothesis and the relationship between the two.Then four kinds of application of input and output theories in the teaching of audio-lingual class are summarized: 1. pay attention to the balance of input and output; 2. improve the quality of teacher discourse and optimize classroom input; 3. create flexible and diverse output activities to effectively help students internalize and absorb language input; 4. skillfully set up questions and correct errors, strengthen the interaction between teachers and students. Finally, it is concluded that successful second language acquisition is the result of both language input and output, thus both input and output should be paid equal attention to. At the same time, when stressing input, it is necessary to provide students with a great deal of output practice. Teachers should be good at guiding teaching practice with relevant theories, and creatively apply various teaching strategies to help students develop their listening, speaking, reading and writing skills harmoniously, and make their second language acquisition achieve the desired result.

Key words: audio-lingual class input hypothesis output hypothesis

1. INTRODUCTION

Listening and speaking are effective learning tools, and to train students' listening and speaking ability is the basic requirement of English teaching, so as a common class, audio-lingual class has been always highly valued. Input and output hypothesis are two key theories in the field of second language acquisition, giving significant enlightening to foreign language teaching. This paper first briefly introduces the basic teaching mode of English audio-lingual class, and analyzes the relationship between input and output; then analyzes the related theoretical basis of audio-lingual teaching mode, namely Krashen's input hypothesis and Swain's output hypothesis and the relationship between the two; in the third part, it explores four kinds of application of input and output hypothesis on audio-lingual class; based on all these discussion at last several conclusions are naturally put forward, among which the emphases of both input and output in audio-lingual is ranked in the first place.

2. THE BRIEF INTRODUCTION OF AUDIO-LINGUAL CLASS

Audio-lingual class is a common class in English teaching activities, and also an important part of English teaching. “Audio-lingual teaching mode is based on the cognitive law of language learning—listening, speaking, reading and writing, in which process the student is taken as the center under the teacher’s leading. By continuously creating scenarios and increasing training of listening and speaking, the students’ level of capturing listening information is improved naturally.”[2]It is through gradual training to gradually strengthen students' listening and language expression ability, as well as reading and writing ability. Its final aim is to effectively cultivate students' oral expression ability and language communication ability.

As for audio-lingual class, listening is the process of input and absorption, while speaking is the process of output and expression, which two are closely linked and inseparable. “Hamer (1983)once put forward the balance of "input, practice, output" which has great referential significance.”[2] He thinks that first of all, the students should have enough language input, perceive a large amount of language through vision and hearing, and understand the meaning, formal structure and communicative function of language materials by reading, listening and reading more; Second, students should be allowed to drill, digest and process the language materials and related knowledge repeatedly in a variety of activities, which

are put into the long-term memory system then; Finally, it is necessary for the students to reorganize the stored materials and knowledge, and express in oral or written form under new communicative circumstances so as to exchange information effectively. Input, intake (absorption) and output are perfectly interlocked, realizing balanced development and consisting an organic whole.

3. THEORETICAL BASIS OF AUDIO-LINGUAL TEACHING MODE

3.1 Input hypothesis

American scholar Krashen's theory of second language acquisition includes the following five hypothesis: the acquisition-learning hypothesis, the monitor hypothesis, the natural order hypothesis, the input hypothesis and the affective hypothesis, among which the input hypothesis is the core. It explores the way people learning language. People acquire the language in natural order by understanding language input that is a little more difficult than their current level which is called i+1. “i indicates the learners' current language knowledge or ability level, 1 means that the input language form or function should be slightly higher than the current level of learners. If learners are exposed to a large number of i+1 language form which suit their own level in the language learning process, they will unconsciously learn new language knowledge and make progress.”[4] Krashen points out four necessary conditions for optimal language input: intelligibility, interest or appropriateness,non grammatical program arrangement, and adequate intake. He emphasizes that comprehensible input is a necessary way of acquisition. Long also mentions that obtaining comprehensible language input is a common characteristic of all successful foreign language learners. The lack of comprehensible language input can lead to poor learning results and not even foreign language learning. At the same time, the input material that is slightly higher than the actual language level of the students will also bring students a sense of accomplishment and satisfaction, establishing the confidence of further study.

3.2 Output hypothesis

Krashen believes that comprehensible input plays a key role in second language acquisition, while Swain argues that output is of great necessity. By comparing the results of measurement in grammar, discourse and social language of six grade students in French immersion teaching and native French students of the same grade, Swain found that immersion teaching was not as successful as Krashen thought, in which the shortage of French output was an important factor restricting the development of language. Although the former had been immersed for several years and accepted a large amount of language input, they did not have access to native speakers of that language ability. Swain believes that "comprehensible input" has a great effect on the acquisition process, but it is still not enough to enable learners acquire the second language completely. “On the contrary, in the output process, the learners will actively mobilize the knowledge they have learned to express themselves, reflecting their positive learning attitude and state which exactly improves the quality of knowledge absorption. That is to say, the understanding of output improves learning efficiency”[3] For Swain, there are three functions of language output, they are: (1) to promote learners to pay attention to language form and the gap between what they intend to express and what they can express; (2) to provide learners with opportunities to check the hypothesis they have proposed; (3) to help learners reflect consciously, and to control and internalize language knowledge in the process of language output, which is called meta-language function.

3.3 The relationship between input and output

Krashen's input hypothesis and Swain's output hypothesis are discussing language acquisition from two perspectives, both which have some enlightenment to foreign language teaching.In the process of language acquisition, language input is the first or to master a language will become empty talk. Language input is an indispensable way to lay good foundation for language, serving as a promise and a guarantee because it is known to all that no input no output. However, language input is not the only condition for language acquisition. “In Swain’s opinion, in addition to the necessary comprehensible input, learners must have the opportunity to use the language, so that it is possible to have access to the level that are fluency and similar to native speakers"[4]. Seen as the most effective way to internalize and consolidate the language, the output of language is the creative application of knowledge, which in turn encourages learners to reflect themselves and to feel the lack of language knowledge, so as to promote more language input. In a word, language input is the source of language output. Only if the input is sufficient is there a possibility to have a good language output. The latter reacts to the former and acts as booster. The two are essentially interactive, forming a complete circle in the process of language acquisition.

4. APPLICATION OF INPUT&OUTPUT HYPOTHESIS IN AUDIO-LINGUAL CLASS

As we mentioned in the first part, in an audio-lingual class listening is a process of input while speaking can be seen as a process of output. The two are closely linked and can not be separated apart, so we should integrate listening and speaking activities. Teachers should not only play the role of knowledge provider in the audio-lingual class, but also the role of guide and learning model. Teachers should be able to use a variety of effective teaching methods to stimulate students’ enthusiasm of communicative interaction in an audio-lingual class, to encourage students to use the language actively, and to help

students transfer from passive receptors of language knowledge to active participants in the language communication. For this an audio-lingual class should pay attention to the following points:

4.1 Focusing on the balance of input and output.

English audio-lingual class mainly focuses on the listening and speaking among four basic skills. Generally speaking, the language input and output should be balanced development".[2] In order to achieve the balance between input and output, some adjustments should be made on the macro level. First, adjust the time occupied by input in the class; second, the language form and related cultural input should be taken into account as for content input in class, so that the input is easily understandable and full of fun; third, the output should be a necessary part of teaching. In addition, much attention should be payed to the balance between oral and written output, so that these two of learners realize a certain degree of cohesion in the content, promoting each other. Finally, some meaningful extracurricular activities can be carried out to increase the chances of language output and provide a good atmosphere for it.

4.2Improving the quality of teachers' discourse and optimizing class input.

In the second language teaching, teacher talk is regarded as the most reliable source of target language of students. Therefore, each teacher should be committed to improve their oral expression, so as to provide a large amount of comprehensible, interesting and appropriate language information in a limited time for students and to promote the second language acquisition. Teachers should follow the "i+1" principle of comprehensible input hypothesis of Krashen, so that the information output is close to the "i+1" level of most of the students in the class as much as possible. Specifically, first of all, in the choices of teaching and listening materials, they are supposed to take into account that the breadth and difficulty of the content is suitable for students or not. Being too difficult will demotivate the enthusiasm of students while too easy will fail to reach the ideal teaching effect; secondly, teachers should insist on teaching in English, so as to increase the input of auditory information and create a foreign language learning atmosphere; finally, as an example of learning and imitation, teachers should strive to standardize, accurate, skilled, authentic speaking as far as possible to create a natural and authentic English environment for students. In addition, extra curricular input is also essential. For example, teachers can propose feasible extracurricular reading suggestions for students of different levels, by various methods like giving reading tasks to the deadline, answering questions or checking in class and so on to urge the students to be fully exposed to the target language, ensuring the quality and quantity of input.

4.3 Creating flexible and diverse output activities.

Teachers should create a variety of output activities to make the class become a practical place for language learning, effectively helping students internalize, absorb language input through language output and improving their English proficiency effectively based on the language acquisition knowledge. For instance, before a new class, the teacher can design topics that are related to the theme of the text for students to discuss, and give timely introduction of new courses; during explanation, teachers can organize group discussion, role-playing, situational dialogues and related games that students are interested in around the text, which will surely let students experience the real scenes in English communication. "In addition, paying attention to the principle of combining inside and outside class is necessary. After all class time is limited. Teachers can also carry out various forms of language practice after class, enabling students to become active exporters of language learning".[1] In a word, a variety of language output activities will promote the transformation of language knowledge stored by students to the application level.

4.4 Questioning and correcting skillfully to strengthen the interaction between teachers and students.

The new teaching model emphasizes on the student-centered teaching and the changing of teachers' dominant position. Strengthening the interaction between teachers and students, fully motivating the enthusiasm of students are also referred. "As the bridge and link of the interaction between teachers and students, questioning is an important means of teachers' organizing classroom teaching and playing a leading role. To cultivate students' communicative competence, teachers should use more referential questions. As for the form of questioning, it is better to adopt special questions or alternative questions to increase the depth of thinking and the expression of space of students ."[4]

For the students' errors in the application of language, teachers should treat them differently and give appropriate feedback. For those errors that can be avoided with the increasing of comprehensible language input, teachers can tolerate to a certain extend. But for the language form errors which emerge repeatedly of the learners, teachers should correct in time. Teachers should try their best to maintain the continuity of the students' thinking and expression, and avoid interrupting the students to correct the mistakes frequently. Teachers should also make good use of the principle of praise to enhance students' confidence and sense of achievement. For the expression errors, teachers could have a try to guide students to self-correct. When commenting the composition of students, teachers may use different symbols to mark different types of errors to correct the hypothesis of target language forms that students have made. Comment feedback could aim at the overall evaluation of the composition, making the

evaluation more targeting.

5. CONCLUSION

Successful second language acquisition is a combination of language input and output. Therefore, in the teaching of audio-lingual class, both input and output should be equally emphasized. When paying attention to input, teachers should provide students with a large number of output practice at the same time. Teacher are supposed to be good at guiding the teaching practice with related theories, creatively use different teaching strategies to help students get coordinative development of all skills including listening, speaking, reading and writing. Teachers should also help students achieve the value of learning English in the application, so that they achieve desired results to the English learning.

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Research on the PH Control Strategy of Waste Water Treatment

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Abstract: In the sewage treatment system, to achieve effective control of pH value, ensure the stable and efficient operation, in view of the pH value has the characteristics of nonlinear, time-varying and uncertainty, used to improve the real-time learning algorithm of soft measurement model, the particle swarm algorithm to optimize parameters, constitute a set of automatic control system can accurately predict waste water pH.
Key words: sewage treatment system; improved real-time learning algorithm; soft measurement; particle swarm optimization; accurately predict

1.INTRODUCTION

Water is the source of life. It nurtures and sustains all living things on earth. With the continuous development of industry and the rapid increase of urban population, a large number of industrial and living sewage treatment has received more and more widely attention, has become China's current water crisis is the most serious water pollution, the most pressing problem. People are increasingly calling for environmental protection, and sewage treatment is imminent. Moreover, China is a country with severe drought and water shortage, and the shortage of fresh water resources has become an important problem that China urgently needs to solve. The treated sewage can irrigate the farmland directly, which can alleviate the water crisis.

PH neutralization was higher in the process of sewage treatment control difficulty, because in the sewage treatment PH neutralization reaction exists serious nonlinear, and the PH neutralization process is in the open air flow in the process of the reaction, the process you are easily influenced by their chemical composition, whether contains other substances, external environment factors such as interference. PH instrument when measuring the PH, whether can be long, uninterrupted, very reliable testing analysis, shall be implemented for sewage and sewage processing stages required PH value is different, this is the main factors of PH control difficult.Although the national problem is becoming more and more attention to the environment, to control the sewage problem also continues to study and formulate corresponding measures, but so far, most of the domestic sewage treatment value control is still in the artificial control or semi-automatic control level, still not found a satisfactory control scheme. Modern control method and intelligent control development, but from the current domestic use value in the automatic control system control strategy, most of them still adopts the single loop controller or simple algorithm, with the continuous development of the industrial production process of large scale and complicated, nonlinear, time-varying, large time delay, system uncertainty does not match, unable to better meet the production control of safe, stable, high quality, efficient, etc. So, be badly in need of the modern control theory, instrument technology, electronic technology and other technology, can develop into suitable for wastewater treatment applications of high precision, high efficiency and practical value of the automatic control system.

2.SEWAGE PH ANALYSIS

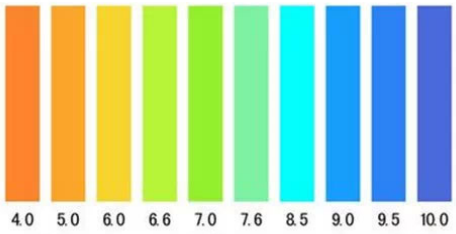

Fig.1 Sewage PH analysis

The structure of the incinerator furnace is shown in

General theory is that the essence of the neutralization reaction acid is in the water dissociation of $[H^+]$ with alkaline substances in the case of $[OH^+]$ water dissociation from water.The neutralization point of water(PH=7)is where the hydrogen ion and hydroxide concentration are equal.

According to the principle of electron neutralization, the charge needs to be balanced in the solution, that is, all ion concentrations in the solution meet the electric neutralization conditions. PH neutralization process is the process of neutralization reaction of acid-base, and the PH value of solution is measured by acid base titration.The acid base titration refers to the change in the value of acid or lye with the addition of neutralizer.

Fig. 1,It is a typical neutralization process curve. It can be clearly seen from the process curve that the PH neutralization process is a typical nonlinear change process.Near the PH = 7, the static gain of the object is large, the added changes slightly acidic or alkaline solution can cause the value of the change of

the larger degree of insulation from PH = 7, the static gain of the object is very small, only to join a large amount of acidic or alkaline solution can cause small changes in PH.The nonlinearity is characterized by high sensitivity near the neutral point and low sensitivity in the distance from the neutralization point. The process gain is extremely high near the neutral point and is very sensitive to interference. Because even though it's smaller the disturbance will significantly change the process dynamics.

3.REAL-TIME LEARNING ALGORITHM BASED ON DISTANCE AND ANGLE INFORMATION.

Instant learning strategy, using the system to the current point, from the historical database for matching with the current point of the best series of data, with some kind of modeling method, establish the local model of the current system, and calculate the output of the system. Compared with the global modeling method, as a result of the real-time learning model is set up and optimize local, makes the model prediction error smaller, and because the forecast model is only produced in the query point, thus can add new online observation data to the database, or deleted from the database of the old data, the model has good adaptive ability.

The current input sample information and database sample information are all 5-dimensional vectors. Current input sample vector, database sample vector. The distance and Angle information are as follows: in working conditions, the static model established by conventional methods decreases with time accuracy, and the real-time learning model can be used to improve the measurement accuracy.

Traditional real-time learning algorithm is chosen using method used for local modeling information vector, however, this method does not fully express the similarity of information to illustrate this, consider a two-dimensional space information vector.The current input sample information and database sample information are all 5-dimensional vectors $X_a = (X_{a1}, \ldots, X_{a5})^T$. Current input sample vector $X_i = (X_{i1}, \ldots, X_{i5})^T$, data base sample vector.The distance and Angle information of X_a and X_i are expressed as follows:

$$d(x_q, x_i) = \sqrt{\sum_{j=1}^{5} (x_{qi} - x_{ij})^2} \qquad (1)$$

$$\cos(\theta_i) = \frac{\Delta X_q^T \Delta X_i}{\|\Delta X_q\|_2 \|\Delta X_i\|_2} \qquad (2)$$

$$s_i = \lambda \sqrt{e^{-d^2(x_q, x_i)}} + (1-\lambda)\cos(\theta_i),$$

$$if\ \cos(\theta_i) \geq 0$$

In the above equation, the coefficient of $\lambda \in [0,1]$ weight is similar to the value range of s_i . The higher X_a , the higher X_i the likelihood.

(1) θ_i when it is larger, namely $\cos(\theta_i) < 0$, the similarity of X_i and X_a is low. To ensure the accuracy of modeling, data samples should be abandoned;

(2)when θ_i is small, namely $\cos(\theta_i) \geq 0$, X_i is similar to X_a , and the similar sample set is selected according to formula (3).

The learning set size of the real-time learning algorithm also affects the accuracy of the model and the speed of the algorithm. There is no good method to determine beforehand, which can only be estimated later. Therefore, at the beginning of modeling, it is possible to determine the change range of neighbor s_i based on prior knowledge to determine the minimum number of θ_i system data required for the model of the current working point, and the maximum number of system data.

4.WASTE WATER TREATMENT PH PREDICTION MODELING.

(2) input and two output system, as shown in Fig.2:

Support vector machine (SVM) is by Vapnik initially established on the basis of statistical learning theory is a powerful machine learning method, is a novel artificial intelligence technology, originally used in pattern recognition, is currently in signal processing, system identification and modeling,advanced control and soft sensor has been widely used.

Compared with artificial neural network, support vector machine (SVM) can effectively overcome the long training time, training results, randomicity, and the learning deficiencies, so more and more widely used in complex nonlinear system modeling. Least squares support vector machine (SVM) is a type of support vector machine, this article aims to illustrate the basic algorithm, analysis of model parameters on the model precision, complexity, amount of calculation and the influence of variable storage space, and proposes the improved algorithm to improve the overall performance of the model.

4.1 The LS - SVM algorithm

Set the input sample , $\{x_j, y_i\}$ $i = 1, \ldots, l$, $x_i \in R^n$ and $y_i \in R$, and use the nonlinear mapping $\phi(\bullet): X \to F$ to map the sample nonlinearity into the high-dimensional feature space, and construct the optimal decision function:

$$f(x) = w^T \bullet \phi(x) + b$$

According to the principle of structural risk minimization, the inequality constraints in the conventional standard SVM are replaced with equality constraints on the LS-SVM regression estimation problem. Therefore, the optimization objective function is transformed into:

$$\min J(w,e) = \frac{1}{2}||w||^2 + \frac{1}{2}C\sum_{I=1}^{L} e_i^2 \quad (4)$$

The constraint conditions are:

$$y_i = w^T\varphi(x_i) + b + e_i, i = 1,2,\ldots,l$$

In the formula, J is the optimization objective function and C is the penalty parameter.

The corresponding Lagrange function is:

$$L(w,b,\alpha,\xi) = \frac{1}{2}w \bullet w^T + \frac{1}{2}C\sum_{i=1}^{l} e_i^2 - \sum_{i=1}^{l}\alpha_i[w^T \bullet \varphi(x_i) + b + e_i - y_i] \quad (5)$$

In the formula, $\alpha = [\alpha_1, \alpha_2, \ldots, \alpha_l]^T$ is Lagrange multiplier.

Take partial derivative of it:

$$\begin{cases} \dfrac{\partial L}{\partial w} = 0 \to w = \sum_{i-1}^{l}\alpha_i\varphi(x_i) \\ \dfrac{\partial L}{\partial b} = 0 \to \sum_{i-1}^{l}\alpha_i = 0 \\ \dfrac{\partial L}{\partial e_i} = 0 \to \alpha_i = Ce_i \\ \dfrac{\partial L}{\partial \alpha_i} = 0 \to w^T\varphi(x_i) + b + e_i - y_i = 0 \end{cases}$$

In this paper, the equation of two dimensional linear equations is obtained, and the optimization problem to be solved is transformed into the following linear equations: $\begin{pmatrix} 0 & I^T \\ I & \Omega + C^{-1}I \end{pmatrix}\begin{pmatrix} b \\ \alpha \end{pmatrix} = \begin{pmatrix} 0 \\ y \end{pmatrix}$

Where: $y = [y_1, \ldots, y_l], I_L = [I, \ldots, I]$, I is the unitmatrix,

$$\Omega_{i,j} = \varphi(x_i) \bullet \varphi(x_j) = K(x_i, x_j), i, j = 1, \ldots, l$$

LS-SVM regression estimation function is:

$$f(x) = \sum_{i=1}^{l}\alpha_i K(x_i, x) + b \quad (6)$$

Therefore the research on the identification parameters of the incinerator system model can be attributed to the study of the identification parameters of a single MISO system.

4.2 Particle swarm optimization system parameters.

Particle Swarm Optimization (Particle Swarm Optimization, PSO) is based on population simulation of swarm intelligence optimization method, proved a point, such as simple structure, easy to be realized.

Particle swarm optimization is used to solve individual optimal solution and population optimal solution. There is a difference between particles in a population. Due to the existence of particles in the search for solutions on interaction, there are also competing with each other, so if a particle found, then the individual with other particles through mutual cooperation,also to find the solution.

In order to make the particles can quickly find a solution in search space, so that each particle has a function to control and adjust the direction and speed of particle flight, thus to speed up the position of particles to find the optimal solution. In order to speed up the convergence rate of particle swarm, particle swarm needs to accelerate the convergence rate of individual in particle swarm. The convergence speed of individual particles is accelerated and the convergence rate of the whole particle swarm is accelerated.

In the process of iteration, the particle will trace two "extreme" to constantly update their information, one is individual extremum $pbest$, refers to the particles themselves until now can find the optimal solution; The other is the global extreme $gbest$, which is the optimal solution that the entire population can find so far. Suppose that in a D dimensional target search space, there are m particles that form a group. Where you use vectors define and minimize quadratic criterion functions: $X_i = (x_{i1}, x_{i2}, \ldots, x_{id}, \ldots, x_{iD})$ said the first i a particle's position, $V_i = (v_{i1}, v_{i2}, \ldots, v_{id}, \ldots, v_{iD})$ said its corresponding speed.The corresponding velocity. When the first i particles by iteration to the current optimal information, at this point the particles is called the individual particles, best for $pbest$, and when all particles iteration to current optimal information referred to as the global best particle, remember to . Each particle can update its speed and position $gbest$ according to the following formula.

$$\begin{cases} v_{id}^{t+1} = \omega v_{id}^t + c_1 r_1(p_{id}^t - x_{id}^t) + c_2 r_2(p_{gd}^t - x_{id}^t) \\ x_i^{(k+1)} = x_i^{(k)} + v_i^{k+1} \end{cases} \quad (7)$$

In the formula, the dimension of the solution is $d = 1, 2, \ldots, n$; The population size $i = 1, 2, \ldots, m$ is generally 5 to 10 times the number of particles. t is the current iteration number of evolution; r_1 and r_2 are the random Numbers between $[0,1]$; c_1 and c_2 are the acceleration factors, and usually the value range is $[0,2]$, c_1 indicates the degree of dependence of the particles on their memory. c_2 determines the influence of other particles in the particle population on the particle itself, which makes each particle close to the position of p_i and p_g respectively.

In order to improve the efficiency of the algorithm, it

is not considered that the parameters of the granule can be adjusted according to the characteristics of the granule. In the same time, in the process of searching for the clustering of the particle swarm, the loss of the multi-sample of the group can be avoided, but it can be trapped in the extreme value of the office, and it can be made early and collected.The particle swarm optimization method is based on the optimization algorithm of swarm intelligence, with simple structure, easy to implement and so on. Because of this, in this paper, the particle swarm method introduced into the identification of nonlinear on the series model, and in order to calculate method of high performance and avoid falling into local extreme point, an improved particle swarm optimization algorithm.

ω is the inertial weight coefficient, which is required to satisfy the $\omega = \omega_{\max} - \frac{t}{t_{\max}}(\omega_{\max} - \omega_{\min})$. When the number of iterations increases gradually, it will change linearly. $v_{id}(t) \in [-V_{\max}, V_{\min}]$, $V_{\max}$ for maximum limit velocity of particles in each dimension, the algorithm is used to balance the search ability and development ability, generally set for each dimension of the particle variable range of 10% 20%, once the updated particles at a faster rate than the $V_{\max}$ is limited as $V_{\max}$. Evolution through continuous particles.

Process of improving PSO algorithm:

(1) initialize a group of particles (group size N), including random location and speed;

(2) evaluate the fitness of each particle;

(3) compare the adaptive value of each particle with the best position of $pbest$, and if it is better, it will be the best position in the current position.

(4) compare the adaptive value of each particle with the best position of $gbest$, and if it is better, it will be the best position in the current position.

(5)adjust particle velocity and position according to formula (2) and (3);

(6)if the end condition is not met, turn to step 2.

The iterative termination conditions are generally selected as the maximum number of iterations or the optimal location of the particle swarm so far to meet the predetermined minimum adaptive threshold.

In formula (2) and (3), $pbest$ and $gbest$ respectively represent the local and global optimal location of the particle swarm.

4.3Prediction model establishment

To make the algorithm has smaller computational overhead, use the add instant learning least-square support vector algorithm, the data acquisition of sample set using real-time learning strategies to the current selection of the input sample data of similar data set.

First, calculate the Euclidean distance of the current input sample data and each cluster center, and find a cluster center nearest to the current input sample data; Then, based on the similarity formula of distance and Angle information, the sample data of local model is selected. At the same time, the updating strategy of the sample data set is designed accordingly.

The process of establishing an improved prediction model is shown in figure 2.

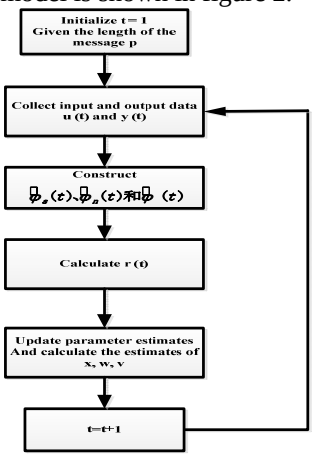

Fig. 2 Predictive model flow chart.

According to the previous analysis, the input vector of the model X was selected as: sewage temperature T, flow rate Q, sludge concentration SS, dissolved oxygen DO, concentration, sewage COD concentration; The output vector Y is: PH value, then:

$$X = [T, Q, DO, SS, COD_{in}]. Y = [PH]$$

For further instructions based on real-time learning strategies LS_SVM waste water PH the validity of the model, select a month of actual production data, after data pretreatment group received 100 valid data, including 50 sets of data for modeling, another 50 group data for calibration algorithm.

In MATLAB simulation environment, select RBF kernel function. At the initial time, each parameter is set to select the optimized parameter range, $C = [10, 1000]$, PSO parameter initial value, $V_{\max} = 10$, $V_{\min} = 0.4$, $c_1 = c_2 = 2$, maximum iteration number 100. Through continuous training and learning of sample data, and using PSO algorithm to adjust and determine the optimal parameters of LS-SVM model, we get $\sigma = 0.069, C = 803$. Finally, the predicted values of waste water PH can be obtained by substituting these two parameter values into the model.

The simulation results of the model are simulated, and the simulation results are shown in the figure below. Figure 3 shows the LS-SVM soft measurement model waste water PH training curve, figure 4 is the model training error; figure 5 is the

prediction curve of the sewage PH, and figure 6 is the poor prediction of the model. The training error and prediction error are analyzed in table 2.

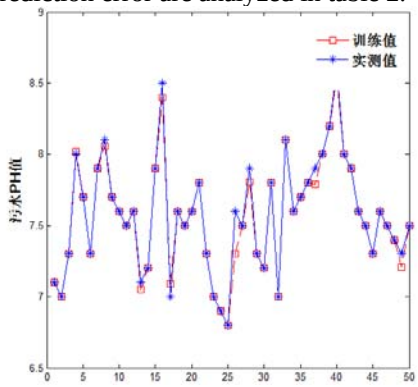

Fig.3 Training curve

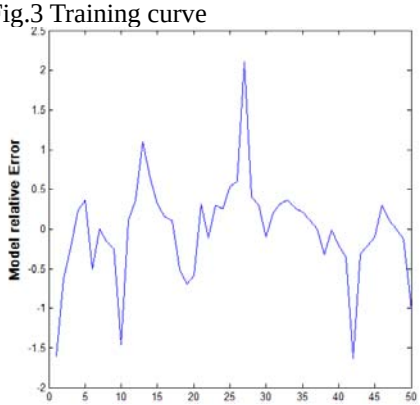

Fig.4 The training error

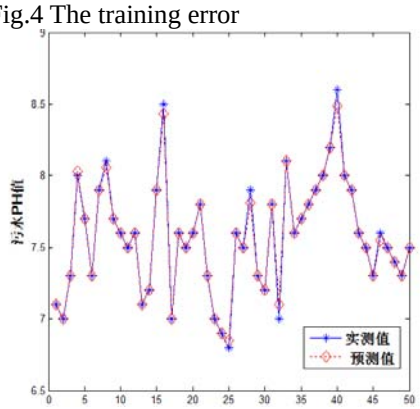

Fig.5 Forecasting curve

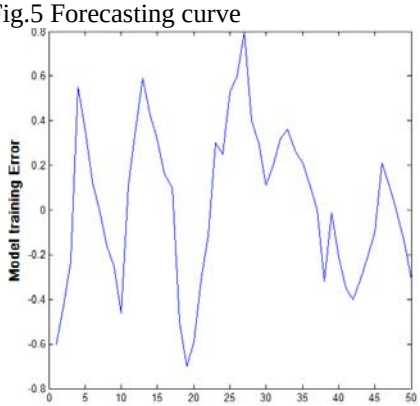

Fig.5 The prediction error

In waste water biochemical treatment process of waste water PH prediction problem, this chapter first instant LS - SVM learning algorithm is studied in theory, and through a lot of theoretical analysis proves that the instant LS - SVM learning good learning performance, especially in dealing with small sample data has significant advantages. Because instant study LS - SVM prediction accuracy depends on the choice of the parameters of the model, this chapter introduces the theory of evolution thought in the particle swarm optimization (POS) algorithm for real-time learning LS - SVM parameter optimization research, and according to the measured data to establish the corresponding waste water PH soft measurement LS-SVM model. Simulation results show that the prediction accuracy of LS-SVM prediction model based on PSO optimization is high and the training time is very short, which further proves the feasibility of this method.

10000 groups of data were collected through field debugging, and the model parameters were identified using the first 3000 sets of data as input and output;The remaining 7000 sets of data are used to verify the correctness of the resulting model, but the data is too much to simulate the distortion, so the data

4 Epilogue

This article in view of the waste water treatment process of waste water PH to timely and accurate prediction problem, from the perspective of improve forecasting precision and generalization ability, put forward a real-time learning algorithm based on the least squares support vector machine (SVM) modeling method, and the use of sewage plant actual data simulation. Through the error analysis of the model itself and the LS - SVM model comparison and analysis, it is put forward in this paper the waste water PH prediction model predictive better, can meet the waste water treatment process of waste water PH accurate real-time forecasting and provide reliable reference for practical production.

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