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CONTENTS

A Novel Representation of Digital Audio on Quantum Computers

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Abstract: Quantum audio representation is the cornerstone of quantum audio processing, In this paper, we propose a novel representation of digital audio (NRQA) on quantum computers, which in a normalized state with entangling information about times and their corresponding amplitudes in the audio, Compared to some known efforts, the NRQA only need one qubit to store arbitrary graded amplitude information by utilizing angle mapping, Then the preparation process for NRQA are introduced based on basic quantum gates, and draw the corresponding implement circuit, It opens the way for introducing audio processing into quantum scenarios,
Keywords: Quantum Audio Processing, Audio Representation, Quantum Computation, Quantum Circuit, Quantum Computer,

1. INTRODUCTION

Since the basic concept of quantum computer was first proposed by Feynman in 1982 [1], quantum computing has attracted the attention of many researchers. In general, the research on quantum computing can be divided into two aspects. One is to use physical particles (i.e. such as photons) to develop quantum computers from hardware and related research in quantum communication, but until now, quantum computers are in the early stages of development [2–4].

The other one is quantum information processing based on quantum computer. Sound and images are the two most important ways for humans to obtain information, but the current research using quantum computing is limited to quantum images and its variant (i.e. quantum video). To diverse it, Yang proposed a quantum representation of audio by saving amplitude values with the phase of qubits, and use the phase gate to perform operation on the amplitude information, however the corresponding preparation method is not provided [5]. Then, a quantum representation of digital audio (QRDA) is proposed by uses two entangled qubit sequences to store the audio amplitude and time information, and performed some exemplary quantum audio processing operations in [6]. But the disadvantage is that the QRDA cannot represent negative amplitude, then to solve this Yan proposed a flexible representation and manipulation of audio signals on quantum computers (FRQA) [7], the FRQA encodes the amplitude component of an audio signal in two's complement notation. Some quantum audio processing algorithm is proposed based on these representations, such as audio endpoint detection [8]. Stereophonic sound or, more commonly, stereo, is a method of sound reproduction that creates an illusion of multi-directional audible perspective. The latest research (quantum representation of multichannel audio, QRMA) have successfully extended quantum expressions from mono to multi-channel audio based on FRQA by entanglement channel information [9].

At present, all the research results have the same problem, that is, the number of quantum bits consumed is large, which is not conducive to real experiments on current quantum computers.

This paper try to solve the problem and promote the development of QAP by giving a quantum representation of digital audio (NRQA). The audio amplitude values are stored in the probability coefficients of the quantum ground state.

The remainder of this paper is introduced as follows. Section 2 gives some preliminaries, including the digital audio, some quantum gates. Section 3 presents a detailed description of the new representation of quantum audio. Section 4 shows the preparation of the new expression. Finally, the conclusion is summarized in Section 5.

2. Preliminaries

In this section, for easier understanding, we introduce some basic knowledge about classical digital audio firstly. Then we introduce some quantum gates which used in implement and extract of quantum audio and NRQA.

2.1. The Mathematical Representation of Classical Digital Audio

The sound is generated by the vibration of the object and spreads in all directions by sound waves. In physics, the object that is vocalizing is called the sound source. Such as: the vocal cord that is vibrating, the tuning fork that is vibrating, the drum that is ringing, etc, are all sound sources. However, the audio signal generated by the sound source is a one-dimensional analog signal that varies continuously in both time and amplitude. A single channel audio can simply represented by a superposition of multiple sine waves:

$$y(t) = A\sin(wt + \psi), w = 2\pi f \quad (1)$$

The symbol A, w, ψ, f, t represent amplitude, angular frequency, primary phase, frequency and time respectively.

In order to be able to use the computer to process the sound, it is necessary to convert the continuous analog audio signal into a discrete digital audio signal. The conversion method is use analog-to-digital converter (A/D) to sampling. Figure 1 give an A/D example with 15 samples.

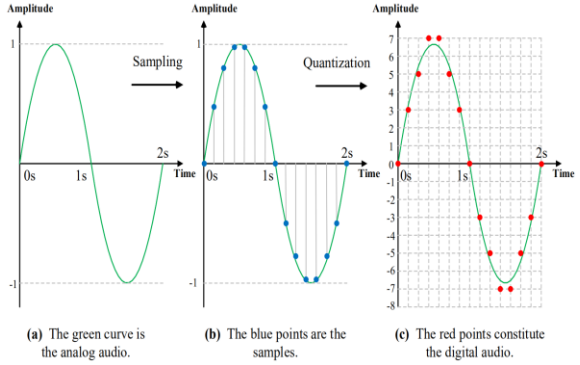


Figure 1 An example about a/d, with the 4-bit quantization

Therefore, a single channel digital audio D can finally be represented by a set of amplitude values obtained after sampling and quantization, which shown in Eq.(2).

$$D=[d_0,d_0,\cdots,d_{L-1}],d_i\in\left\{-2^{q-1},\cdots,2^{q-1}-1\right\} \quad (2)$$

(2)Quantum gates

In quantum computer, analogous to the concept of 0 and 1 in classic computer, information is store in two dimensional computational basis quantum states, i.e. $|0\rangle$ and $|1\rangle$. They are a set of orthogonal bases that make up the Hilbert vector space.

The Identity (I), Hadmard (H) and Pauli-X (X) gates (NOT gate) are three commonly used single gates, their corresponding matrices are

$$I=\begin{bmatrix}1&0\\0&1\end{bmatrix},H=\frac{1}{\sqrt{2}}\begin{bmatrix}1&1\\1&-1\end{bmatrix},X=\begin{bmatrix}0&1\\1&0\end{bmatrix} \quad (3)$$

3. A NOVEL REPRESENTATION OF DIGITAL AUDIO ON QUANTUM COMPUTERS

Based on the analysis of existing FRQI quantum image representation [10], a quantum representation of single-channel audio (NEQA) is proposed. In this model, amplitude and time information are entangled, and amplitude are store in the angle parameters of the coefficients of basic state $|0\rangle$ and $|1\rangle$ of qubit.

For clarity, NRQA for a single-channel audio $D\left(D=[d_0,d_0,\cdots,d_{L-2},d_{L-1}]\right)$ is defined as a state $|A(\theta)\rangle$ in the Eq.(4-5)

$$\begin{aligned}|A(\theta)\rangle&=\frac{1}{\sqrt{2^l}}\sum_{T=0}^{L-1}|D_T\rangle\otimes|T\rangle,\\ |T\rangle&=|t_0t_1\cdots t_{l-2}t_{l-1}\rangle,t_i\in\{0,1\},\\ |D_T\rangle&=\cos\theta_T|0\rangle+\sin\theta_T|1\rangle,\end{aligned} \quad (4)$$

where

$$\theta_T\in\left[0,\frac{\pi}{2}\right],l=\begin{cases}1, & L=1,\\ \lceil\log_2 L\rceil, & L>1\end{cases}. \quad (5)$$

Here, $|A\rangle$ is a quantum state represent a mono audio which length is L, T=0,1,2,⋯,L-2,L-1 and use l qubits to store the time component $|T\rangle$ that can represent up to 2^l samples (i.e. in this study, we use Hadamard gates in Eq.(3) to code time information so that $|0\rangle$ and $|1\rangle$ appear with equal probability). $\otimes$ is the tensor product notation. The sample amplitude information store in $|D_T\rangle$. Differently, a amplitude information d_T is encoded into the angle parameter of probability coefficient θ_T of a qubit rather than the basis states of a qubit sequence, compared with earlier research results QRDA and FRQA[6,7], so vectors of angles $\theta=(\theta_0,\theta_0,\cdots,\theta_T,\cdots\theta_{L-1})$ can describe the D. Therefore, the NRQA model only needs (l + 1) qubits to represent a single-channel audio of length L and it is currently the most economical way to save quantum bits.

Note that for an audio with L length, usually the L cannot be represented by 2^l, so using l qubits to represent time information will reduce 2^l-L audio redundancies [6]. This is caused by the binary operation feature and is inevitable, for example, to represent a single-channel audio with L = 6, according to Eq.(5) need $l=\lceil\log_2 6\rceil=3$ qubits to code time information, so the 000, 001, 010, 011, 100, 101 is useful and 110, 111 is redundancies. In this study, we have agreed that the first L time points are effective, and the remaining part as redundancy, moreover set the redundancy to a special superimposed state

$$|Z\rangle=\cos\frac{\pi}{4}|0\rangle+\sin\frac{\pi}{4}|1\rangle=\frac{1}{\sqrt{2}}|0\rangle+\frac{1}{\sqrt{2}}|1\rangle \quad (6)$$

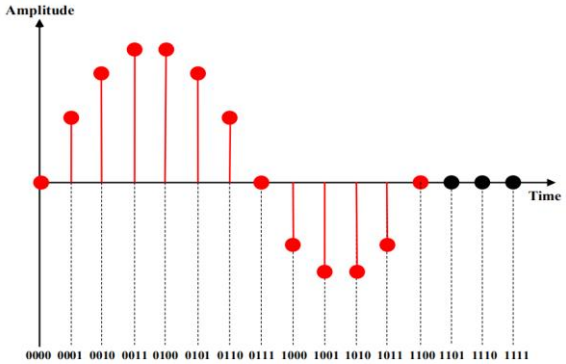
Figure 2 Give a Nrqa Example for a Mono Audio.

Besides, the NRQA state is a normalized state for $\||S\rangle\|=1$, the calculation process is as follows:

$$\begin{aligned}\||S\rangle\|&=\frac{1}{\sqrt{2^l}}\sqrt{\sum_{T=0}^{L-1}\left(\cos^2\theta_T+\sin^2\theta_T\right)+\sum_{T=L}^{2^l-1}\left(\cos^2\frac{\pi}{4}+\sin^2\frac{\pi}{4}\right)}\\ &=1\end{aligned} \quad (7)$$

4. NRQA PREPARATION

In order to process an audio using quantum mechanics, the quantum audio preparation procedure should be done at first which makes the audio information to be stored in the quantum state. In this section, the NRQA preparation is described. However, the preparation of NRQA includes preparation for redundancy. The preparation of NRQA from quantum computer will be discussed. Due to the difference between mono and multi-channel audio, we will separately introduce their preparation.



$$
\begin{aligned}
|S\rangle = \frac{1}{\sqrt{16}}\Big[&\left(\cos\theta_0|0\rangle+\sin\theta_0|1\rangle\right)\otimes|0000\rangle+\left(\cos\theta_1|0\rangle+\sin\theta_1|1\rangle\right)\otimes|0001\rangle\\
&+\left(\cos\theta_2|0\rangle+\sin\theta_2|1\rangle\right)\otimes|0010\rangle+\left(\cos\theta_3|0\rangle+\sin\theta_3|1\rangle\right)\otimes|0011\rangle\\
&+\left(\cos\theta_4|0\rangle+\sin\theta_4|1\rangle\right)\otimes|0100\rangle+\left(\cos\theta_5|0\rangle+\sin\theta_5|1\rangle\right)\otimes|0101\rangle\\
&+\left(\cos\theta_6|0\rangle+\sin\theta_6|1\rangle\right)\otimes|0110\rangle+\left(\cos\theta_7|0\rangle+\sin\theta_7|1\rangle\right)\otimes|0111\rangle\\
&+\left(\cos\theta_8|0\rangle+\sin\theta_8|1\rangle\right)\otimes|1000\rangle+\left(\cos\theta_9|0\rangle+\sin\theta_9|1\rangle\right)\otimes|1001\rangle\\
&+\left(\cos\theta_{10}|0\rangle+\sin\theta_{10}|1\rangle\right)\otimes|1010\rangle+\left(\cos\theta_{11}|0\rangle+\sin\theta_{11}|1\rangle\right)\otimes|1011\rangle\\
&+\left(\cos\theta_{12}|0\rangle+\sin\theta_{12}|1\rangle\right)\otimes|1100\rangle+\left(\frac{1}{\sqrt{2}}|0\rangle+\frac{1}{\sqrt{2}}|1\rangle\right)\otimes|1101\rangle\\
&+\left(\frac{1}{\sqrt{2}}|0\rangle+\frac{1}{\sqrt{2}}|1\rangle\right)\otimes|1110\rangle+\left(\frac{1}{\sqrt{2}}|0\rangle+\frac{1}{\sqrt{2}}|1\rangle\right)\otimes|1111\rangle\Big]
\end{aligned}
$$

Figure 2 An example about nrqa with the l = 13, the red points are samples and the black points are redundant points, the amplitude value of the i-th point store in θ_i.

NRQA preparation theorem steers a NRQA quantum state from its initialized state to the desired quantum audio state. The Theorem-1 is derived from Lemma-1.

Lemma-1 Given an angle vectors $\theta=\left(\theta_0,\theta_1,\theta_2,\cdots,\theta_{L-1},\theta_L,\cdots,\theta_{2^l-1}\right)$,where $\theta_0,\cdots,\theta_{2^l-1}=\frac{\pi}{4}$, and the initialized state $|0\rangle^{\otimes l+1}$ (l and 1 are the number of qubits required to encode time and amplitude information, respectively), there is a unitary transformation P that turns the quantum state from initialized state to expected state.

Proof The unitary transformation P can be divided in three steps.

Step 1: Preparation the initialization state ψ_0. Firstly, for a mono audio with the length L ($L<2^l$), as discussed in section 3, the whole l+1 qubits needs to be initialized in the following equation:

$$\psi_0=|0\rangle^{\otimes l+1} \tag{8}$$

Step 2: Preparation the middle state ψ_1. The initialization state ψ_0 does not yet represent time and amplitude information. Then, use quantum gates H and I which shows in Eq.(2) to construct an empty NRQA based on ψ_0, in other words, amplitude corresponding to each time is $|0\rangle$. The quantum operation of this step can be denotes as U_1 in Eq.(9).

$$U_1=I\otimes H^l \tag{9}$$

By using U_1, the ψ_0 can be transform to ψ_1. Eq(10) describe this transformation.

$$
\begin{aligned}
\psi_1 &= U_1(\psi_0)\\
&=\left(I\otimes|0\rangle\right)\otimes\left(H\otimes|0\rangle\right)^{\otimes l}\\
&=|0\rangle\otimes\frac{1}{\sqrt{2^l}}\sum_{t=0}^{2^l-1}|T\rangle\\
&=\frac{1}{\sqrt{2^l}}\sum_{T=0}^{2^l-1}|0\rangle\otimes|T\rangle
\end{aligned}
\tag{10}
$$

In ψ_1, the $|0\rangle$ and $|1\rangle$ have the same probability in both $|T\rangle$ (i.e. representative time information) and $|D_T\rangle$ (i.e. representative amplitude information), it means build 2^l samples, in general, the whole 2^l samples with empty amplitude have been manufactured in step 2.

Step 3: Preparation the final state ψ_2. In this step, amplitude value for all samples will be set. This step can be divided into two substeps, i.e, set amplitude values of sampling points and redundant points respectively. For set an amplitude value D_T, consider the controlled rotation matrices Ω_T which

$$\Omega_T=I\otimes\sum_{i\neq T}|i\rangle\langle i|+R_y\left(2\theta_T\right)\otimes|T\rangle\langle T|. \tag{11}$$

Here, $T=0,1,\cdots,L-1$ and $i=0,1,\cdots,2^l-1$. Obviously, $\Omega_T\Omega_T{}^{\dagger}=I^{\otimes l+1}$, so U_T is also a unitary matrix. In fact, Ω_m can be implemented as a C^l(Ry (2θ)) gate (a (l + 1) -qubits controlled rotation gate, with use l qubits as controlled qubits) which shown in Figure 3. Apply $\Omega_m(m\in0,1,\cdots L-1)$ to middle state ψ_1 for set amplitude D_m, as shown in Eq.(11).

Continue setting a new amplitude value D_n, which

$$
\begin{aligned}
\Omega_m(\psi_1)&=\Omega_m\left(\frac{1}{\sqrt{2^l}}\sum_{T=0}^{2^l-1}|0\rangle\otimes|T\rangle\right)\\
&=\frac{1}{\sqrt{2^l}}\left[I|0\rangle\otimes\left(\sum_{T=0,T\neq m}^{2^l-1}|T\rangle\right)\right]\\
&+R_y\left(2\theta_m\right)|0\rangle\otimes|m\rangle\langle m|\left(\sum_{T=0}^{2^l-1}|T\rangle\right)\\
&=\frac{1}{\sqrt{2^l}}\left[|0\rangle\otimes\left(\sum_{T=0,T\neq m}^{2^l-1}|T\rangle\right)\right.\\
&\left.+\left(\cos\theta_m|0\rangle+\sin\theta_m|1\rangle\right)\otimes|m\rangle\right]
\end{aligned}
\tag{12}
$$

by using a new controlled rotation matrices, i.e,

$$\Omega_m(m\in0,1,\cdots L-1),\ \ m\neq n:$$

$$\Omega_n\Omega_m(\psi_1)=\frac{1}{\sqrt{2^l}}\Bigg[|0\rangle\otimes\sum_{T=0,T\neq n,m}^{2^l-1}|T\rangle\langle T| +\left(\cos\theta_m|0\rangle+\sin\theta_m|1\rangle\right)\otimes|m\rangle +\left(\cos\theta_n|0\rangle+\sin\theta_n|1\rangle\right)\otimes|m\rangle\Bigg] \quad (13)$$

For set the amplitude of all the First L points, the Ω_T operation should be executed L times. Define U_2 as in Eq.(13) to implement the process.

$$U_2=\prod_{T=0}^{L-1}\Omega_T \quad (14)$$

Apply U_2 to the intermediate state ψ_1,

$$U_2(\psi_1)=\frac{1}{\sqrt{2}^l}\sum_{T=0}^{L-1}|D_T\rangle\otimes|T\rangle+\frac{1}{\sqrt{2}^l}\sum_{T=0}^{L-1}|0\rangle\otimes|T\rangle =\psi_2 \quad (15)$$

In ψ_2, all samples value have been set correctly but redundant points. Then, because the amplitude value of the redundant points can be expressed as $\frac{1}{\sqrt{2}}|0\rangle+\frac{1}{\sqrt{2}}|1\rangle$, both Hadamard gate and Ry(π/2) gate (they are completely equivalent) can change $|0\rangle$ to it. So, in order to pursue the consistency of the formula specification and subsequent operations is simpler, controlled rotation Ω_R can be are given in Eq.(14-15):

$$\Omega_R=I\otimes\sum_{i\neq T}|i\rangle\langle i|+R_y(\pi/2)\otimes|T\rangle\langle T|, \quad R=L,L+1,\cdots 2^l-1, U_3=\prod_{T=L}^{2^l-1}\Omega_R. \quad (16)$$

Finally, apply U_3 (consisting of a set of operations) to ψ_2 can get the final state ψ_3 which same as $|S\rangle$ in Eq.(17). At this point, the preparation process is complete. Then a quantum state $|S\rangle$ (include redundant points) containing information about all the sample points is successfully obtained

$$\psi_3=U_3(\psi_2)=U_3(U_2(\psi_1)) =U_3(U_2(U_1(\psi_0)))=|S\rangle \quad (17)$$

Then, we focus on the feasibility of broken down the transform P into simple gates such as NOT gate, Hadamard gate, and CNOT gates. Now we give the polynomial preparation theorem in Theorem-1.

Theorem-1 (NRQA preparation theorem) Given an angle vectors θ, where $\theta=(\theta_0,\theta_1,\theta_2,\cdots,\theta_{L-1},\theta_L,\cdots,\theta_{2^l-1})$ and the initialized state $|0\rangle^{\otimes l+1}$ (l and 1 are the number of qubits required to encode time and amplitude information, respectively), there is a unitary transformation P that turns the quantum computers from initialized state to expected NRQA state, composed of no more than $O\left(l+2^{2l+1}-3\cdot 2^l\right)$ simple polynomial gates.

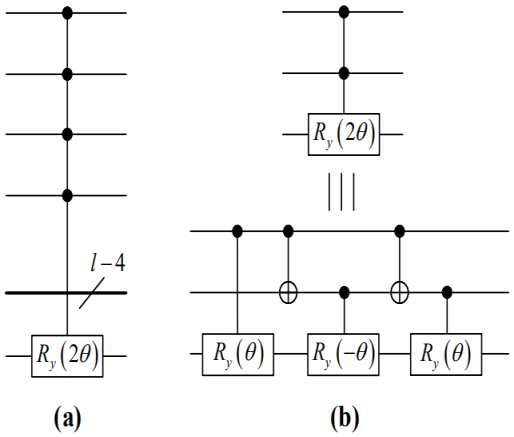


Figure 3 (a) is C^l (Ry (2Θ)) Gate, (B) is C^2 (Ry (2Θ)) Gates Are Built from Three Single Gates, Which Are C^1 Ry (Θ), C^1 Ry (Θ) and Cnot Gate [10].

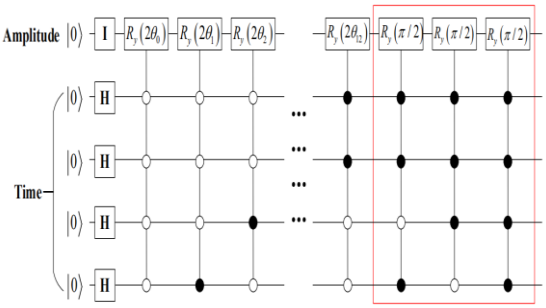


Figure 4 The circuit of Figure 2.

5. CONCLUSIONS

In this paper, for store digital audio in quantum computer, we proposed a novel representation (NRQA) and given its preparation process. Compared with other models, the new model represents audio by establishing a mapping of the angle parameters and amplitude values of the basic state coefficients. Therefore, NRQA can represent waveform audio more accurately and uses the fewest qubits. Simulation experiments on classical computers have proved its feasibility, by using matlab tool. In future work, we will explore the more advanced applications based on the NRQA proposed in this paper, such as quantum audio watermarking, quantum audio encryption and quantum speech recognition.

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Bayesian Estimation for a Dirichlet Process Mixture of Kumaraswamy Distributions

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Abstract: The finite mixture model is very powerful and flexible in data modeling. A challenging problem is how to determine the appropriate number of mixture components. This involves the quality and performance of the mixture model. In this paper, a nonparametric Bayesian infinite mixture model based on Kumaraswamy distributions is proposed for bounded data which well averts the control puzzle of model complexity. The model is Bayesian which effectively vanish the difficult task of overfitting and underfitting. Meanwhile, the inference of the model depends on the estimation of the posterior distribution using Markov chain Monte Carlo techniques. Through synthetic data, the validity of the infinite mixture model has been verified
Keywords: Mixture Model, Mcmc, Kumaraswamy Distributions, Dirichlet Process, Clustering

1. INTRODUCTION

In the direction of artificial intelligence, it is very common to use statistical methods for model building and data analysis [1–3]. From a statistical point, datasets observed in reality, such as computer vision, image processing, and signal processing, are often viewed generated from an analytically intractable distribution. The statistical method estimates the parameters of the complex distribution based on the acquired datasets so that it can accurately describe the mathematical features of the data sources. In addition, the datasets obtained in real scenes are sometimes a bit small, and a mass of similar datasets can be generated relies on the grown-up model to meet the actual production needs.

Finite mixture model (FMM) is exceedingly popular and powerful statistical measure for the process of data [4, 5], which have been enormously developed in the past years and have been widely applied [6–11]. Finite mixture model based on Gaussian distributions (GMM) is a well known probabilistic tool, which has good generalization ability and achieves favorable performance in some experiments. There are two cardinal factors. On one hand, most data sources follow the Gaussian distribution due to the central limit theorem, which makes the GMM has the good capabilities of robustness and steadiness. On the other hand, the GMM is analytically tractable owing to probability density function has features that are easy to manage.

Gaussian distribution is symmetrical and unbounded, which potentially assume that the values of datasets observed range from negative infinity to positive infinity and the spread of datasets observed takes on symmetrical characteristics on some unknown points. In some special practical applications, however, this assumption is not valid. For example, in the field of medical image processing, the values of pixels obtained from each image are bounded and the joint distribution of pixels is asymmetric. In the Natural Language Processing, the values of datasets after word vectorization are bounded and complex. In view of these tangibles, the non-Gaussian mixture models are studied energetically and many novel finite mixture models are proposed recently [11–15].

Another challenging problem is how to properly determine the number of components in the finite mixture model, which is related to the performance of the model. The usual practice is to prepend a K value (K represents the number of mixed components), but this often leads to overfitting or underfitting unless the researchers have enough empirical knowledge of the data sources and are able to make the right choices. In order to deal with these troubles, the infinite mixture model is gradually emerging [16]. This type of model is a nonparametric Bayesian method whose's footstone is Dirichlet process and is increasingly popular. By giving the model special prerequisite, the number of components is not fixed in advance, but the model is assumed to have infinite hybrid components which means it has infinite parameters. During the growing of the model, the complexity is constantly and automatically adjusted to fit the acquired datasets [17, 18].

In this paper, based on the Dirichlet process and Kumaraswamy distributions, a novel infinite mixture model (InKMM) is introduced to model bounded, asymmetrical and non-negative data sources. Kumaraswamy distribution is presented in [19], which can be seen frequently in hydrological literature and get less interest compared with other common statistical distributions. The Kumaraswamy distribution is a two-parameter distribution defined on (0,1) which can be called as Kum(x; a,b). The probability density function (pdf) is shown as below:

$$Kum(x\ ;\ a,b) = abx^{(a-1)}(1-x^a)^{(b-1)}, \quad 0 < x < 1 \quad (1)$$

where a and b are two non-negative shape parameters, which control its pdf are unimodal, increasing, decreasing, constant, skew or some other special properties. Despite Kumaraswamy distribution is similar to the Beta distribution in many characters, it

has some superiorities in the domain of tractability and simplicity.

Markov chain Monte Carlo (MCMC) methods are used in parameters estimation due to the unbiasedness frequently and effectively and have made considerable progress [20, 21]. Accordingly, MCMC sampler about the learning of InKMM executes the inference of posterior distributions.

The remainder of this paper is introduced as follows: In Section 2, InKMM is fully presented. In Section 3, learning the parameters of InKMM by Gibbs sampler. Experimental results are done in Section 4. Finally, the conclusion is given in the last Section.

2. Infinite Kumaraswamy Mixture Model

In this section, the finite mixture model based on Kumaraswamy distributions was first introduced. Subsequently, the model was spread to the infinite case in the light of the Dirichlet process with Chinese restaurant process (CRP) [22].

2.1. Finite Kumaraswamy mixture model

If D-dimensional random variable$x = (x_1, x_2, \cdots, x_D)$, which all the elements have values in the range of 0 to 1, is drawn from a mixture of non-Gaussian distributions. We can suppose x satisfys multivariate Kumaraswamy distribution. The joint pdf is as follows:

$$\begin{aligned} & f(\mathbf{x}\ ;\ a_1, b_1, \cdots, a_D, b_D) \\ &= \prod_{l=1}^{D} Kum(\mathrm{x}_l\ ;\ \mathrm{a}_l, b_l) \qquad (2) \\ &= \prod_{l=1}^{D} a_l b_l x_l^{a_l - 1}(1 - \mathrm{x}_l^{a_l})^{b_l - 1}, \end{aligned}$$

where $0 < x_l < 1$ and $a_l, b_l > 0$ for $l = 1, \cdots, D$. Note that the members of the D-dimensional variable x usually have an interdependent relationship in practical problems or applications. However, this interdependency can be replaced by a mixture form of product, which each specific mixed part only and independently control designated members x_l [4,5,13].

Let $\mathrm{X} = (x_1, \cdots, x_N)$ is a dataset identically drawed from finite Kumaraswamy mixture model (KMM):

$$\begin{aligned} f(\mathbf{x}_i\ ;\ \Pi, \mathrm{A}, \mathrm{B}) &= \sum_{j=1}^{M} \pi_j Kum(\mathbf{x}_i\ ;\ \mathbf{a}_j, \mathbf{b}_j) \\ &= \sum_{j=1}^{M} \pi_j \prod_{l=1}^{D} Kum(\mathbf{x}_{il}\ ;\ \mathbf{a}_{il}, \mathbf{b}_{il}), \end{aligned} \qquad (3)$$

where $A = (a_1, \cdots, a_M), B = (b_1, \cdots, b_M)$ and (a_j, b_j) denote the parameter vectors of the jth mixture component. The proportional coefficient vector is represented by $\Pi = (\pi_1, \cdots, \pi_M)$. In addition, $0 < \pi_j < 1$ and $\sum_{j=1}^{M} \pi_j = 1$. The dataset X is usually viewed as incomplete. Therefore, the N-dimensional indicated vector $Z = (Z_1, \cdots, Z_N)$ is raised on all elements of X to build complete dataset and Z_i is a integer valued in $\{1, \cdots, M\}$ which denotes a specific hybrid component from which x_i is generated. The missing vector Z is generally seen as "membership vector" and supposing Z are independent and identic given the Π, the conditional pdf of Z is as follows:

$$f(Z_i = j\ ;\ \Pi) = \pi_j. \qquad \mathrm{j}=1,\cdots,\mathrm{M} \quad (4)$$

2.2. Hierarchical model and conditional posteriors

Considering that the symbol $\Theta = (\mathrm{A}, \mathrm{B}, \Pi)$ refers to a holonomic set of parameters that need to be estimated precisely in KMM and the joint distribution of all variables can be written as:

$$\begin{aligned} f(\mathbf{X}, Z, \Theta) &= f(\Pi) f(Z\ ;\ \Pi) f(A, B) f(\mathbf{X}\ ;\ A, B, \Pi) \\ &= f(\Pi) f(Z\ ;\ \Pi) \prod_{j=1}^{M} f(\mathbf{a}_j) f(\mathbf{b}_j) \prod_{i=1}^{N} f(\mathbf{x}_i\ ;\ \Lambda_{Z_i}). \end{aligned} \qquad (5)$$

Attentively, the joint distribution is factorized relies on a common and effective conditional independence [23], which show well performance in the later experiments. And for the sake of increasing the flexibility and plasticity of the model, it is necessary to add some extra layers.

As we can see, the shape parameters a_{jl} and b_{jl} are defined in the loose support $(0, \infty)$, then a vague and flexible prior of inverse Gamma distribution is selected with shape parameter and scale parameter common to all components [24], which was found effective in experiments. Consequently, a_j is given the prior as following in mixture model:

$$f(\mathbf{a}_j\ ;\ \varphi, \delta) \sim \prod_{l=1}^{D} \frac{\delta^{\varphi} \exp(-\delta / \mathbf{a}_{jl})}{\Gamma(\varphi) \mathbf{a}_{jl}^{\varphi+1}}, \quad (6)$$

b_j is given the prior as following in mixture model:

$$f(\mathbf{b}_j\ ;\ \mu, \eta) \sim \prod_{l=1}^{D} \frac{\eta^{\mu} \exp(-\eta / \mathbf{b}_{jl})}{\Gamma(\mu) \mathbf{b}_{jl}^{\mu+1}}, \qquad (7)$$

where φ, δ, μ and η are hyperparameters which can be also regarded as random variables to augment applicability and $\Gamma(\cdot)$ is Gamma funciotn: $\Gamma(\mathrm{t}) = \int_0^{\infty} x^{t-1} e^{-x} dx$. Thus, the conditional posterior distributions are computed by uniting the likelihoods from Equation 3 and the priors Equation 6 conditioned on the effect of the indicated vector:

$$\begin{aligned} & f(\mathbf{a}_j\ ;\ \cdots) \\ & \propto f(\mathbf{a}_j\ ;\ \varphi, \delta) \prod_{i=1}^{D} f(\mathbf{x}_i\ ;\ \Lambda_{Z_i}) \\ & \propto \prod_{l=1}^{D} \frac{\delta^{\varphi} \exp(-\delta / \mathbf{a}_{jl})}{\Gamma(\varphi) \mathbf{a}_{jl}^{\varphi+1}} (\prod_{Z_i = j} \mathbf{x}_{il})^{\mathbf{a}_{jl}-1} (\prod_{Z_i = j} (1 - \mathbf{x}_{il}^{\mathbf{a}_{jl}}))^{\mathbf{b}_{jl}-1} \\ & \quad \times (\prod_{l=1}^{D} \mathbf{a}_{jl} \mathbf{b}_{jl})^{n_j}, \end{aligned} \qquad (8)$$

where the occupation number, $n_j = \sum_{i=1}^{N} \Delta_{z_i = j}$, represents the totality of captured x_i belonging to the jth mixture component. Correspondingly, the conditional posterior distributions for b_j are computed by uniting the likelihoods from Equation 3 and the priors Equation 7:

$$f(\mathbf{b}_j\ ;\ \cdots)$$
$$\propto f(\mathbf{b}_j\ ;\ \mu,\eta)\prod_{i=1}^{N} f(\mathbf{x}_i\ ;\ \Lambda_{Z_i})$$
$$\propto \prod_{l=1}^{D}\frac{\eta^{\mu}\exp(-\eta/\mathbf{b}_{jl})}{\Gamma(\mu)\mathbf{b}_{jl}^{\mu+1}}(\prod_{Z_i=j}\mathbf{x}_{il})^{\mathbf{a}_{jl}-1}(\prod_{Z_i=j}(1-\mathbf{x}_{il}^{\mathbf{a}_{jl}}))^{\mathbf{b}_{jl}-1}$$
$$\times(\prod_{l=1}^{D}\mathbf{a}_{jl}\mathbf{b}_{jl})^{n_j}. \tag{9}$$

The hyperparameters φ and δ concerned with a_j are given separately inverse Gamma and exponential priors:

$$f(\varphi\ ;\ \xi,\ \gamma)\sim\frac{\gamma^{\xi}\exp(-\gamma/\varphi)}{\Gamma(\xi)\varphi^{\xi+1}}, \tag{10}$$

$$f(\delta\ ;\ \psi)\sim\psi\exp(-\psi\delta). \tag{11}$$

Consequently, according to equation 10 and Equation 6, the conditional posterior distribution for φ is gained:

$$f(\varphi\ ;\ \cdots)\propto f(\varphi\ ;\ \xi,\gamma)\prod_{j=1}^{M} f(\mathbf{a}_j\ ;\ \varphi,\ \delta)$$
$$\propto\frac{\gamma^{\xi}\delta^{\varphi MD}\exp(-\gamma/\varphi)}{\Gamma(\xi)\Gamma(\varphi)^{MD}\varphi^{\xi+1}}\prod_{j=1}^{M}\prod_{l=1}^{D}\frac{\exp(-\delta/\mathbf{a}_{jl})}{\mathbf{a}_{jl}^{\varphi+1}}. \tag{12}$$

Combining Equation 11 with Equation 6 gives the conditional posterior for δ:

$$f(\delta\ ;\ \cdots)\propto f(\delta\ ;\ \psi)\prod_{j=1}^{M} f(\mathbf{a}_j\ ;\ \varphi,\ \delta)$$
$$\propto\frac{\psi\delta^{\varphi MD}\exp(-\psi\delta)}{\Gamma(\varphi)^{MD}}\prod_{J=1}^{M}\prod_{l=1}^{D}\frac{\exp(-\delta/\mathbf{a}_{jl})}{\mathbf{a}_{jl}^{\varphi+1}}. \tag{13}$$

Just like the previous process, the hyperparameters μ and η related to b_j are given analogous inverse Gamma and exponential priors:

$$f(\mu;\ \alpha,\beta)\sim\frac{\beta^{\alpha}\exp(-\beta/\mu)}{\Gamma(\alpha)\mu^{\alpha+1}}, \tag{14}$$

$$f(\eta;\ \lambda)\sim\lambda\exp(-\lambda\eta). \tag{15}$$

Equation 7 plays a role of likelihood in conjunction with the prior knowledge of Equation 14 and Equation 15 give:

$$f(\mu;\ \cdots)\propto f(\mu;\ \alpha,\beta)\prod_{j=1}^{M} f(\mathbf{b}_j;\ \mu,\ \eta)$$
$$\propto\frac{\beta^{\alpha}\eta^{\mu MD}\exp(-\beta/\mu)}{\Gamma(\alpha)\Gamma(\mu)^{MD}\mu^{\alpha+1}}\prod_{j=1}^{M}\prod_{l=1}^{D}\frac{\exp(-\eta/\mathbf{b}_{jl})}{\mathbf{b}_{jl}^{\mu+1}}, \tag{16}$$

$$f(\eta;\ \cdots)\propto f(\eta;\ \lambda)\prod_{j=1}^{M} f(\mathbf{b}_j;\ \mu,\ \eta)$$
$$\propto\frac{\lambda\eta^{\mu MD}\exp(-\lambda\eta)}{\Gamma(\mu)^{MD}}\prod_{j=1}^{M}\prod_{l=1}^{D}\frac{\exp(-\eta/\mathbf{b}_{jl})}{\mathbf{b}_{jl}^{\mu+1}}. \tag{16}$$

2.3. Infinite mixture case

For conquer the selective challenge of the number of mixture components in the model, infinite components are recommended by giving a typical and symmetric Dirichlet prior to hybrid proportional coefficient Π with concentration parameter ε/M:

$$f(\Pi\ ;\ \varepsilon)\sim Dirichlet(\varepsilon/M,\ \cdots,\varepsilon/\mathrm{M})$$
$$=\frac{\Gamma(\varepsilon)}{\Gamma(\varepsilon/M)^{M}}\prod_{J=1}^{M}\pi_j^{\varepsilon/M\ -\ 1}. \tag{17}$$

In addition, given the mixing proportionality, the joint distribution of the indicated vector with n_j is multinomial turns into:

$$f(Z\ ;\ \Pi)=\prod_{j=1}^{M}\pi_j^{n_j}. \tag{18}$$

Thus, utilizing the integral formula and combining Equation 18 with Equation 19, the prior in regard of the indicated vector can be written convertibly as Equation 20 under the condition of the Dirichlet distribution is a conjugate prior to the multinomial distribution.

$$f(Z;\ \varepsilon)=\int_{\Pi} f(Z;\ \Pi)f(\Pi;\ \varepsilon)d\Pi$$
$$=\int_{\pi_1}\cdots\int_{\pi_M} f(\mathrm{Z}_1,\cdots,\mathrm{Z}_N;\ \pi_1,\cdots,\ \pi_M)$$
$$f(\pi_1,\cdots,\ \pi_M;\varepsilon/\mathrm{M},\cdots,\ \varepsilon/\mathrm{M})d\pi_1\cdots d\pi_M \tag{19}$$
$$=\frac{\Gamma(\varepsilon)}{\Gamma(\varepsilon/M)^{M}}\int_{\pi_j}\prod_{j=1}^{M}\pi_j^{n_j+\ \varepsilon/M\ -1}d\pi_j$$
$$=\frac{\Gamma(\varepsilon)}{\Gamma(\varepsilon+N)}\prod_{j=1}^{M}\frac{\Gamma(n_j\ +\ \varepsilon/\mathrm{M})}{\Gamma(\varepsilon/M)}.$$

In order to draw effectively samples from the joint distribution of discrete indicated vector, the conditional prior of the onefold indicator is necessarily needed with all other indicators are given. From Equation 20, we can get

$$f(Z_i=j\ \ ;\varepsilon\ \ _{,-i}Z=)\frac{n_{-i,j}\ +\frac{\varepsilon}{M}}{N-1+\varepsilon}, \tag{20}$$

where $Z_{-i}=\{Z_1,\cdots,Z_{i-1},Z_{i+1},\cdots,Z_N\}$ which represents all indicator except the ith, and $n_{-i,j}$ is the number of observed samples in X excluding x_i, that are bound up with the jth mixture component.

Later, the concentration parameter ε is tightly related to the change of the number of mixture components in the model. The smaller parameter ε gets the greater the probability of random samples belonging to represented components becomes correspondingly. A flexible prior of inverse Gamma distribution is picked for ε:

$$f(\varepsilon\ ;\ \vartheta,\ \tau)\sim\frac{\tau^{\vartheta}\exp(-\tau/\varepsilon)}{\Gamma(\vartheta)\varepsilon^{\vartheta+1}}, \tag{21}$$

which together with the likelihood derived from

Equation 20, the posterior of ε is introduced as below [16]:

$$f(\varepsilon\ ;\ \cdots) \propto \frac{\tau^{\vartheta}\exp(-\tau/\varepsilon)\varepsilon^{M}}{\Gamma(\vartheta)\varepsilon^{\vartheta+1}}\frac{\Gamma(\varepsilon)}{\Gamma(N+\varepsilon)}. \quad (22)$$

Now, in order to expand to an infinite case, let $M \to \infty$ in Equation 21, the conditional prior gets to the nether limits:

Case 1:

$$f(Z_i = j\ ;\ \varepsilon, Z_{-i}) = \frac{n_{-i,j}}{N-1+\varepsilon}. \qquad \text{if} \quad n_{-i,j} > 0 \quad (23)$$

Case 2:

$$f(Z_i = j\ ;\ \varepsilon, Z_{-i}) = \frac{\varepsilon}{N-1+\varepsilon}. \qquad \text{if} \quad n_{-i,j} = 0 \quad (24)$$

The above formulas indicate the probability of Z_i is geared to appeared and non-appeared mixture components, respectively. But beyond that, case 1 show the conditional prior of indicator (Z_i) assigned to a appeared component is associated with other observations in jth component and case 2 instruct its conditional prior is only related to N and ε. Notice that the number of observed samples is a fixed value, which means implicitly that the number of categories to which the datasets X belong must also be limited ($1 \le M \le N$). From these, the final average number of mixture components is subject to $O(\varepsilon \log N)$ [25], which also in line with the intuitive suspect. For all the model variables not counting indication vector, the conditional posteriors with regard to the infinite case can be gained by using $M_{appearing}$ that the number of components which is not empty instead of M in the previous formulas [16].

The conditional posteriors for all indicators depend on the conditional priors from case 1 and case 2, which in company with the likelihood derived from Equation 3 give:

Homologous case 1:

$$f(Z_i = j\ ;\ \cdots) \propto \frac{n_{-i,j}}{N-1+\varepsilon} f(\mathbf{x}_i;\ \mathbf{a}_j,\ \mathbf{b}_j). \qquad \text{if} \quad n_{-i,j} > 0 \quad (25)$$

Homologous case 2:

$$f(Z_i = j\ ;\ \cdots) \propto \frac{\varepsilon}{N-1+\varepsilon}\int f(\mathbf{x}_i\ ;\ \mathbf{a}_j,\ \mathbf{b}_j) f(\mathbf{a}_j\ ;\ \varphi, \delta) f(\mathbf{b}_j\ ;\ \mu, \eta) d_{a_j} d_{b_j}. \qquad \text{if} \quad n_{-i,j} = 0 \quad (26)$$

Ultimately, for a different indicator Z_i, the probabilities of assigning it to all the components that have already appeared and the probability of assigning it to a new component can be get by homologous case 1 and homologous case 2. What is noteworthy in the iteration is that the appeared jth component with which all observations associated are assigned to other components should be removed from the mixture model and is seen as a non-appeared component. This frequently happens when an appeared component contains only one observation. For the generation of new components, the integral needs to be processed in Equation 27, but that is a tricky problem. Thus, the challenge is handled by means of sampling solitarily from the priors of a_j and b_j [16,17].

Up to the present, the fundamental derivations of the conditional posteriors of all parameter variables are completed in infinite Kumaraswamy distribution mixture model. Figure 1 shows the corresponding probabilistic graphical model.

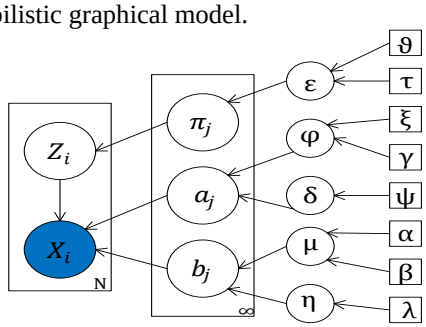

Figure 1 Probabilistic graphical model representation of the InKMM.

All circular nodes represent stochastic variables with unfixed values. Every rectangular node indicates confirmed hyperparameter. Arrows display the conditional dependent relations between nodes. The boxes indicate that the variables in it need to be independently and identically repeated a certain number of times according to the values in the lower right corner.

3. Model Inference

For inference of model, MCMC techniques are important and effective statistical methods which sampling from intractable intricate distributions and have been considerably developed and exploited recently [26,27]. In the proposed model, these popular tools are used to dispose all conditional posteriors, which can be called as the procedure of Gibbs sampling. And the complete algorithm steps are shown as follows:

∗ Compute Z_i according to Equation 26 and Equation 27, $i = 1, \cdots, N$.

∗ Compute n_j and the number of appeared mixture components M, $j = 1, \cdots, M$.

∗ Compute the mixing proportion π_j, $j = 1, \cdots, M$

∗ Draw stochastic variables $a_j, b_j, \varepsilon, \varphi, \delta, \mu, \eta$ from Equation 8, Equation 9, Equation 23, Equation 12, Equation 13, Equation 16 and Equation 17.

For an infinite mixture model, an initial component is required for Gibbs sampler which can be generated from priors. And supposing that all gained observations are assigned to the identical component. Notice that all correlative conditional posteriors are not normative forms, so it is not light to draw random variables in an analytical and tractable manner. But we see that the distributions $f(\log(\varepsilon)\ ;\ \cdots)$, $f(\log(\varphi)\ ;\ \cdots)$, $f(\log(\delta)\ ;\ \cdots)$, $f(\log(\mu)\ ;\ \cdots)$ and

$f(\log(\eta); \cdots)$ are log-concave, which intimates the independent samples of $\varepsilon, \varphi, \delta, \mu$ and η can be generated from adaptive rejection sampling [28]. As for the posterior functions of $f(a_j; \cdots)$ and $f(b_j; \cdots)$, it is more formidable to produce samples since the density functions are multidimensional and have irregular forms. Thus the Metropolis-Hastings algorithm is feasible to address these perplexities.

4. Experiment

In this part, the proposed model is verified for the Bayesian estimation. We design some experiments for artificial datasets for statistical analysis. We generate synthetic data from known finite Kumaraswamy mixture model (KMM) and use MCMC approaches to learn potential parameters for effectiveness. Note that the generation of random variables obeying the Kumaraswamy distribution can be obtained from the following fact. If $U \sim U(0,1)$, then $x \sim Kum(x; a, b)$ if $x = (1 - U^{1/b})^{1/a}$. Through all the experiments, we select specific model hyperparameters as $\vartheta = 2, \tau = 4, \xi = 1, \gamma = 1, \psi = \frac{1}{4}, \alpha = 1, \beta = 1,$ and $\lambda = 1/4$. Indeed, the selection of the special values of all hyperparameters is based on the expediency of our experiments and the environment in which it is located. We exhibit the performance of InKMM in regard to parameter estimation and model selection on several emulation datasets. For a known KMM, quantitative samples were generated. Later, we perform 20 rounds of experiments and average the estimated parameters, which are taken from mean values of posterior distributions after Markov chains convergence, as potential parameters for a particular dataset. Table 1 describes the estimation of the parameters using two-dimensional synthetic datasets (500 samples and 1000 samples) composed of two components and three components, respectively. For mixed components, Figure 2 shows the variation of the number during the sampling process. Obvious, the number of components shall eventually fluctuate around a certain value. And the 1000 emulation values of some parameters of the second mixture model are shown in figure 3. Apparently, IKMM is performing well and effective in these experimental datasets.

Table 1 The Comparison of the Real Parameters and the Parameters Estimated by the Proposed Mode

		True parameters	Estimated parameters
M=2	a_j	$[14, 11;\ 5, 9]$	$[14.10, 11.53;\ 4.76, 8.22]$
	b_j	$[7, 18;\ 12, 4]$	$[7.21, 18.56;\ 11.67, 3.48]$
	π_j	$[0.4, 0.6]$	$[0.39, 0.61]$
M=3	a_j	$[2, 12;\ 6, 4;\ 3, 25]$	$[2.11, 11.41;\ 6.12, 3.79;\ 2.99, 24.53]$
	b_j	$[6, 20;\ 11, 10;\ 8, 35]$	$[6.83, 19.12; 12.09, 9.94; 8.69, 35.10]$
	π_j	$[0.4, 0.3, 0.3]$	$[0.38, 0.31, 0.31]$

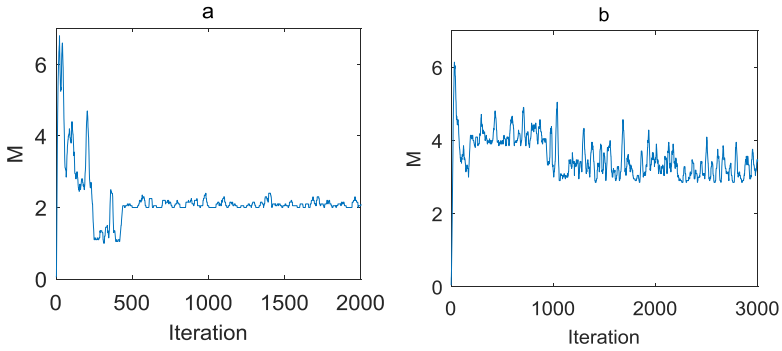

Figure 2 The number of appeared components varying in Monte Carlo iteration. (a) Dataset of two components. (b) Dataset of three components.

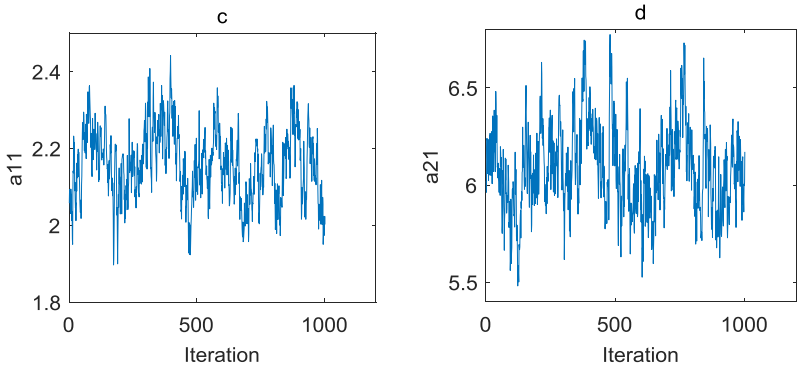

Figure 3 The 1000 emulation values of some parameters of the second mixture model. (c) Values of a_{11}. (d) Values

of a_{21}

4. CONCLUSIONS

In this paper, we have first proposed finite Kumaraswamy mixture model in detail and extended it to infinity based on the Dirichlet process that is the cornerstone of nonparametric Bayesian statistical theory. Compared with the finite mixture model, InKMM can perform automatical model selection very well without overfitting in the emulation experiments. We were pleasantly surprised to find that the Kumaraswamy distribution not only has great practical significance in the field of hydrology, but also plays a non-negligible role in the statistical modeling of other bounded and asymmetrical data. We describe a full efficient Bayesian method for the learning of the Dirichlet process mixture model. The following works, that we are energetically thinking and implementing, are applying InKMM to handle real-world tasks such as images or texts and extending the proposed model into a hierarchical or online model to better meet the actual scenes.

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Design of Temperature and Humidity Monitoring System for Agricultural Greenhouse Based on Internet of Things Technology

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Abstract: With the rapid development of big data and 5G, Internet of things technology is increasingly used in agriculture. However, work efficiency and intelligent control level still need to be improved. In this paper, we propose the temperature and humidity monitoring system for agricultural greenhouse based on internet of things technology. An embedded microprocessoris used to build a temperature and humidity control system for agricultural greenhouses. The system consists of six parts: the main control unit, temperature and humidity sensor, Wifimodule, wireless LAN, an intelligent control terminal, automatic ventilation and irrigation system. The host software which is based on B/S architecture and the environment monitoring software of mobile terminal is designed to realize the monitoring and control of the environment. The application results show that the designed temperature and humidity monitoring system has simple structure, high reliability and stable performance

Keywords: Agricultural Greenhouses, Internet of Things, Wifi

1. INTRODUCTION

The Internet of Things can be considered as a network of numerous sensors that connect to each other based on a specific communication protocol to enable intelligent identification. Data interaction between objects and objects, and human-to-object monitoring and management [1].In the era of big data and 5G technology popularity, intelligent agriculture based on Internet of Things technology came into being. The design of the system architecture of this paper is mainly aimed at the transformation of small-scale individual agriculture to large-scale farm model, and in the process of agricultural supporting facilities are relatively complete, the Internet of Things is fully utilized to dynamically monitor the temperature and humidity of agricultural greenhouses to achieve adjustment of crops produce period, improve the automation level of agricultural production and the production efficiency [2].

2. SYSTEM DESIGN

The system consists of the main control unit, temperature and humidity sensor, Wifi module, wireless local area network, intelligent control terminal, automatic ventilation and irrigation system [3]. The basic operation process is: the agricultural greenhouse is installed with a temperature sensor, and the humidity sensor is buried in the soil. The main control unit collects the sensor data according to the present time, interacts with the Wifi module, and sends it to the intelligent control terminal via the Internet via the router in the wireless local area network. Users can get the humidity and temperature in the shed through their mobile phones. When the temperature is too high or the soil needs to be watered, the user utilizes the mobile phone to send ventilation and irrigation instructions to the main control unit through the Internet, router and Wifi module. When a certain temperature and humidity has reached a standard value, the main control unit automatically stops ventilation and irrigation for remote control purpose. The process is shown in figure 1.

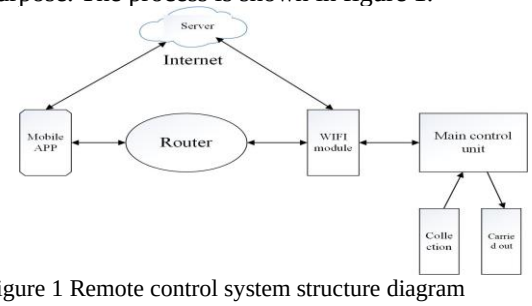

Figure 1 Remote control system structure diagram

3. HARDWARE DEVICES

3.1. Main control Unit

The main control unit is the core part of the system and has communication and control functions. Responsible for receiving data sent from the sensor and sending the data to the user, then controlling the ventilation and irrigation system according to the user's feedback instructions, and shutting down the system when a certain value is reached. The main control unit selects the latest 32-bit ARM [4] microcontroller STR910F from ST Microelectronics, which supports an Ethernet connection. Based on the ARM7 architecture, it can respond quickly to various needs and has ultra-low power consumption.

3.2. Temperature and Humidity Sensor

The temperature sensor uses the DS18B20 from Dallas. The chip has the characteristics of large

temperature difference detection, small volume, anti-interference ability, and full digital temperature conversion output. When connecting with the microprocessor, only one port line is needed to realize two-way communication. Parasitic working mode, built-in EEPROM and temperature limit alarm function can be selected. Measuring circuit is shown in figure 2.

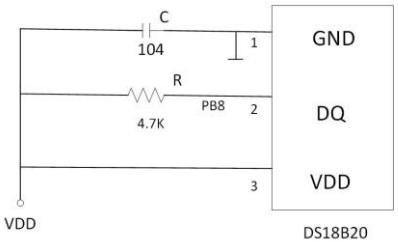

Figure 2 Measuring circuit for Ds18b20

The humidity sensor uses the LM393 chip. The chip is a voltage comparison chip, and we designed the humidity sensor ourselves in consideration of the cost. Connect the chip to two pieces of metal and insert it into the soil. According to the soil moisture, the chip produces a voltage difference. The voltage difference is compared with the set standard value. When the humidity is high, the voltage becomes small, the chip outputs a low voltage, and on the contrary, a high voltage is output. Humidity detection circuit is shown in figure 3.

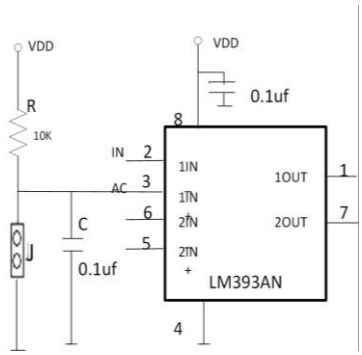

Figure 3 Humidity detection circuit

3.3. Wifi Module and Wireless LAN

Since main control unit uses the STR910F 32-bit ARM microcontroller supporting Ethernet connection, this provides great convenience for the establishment of LAN. Ethernet-based Wifi technology has a long transmission distance and a fast rate, and can maintain good transmission characteristics under the mobile state, and is beneficial to the expansion of the system in the development of the agricultural greenhouse in the later stage. We chose Hikvision outdoor intelligent wireless base station DS-3WA2-25ACO, because the base station has the characteristics of a general base station, it is also suitable for use in extreme outdoor environment. It avoids the impact of outdoor bad weather and environment, and is highly adapted to the requirements of equipment in cold weather in northern China and wet weather in southern China. The composition is shown in figure 4.

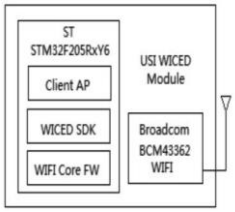

Figure 4 Wifi communication module

The embedded serial port module supports a USB interface and supports a maximum bandwidth of 65Mbit/sec [5]. Responsible for establishing a path between the host system and the smart terminal, connecting to the router through the wireless local area network, and then connecting with the remote server for data exchange and completing data transmission. When the main control unit, temperature and humidity sensor, and Wifi LAN are ready, we can start collecting temperature and humidity.

3.4. Intelligent Control Terminal

I can use a tablet or a smartphone, and I use Huawei P9plus.

3.5. Automatic Ventilation and Irrigation System

After the main control unitoutputs, the water spray and ventilation switch signals, the AC contactor and the motor of the water pump and the fan are controlled by the relay to complete the corresponding action. The motor is selected according to the load size.

4. SOFTWARE DESIGN

The main control software of the system is an embedded program written in the Keil development environment, including the main program, the communication program of the main control unit and the Wifi module, the communication module and the intelligent control terminal communication program, and the intelligent terminal program.

4.1. Main Program

The main control unit STR910F collects the data of the sensor at regular intervals, and communicates with the SPI interface of the Wifi module, transmits the collected data to the intelligent terminal through the Internet, or receives the cloud sprinkler and ventilation instructions. Initially, the main program needs to initialize the I/O port and communication serial port at the initial power-on, and configure the corresponding timer and clock, and run the Wifi module driver. After the peripheral initialization is completed, the main program is entered. The flow chart is as follows figure 5.

The SPI interrupt performs the acquisition of the data via the Wifi module, and downloads the mobile phone command, displays the relevant data or performs the operation of opening the sprinkler and the fan.

4.2. Communication Module and Intelligent Controlterminal Communication Program

The main process of the communication process assigns the collected value to the predetermined structure variable and packages it into a fixed format,

and sends the data to the Wifi module through the SPI interface, and uploads it to the cloud server rented by the Internet operator through the Http protocol, and then The mobile phone that the cloud server sends to the user.

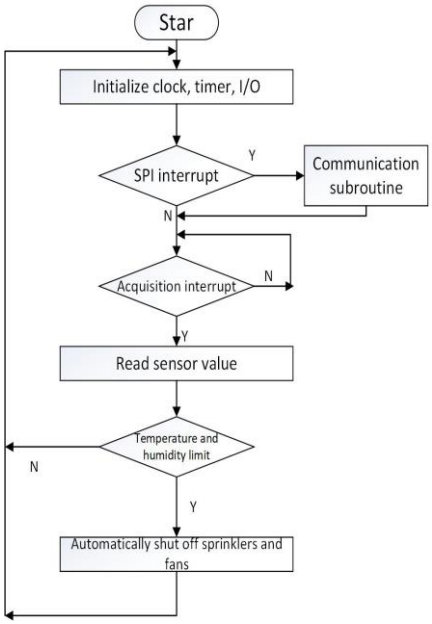

Figure 5 Main program flowchart of Str910f

4.3. The Intelligent Terminal Program

The intelligent terminal APP program is based on the C/S architecture design and is developed in Java language. The terminal accesses the Wifi network or the mobile traffic network according to the location of the user. The main control unit pushes the message to the intelligent terminal according to the temperature and humidity. When a certain temperature or humidity value exceeds the preset value, the smart terminal APP program. The program includes an all-weather temperature and humidity values as well as weather forecasts and some agricultural news.

5. CONCLUSION

We have designed the temperature and humidity monitoring system for agricultural greenhouse based on internet of things technology. The temperature and humidity control of agricultural greenhouses based on the Internet of Things makes full use of the characteristics of all things connected, and its end-to-end solution connects devices, the Internet and mobile APP. In the intelligent agricultural greenhouse, multiple AP points can be set according to the size of the area, which realizes mobile application access and remote control for the customer intelligent system, and has broad application prospects.

ACKNOWLEDGMENT

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Early Warning Indicators of Insufficient Middleware Capacity

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Abstract: Transaction middleware is widely used by trading systems, The important feature of the trading system is high real-time, high availability and the ability of rapid recovery when system failure, When the trading system's exceptions which use transaction middleware occur, the common and easy-to-find exception should be the blocking in transaction processing, At present, the cause analysis and research on the blockingis quite comprehensive, Many trading systems have the transaction processing monitoring, which can alarm timely when busy server causes blocking, But once the monitoring alarms, production system has occurred abnormal, Therefore, the early warning and prevention for the blocking is very important for the smooth running of the production system, One of the important reasons of the transaction processing blocking is the capacity lack of middleware servers, which may lead to server busy,This paper focuses on findingthe early warning indicatorsof insufficient middleware capacitywhich is server utilization rate, The research realizes the acquisition and calculation of the server utilization rate through the analysis of server call process, According to the results of the summary data show, the administrator can observe and analysis server utilization rate, so as to achieve the reference of the server configuration capacity, When finding that server utilization rate is too high, the administrator should analyze and deal with the problem before the server busy occurred

Keywords: Capacity; Middleware, Utilization Rate; Trading System

1. INTRODUCTION

Transaction middleware is widely used in transaction system. The important characteristics of transaction system are high real-time performance, high system availability requirements, and rapid recovery in case of problems. When the transaction system using transaction middleware is abnormal, the common and easy to find exception is transaction processing blocking.

At present, Analysis of the causes of transaction processing blocking and positioning research is more comprehensive. Many systems have realized the monitoring of transaction processing slow or blocking. However, once blocking occurs, the production system has an exception. If customers complain about the performance of the trading system and then start to deal with it, it will be more hasty and passive. Therefore, potential system performance problems should be found in daily operation and maintenance. When the problems have not affected the business itself, it will be more active to deal with them [1]. In this paper, Tuxedo is taken as an example to study and find out the early warning indicators of middleware, which are used to monitor the running capacity of middleware.So as to alert the situation that is easy to be abnormal.The administrators can take measures to avoid the occurrence of application system exceptions in time.

2. BASIC WORKING PRINCIPLE

Middleware is the software that lies on the operation system layer and under the application software. The purpose of middleware is to serve the upper application and provide the interoperability mechanism between different services in the application layer [2].

2.1. Server and Service

In Tuxedo application system, service is a single function, which is used to process a corresponding transaction request according to the application logic. Server is a process, waiting for a message queue [3], which receives requests from clients or other servers and sends response information to them, including one or more services. In the system design, multiple application units can be integrated into one server, and the system concurrency can be improved through multiple servers, multiple services and multiple queues, so as to improve the system capacity. No matter aaaa, abcd, ccdd and other different requests are put forward by the client side, these requests can be evenly distributed to each queue to ensure the fast and stable operation of the system. For example, in a savings system, services such as deposit, withdrawal, supplementary registration can be integrated into one server, and then multiple servers can be started, so that the deposit, withdrawal, supplementary registration transactions can share all these servers and corresponding queues, thus improving the system efficiency[3].

From the perspective of the client, the customer only needs to know the service name and parameters, and doesn't care which server the service is placed in. But from the perspective of the server, both should be concerned, because the server is the program of the

server, which needs to be edited, compiled and run manually. When the server is running, it is a process, while the service is a specific service.

Usually, multiple services are put into one server to reduce the demand of tuxedo for system IPC resources [4].

2.2. Message and Message Queue

IPC (interprocess communications) is a system resource used by UNIX operating system to help realize interprocess communication. UNIX System provides three types of IPC resources: Message Queue (MSG), shared memory (SHM), and semaphore (SEM) [5]. Tuxedo uses a lot of IPC resources of the operating system. This paper focuses on message queue. Message queue model provides message transmission service based on queue, which is mostly used for inter process communication and inter thread communication. Message queue, sender and receiver provide a point-to-point message delivery method. They have a corresponding relationship [6].Messages include customer request, service response, session message, notification message, management message, transaction control message, etc. So how can messages be delivered through message queues? For example, program A needs to exchange data with program B. program A encapsulates the data into a message and puts it into the queue. Program B takes out the message from the queue in the first in first out order, and puts the reply message into queue 2 after coming out. Program A also takes out the reply message from queue 2 in the first in first out order, so as to complete a data processing [7].By default, each server has a request queue to receive customer requests. This is the SSSQ (single server single queue) model. Each server has a request queue, and each client has a response queue to receive the server's response messages. If there are too many servers, you can also configure multiple servers to share the same request queue. This is the MSSQ (multiple servers single queue) mode. Multiple servers share a request queue. If a server calls another service, you also need to create a response queue for it.

2.3. Principle and Configuration of MSSQ

In MSSQ mode, multiple instances of the same server are started. All of which share the same request queue. As shown in Figure 1, simpserv, the service process of simpapp, has been started with five instances, which share a request queue Q1. All the toupper service call requests sent by the client are put into Q1, and all simpserv process instances extract the requests from Q1 for processing. Thus, mssq can optimize request scheduling.

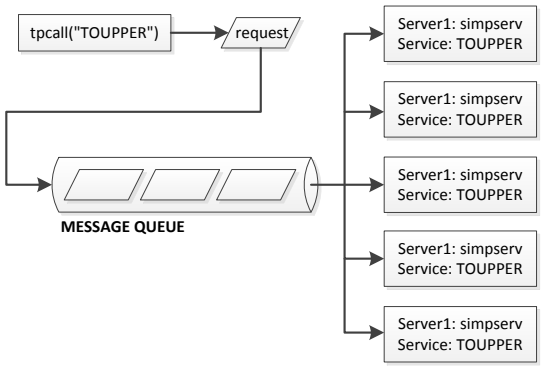

Figure 1 Principle of mssq

3. TRANSACTION PROCESSING CAPACITY

For online trading systems, capacity is usually the maximum number of transactions that can be processed per unit time. For example, TPS (transaction per second) is the commonly used indicator in this area. During the operation of the system, if the transaction request received by the application server is less than this indicator, the processing is normal. If the transaction speed received exceeds this indicator, the server will not be able to handle it, resulting in transaction timeout or failure, which makes the system in abnormal.

The overall performance of a tuxedo application system is often determined by many aspects. The design of operating system, network, database, application system and the level of programming will affect the performance of the tuxedo application system. When the performance is not good, the main performance is that the response to the client's request is slow [8]. At this time, if you check the message queue used by tuxedo, you will find that there are more requests in the queue, which is the performance of message queue blocking. The common exception is the transaction processing stagnation caused by message queue blocking used by middleware.

Based on the basic principle of tuxedo, we can see that the main cause of message queue blocking is the high utilization rate of server or service, which leads to the request in message queue can not be processed in time, thus causing message queue blocking. Therefore, this paper selects server and service utilization rate as the focus and entry point of Tuxedo capacity analysis, and finds out the index and calculation method of early warning by analyzing these two indexes.

4. USAGE COMPARISON

According to the service invocation principle of tuxedo, the function of server is equivalent to process, which can also be understood as container. A server can be configured with single or multiple services, and service is the processing function that really provides services. Therefore, in the selection of Tuxedo capacity analysis objects at the beginning of this paper, it is easy to have a question: what causes tuxedo message queue blocking? Is it server usage or service usage? In this section, through multi-party

analysis and comparison, the answer to this question is obtained. The sssq and mssq are discussed separately.

4.1. For SSSQ

SSSQ refers to that a server has a request queue to receive customer requests, which can be divided into two sub situations: (a) one server corresponds to one service,(b) one server corresponds to multiple services. It is assumed that three servers 1, 2 and 3 are configured on the server side to provide service a, B and C. There is no call relationship between the functions.

4.1.1 One server contain one service

When a server contains one service, as shown in figure 2, the utilization rate of the server is the same as that of the corresponding service. If the utilization rate of service a is 100%, the utilization rate of server 1 is 100%. At this time, server 1 is full, and the message queue corresponding to server 1 is in the state of possible blocking.

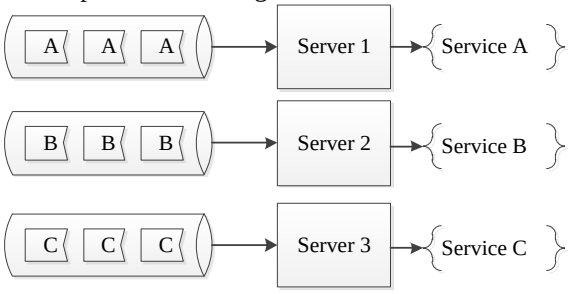

Figure 2 One server contains one service

4.1.2. One server contain multiple services

When a server contains multiple services, as shown in figure 3.Assuming that the services provided by each server are different, the utilization of a service does not directly determine the utilization of its corresponding server. Taking server 1 as an example, if the utilization rate of service a and service B is 30% and 70% respectively in a certain period of time, then the utilization rate of server 1 is 100% and the message queue corresponding to server 1 is in a possible blocked state. It can be concluded that the utilization rate of a single service has no decisive effect on the blocking state of message queue, and the utilization state of server should be comprehensively examined.

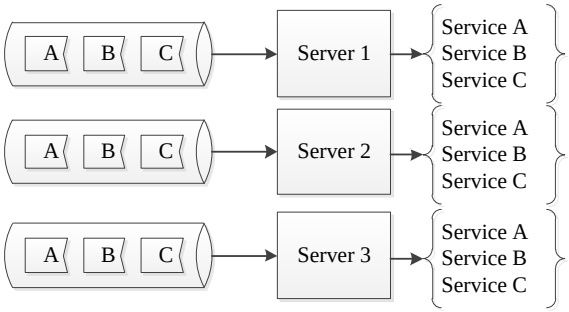

Figure 3 One server contains multiple services

4.2. For MSSQ

MSSQ refers to that multiple servers share a request queue, which can also be divided into two sub situations: (a) multiple server instances correspond to one service, (b) multiple server instances correspond to multiple services.

4.2.1. Multiple servers contain the same service

Multiple server instances correspond to one service. As shown in the figure4, server 1 starts three instances, and each server provides one service a. In this case, the utilization rate of the server is the same as that of the corresponding service. If the utilization rate of service a is 100%, the utilization rate of server 1 is 100%. At this time, server 1 is full, and the message queue corresponding to server 1 is in a possible blocking state.

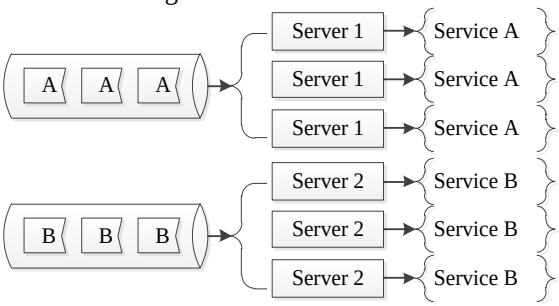

Figure 4 Multiple servers contain the same service

4.2.2. Multiple servers contain the multiple services

Multiple server instances correspond to multiple services. As shown in the figure5, server 1 starts three instances, and each server provides three services a, B and C respectively. In this case, the usage of a service is not directly related to the usage of its corresponding server. Take server 1 as an example. Suppose that the usage rate of service a and service B is 30% and 70% respectively in a certain period of time, then the usage rate of server 1 is 100%. For Service C, although the usage rate is 0, the corresponding server is full. If the request calling Service C cannot respond in time in this period, the usage rate of a single service will block the message queue The state has no decisive effect, so the use state of the server should be comprehensively examined.

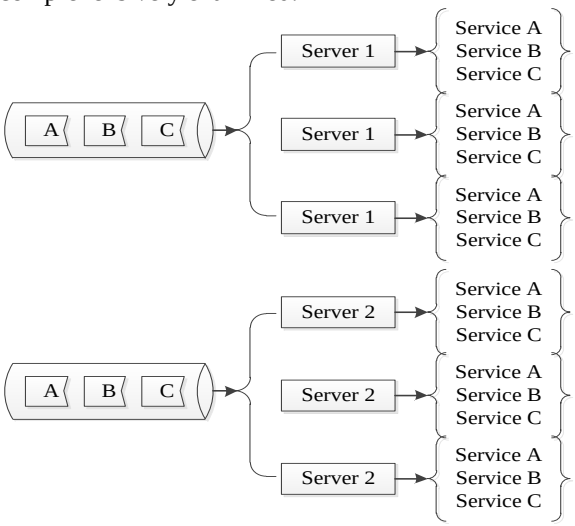

Figure 5 Multiple servers contain the same service

5. CALCULATIONOF SERVER USAGE

How to collect and calculate the utilization rate of

Tuxedo server in a period of time t? If you can collect the number of busy servers at eachpoint to summarize. But this method requires a certain acquisition frequency, and to achieve a certain frequency, it will occupy a certain amount of system resources, not an optimal method. The other method is based on the duration of each service called D, the total number of times called T and the total number of server s configured s. The server utilization can be calculated according to Formula (1).

$$R = \frac{\sum_{i=1}^{t} d}{sT} \qquad (1)$$

If you can get the average time a of server being called in a period of time, you can also calculate the server utilization rate according to formula (2).

$$R = \frac{at}{sT} \qquad (2)$$

After the study of Tuxedo's commands and tools, the following methods can be used to obtain the required data and calculate the server utilization rate according to Formula (1) or formula (2).

(1) Correspondence between server and service

Use the print service (PSC) command in tmadmin to get the corresponding relationship between server and service.

(2) Number of server starts

Use the print server (PSR) command in tmadmin to get the number of server starts

(3) Call time of service

In ubbconfig, the * servers section is set as follows: add the - R parameter to crop, and the call time information of each service will be output to the stderr file.

(4) Average time of service call

Txrpt, tuxedo's own analysis tool, can analyze stderr and get the average call time of service in a period of time.

Through the above methods, the server utilization can be calculated in real time for monitoring, or the historical data can be used for statistical analysis to realize the early warning of the insufficient capacity of TUXEDO middleware.

6. CONCLUSIONS

Through the above case analysis, it can be concluded that: after comprehensive consideration of various situations, the service utilization rate can not fully reflect the processing and accumulation of requests, and the root cause of transaction request blocking lies in that the corresponding server is full. Therefore, the server utilization rate is used as the judgment standard for transaction request accumulation, that is to say, the server utilization rate is determined as the middleware Early warning indicators of insufficient capacity.

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Research on Target Feature Fusion Method Based on Bp Neural Network

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Abstract: With the further development of artificial intelligence technology and its wide application in many fields, target detection and recognition, which takes pattern recognition as the application requirement, has become a hot research topic, In this paper, it firstly discusses the main neural network structure model in machine learning, and then taking the BP neural network as base learner, it analyzes and studies the target feature fusion model, and puts forward the BP fusion model-based target feature fusion method, which provides some technical reference for more accurate target detection and pattern recognition in complex environment
Keywords: Bp Neural Network, Base Learner, Feature Fusion Model, Iterative Learning

1. INTRODUCTION

With the further development of multi-source information technology, target detection and recognition technology has become an important research direction in the field of pattern recognition [1]. Bub the diversity and massive features of target information also challenge the accurate target detection and recognition [2]. Among many methods of target detection and recognition based on data-driven, the statistical analysis method based has a wide range of applications. The traditional statistical analysis methods mainly include principal component analysis (PCA) [3,4], also known as principal component analysis, which is a common data analysis method in statistical analysis. PCA is also a commonly used method of data dimensionality reduction. Its basic idea is to calculate new data features of new dimension space from a set of data features according to the different importance, and arrange them in the order of large to small. The new features obtained are taken as the linear combination of the original dimension space data and represent the unrelated features, and the feature mapping from the original data sample in the new dimension space is the new data sample after dimension reduction. It can be seen that PCA is to use a set of orthogonal vectors to transform the data features of the original dimension space so as to get new data features of the dimension space. Through this linear transformation of PCA, the original data can extract the main features of the data, while the new dimensional space data should keep the information of the original spatial data as much as possible on the basis of the demand of data dimensionality reduction. Therefore, it is necessary to select the first *n* largest principal components of the new dimensional features that can represent the information of the original spatial data. PCA method can effectively eliminate the redundancy between the original data and reduce the complexity of data processing. However, due to its characteristics of spatial dimensionality reduction, PCA can also cause some important data information loss in some cases.

With the development of artificial intelligence technology, various target detection and recognition methods of artificial intelligence technology have been put forward one after another, and machine learning based methods gradually show their advantages in various application fields. Common machine learning methods include k-nearest neighbor, support vector machine, random forest and neural network. In this paper, the current mainstream neural network technology is used to study the target feature fusion method based on neural network in the fields of target detection and recognition.

2. Feature Fusion

In the current fields of target detection and recognition, based on the target attribute data obtained by multiple target sensors, the related data combination method can be used to get the attribute information about the target identity and the target location. However, because of the variety of target sensors involved, the target attribute data obtained will be many in some cases, thus, there will be feature variables and feature data with higher dimensions. With the further development of current artificial intelligence technology, the related data combination methods involved in the process of target detection and recognition, are mainly the multi-source data feature fusion methods. As a kind of attribute distribution information of target in time and space, feature can be fused and calculated by computer, and the fused feature can get better expression performance. Therefore, in the process of complex target detection and recognition, using appropriate feature fusion method can achieve better processing effect.

3. Neural Network and Its Structure

3.1. Overview of Neural Network

As a research hotspot in the field of artificial intelligence, neural network (NN) has been widely concerned at home and abroad since it came into

being, and neural network has been widely used in many industries with its unique performance advantages. Artificial neural network in the field of artificial intelligence is a kind of mathematical operation model designed to process data and information by imitating the structure, thinking, memory and other related functions of biological neural network. Through the mathematical operation model, the data information can be processed nonlinearly, and the related functions can be realized. Similar to the biological neural network, the artificial neural network is also composed of a large number of nodes called neurons, which are connected to each other layer by layer. Neurons are responsible for the storage and update of data information, and the connection between different layers of neurons also corresponds to a parameter called weight. It can be seen that neurons are the basic unit of neural network to process data and information. In order to make the neural network more conform to the information expression characteristics of the real world, the activation function is added between the nodes connected by different network layers, and the linear input is transformed into a non-linear function relationship. Through the introduction of this non-linearity, the neural network has more abundant data expression ability. In neural network, the commonly used nonlinear activation functions are Sigmoid function, tanh function and Relu function.

3.2. Structure of Neural Network

Neural network adopts multi-layer structure form in the structure expression, that is, the layers in neural networkare divided into input layer, hidden layer and output layer according to different functions [5]. In the structure, the number of the input layer and output layer are both only one, while the hidden layer can have multiple layers. It can be seen that the simplest structure of neural network is three-layer neural network structure, that is, the structure with only one hidden layer, as shown in figure 1. The neurons in the adjacent layers are connected to each other, while the ones in the same layer are no. In each layer of the neural network, according to the design requirement, the neuron of the input layer is used to receive external data, which is then transmitted to the neurons of the hidden layers for processing, and after being processed by all hidden layers, the data will be transmitted to the output layer for subsequent analysis. As data processing unit, the hidden layers are only responsible for data processing and internal transmission of the network.

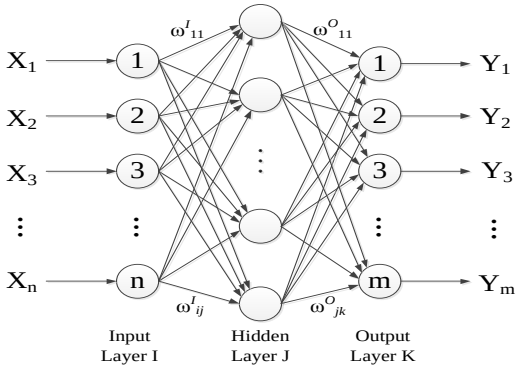

Figure 1 Three layer bp neural network topology

3.3. Bp Neural Network

The most widely used form of neural network is back-propagation neural network, which is called BP for short [6]. BP is based on the general approximation theorem [7,8] in its design and implementation, that is, through the iterative learning the, the network that can approximate any function can be trained. It can train networks that could approximate any function. In the specific implementation, BP adopts back propagation algorithm, which updates the parameters and adjust the connection between neurons in different layers, so as to obtain the function mapping relationship between the input and the output of the whole network. Because of the back propagation characteristic of BP neural network, it has the ability of self-learning and self-adaptive.

The working process of BP neural network can be divided into two processes: forward propagation of input signal and back propagation of error signal. In forward propagation, the data enters the neural network through the input layer, and reaches the output layer through the data processing of a single hidden layer or multiple hidden layers. In the forward propagation process of the data, the network weights of the neural network remains unchanged, while the data information stored by each neuron is only affected by the data transmitted by the upper connecting neuron and the corresponding network weight, and then the updated data will betransmitted to the lower layer neuron. If the output data obtained in the output layer by such way of forward propagation meets the conditions, the learning and training process will be end, otherwise, if there is a large error between the actual output and the expected output, the back propagation process of the error signal will be carried out. In back propagation, the error signal starts from the output layer and transmits data layer by layer. In this process, the network weights of each layer will also be adjusted adaptively according to the feedback information of the error signal to meet the demand of the gradual reduction of the error. That is to say, through the continuous adaptive adjustment of network weights, the error between the actual output and the expected output of the whole neural network is gradually reduced, and

the actual output is also gradually close to the expected output.

It can be seen that the forward and back propagation of BP neural network is an iterative self-learning process. Through the iterative learning process, the network weight parameters that can meet the actual needs could be obtained, and the error between the actual output and the expected output of the network will be within the allowable range.

4. Target Feature Fusion Model

A single learning model which is also called base learner in this paper can only predict results under the environment of the one model. Compared with the one model of the base learner, feature fusion model can organically combine multiple features of multiple different base learners through relevant target feature fusion rules, so as to obtain more accurate predict results than base learner through the fused feature learning model. It can be seen that feature fusion can combine the performance advantages of multiple base learners, and its prediction effect can also be better than different base learners. The design of efficient feature fusion model can effectively improve the prediction accuracy of learning model, and at the same time, it can avoid over fitting of feature learning model through the differences of different base learners. With the further development of information fusion technology in recent years, various feature fusion models with superior performance also appear, which makes the prediction accuracy of the target improved to a certain extent.

In this paper, based on the BP neural network, the BP network models with the same network structure are used as the base learners, and a target feature fusion model based on BP neural network is proposed, as shown in figure 2.

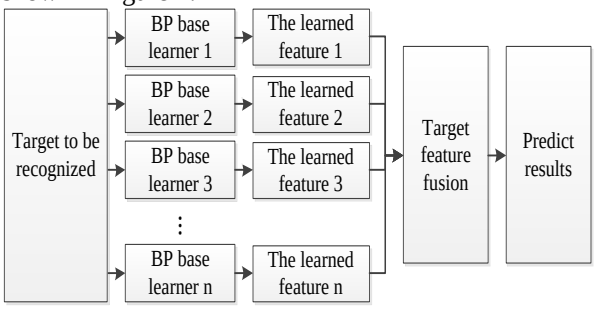

Figure 2 Target feature fusion model based on bp neural network

It can be seen from Figure 2 that the BP neural network based target feature fusion model constructed in this paper is composed of multiple BP neural network based learners. Through iterative learning training of the multiple BP base learners, it can get multiple different features learned by the base learners, and on this basis, it further constructs the fused target feature. In the implementation, firstly, as the input data, the target to be identified will be input into the multiple BP base learners, respectively, and the multiple learners are trained in parallel iterative learning by using the network parameters such as the initial weight value and threshold value of randomization and the nonlinear activation function, so as to obtain the convergence network state and related weight parameters. Because of the randomness of network parameter initialization, the multiple trained BP network parameters are not the same, thus, the features learned by the different base learners may not be the same. And then, the features learned by multiple BP base learners will be fused. By fusing the target features with differences, the fusion features with more performance advantages can be obtained, which can be used for further target prediction.

5. CONCLUSION

With the development of multi-source information technology and artificial intelligence technology, accurate target detection and recognition has become an important research direction in many application fields. In the face of increasingly complex and diversified application environment, how to improve the discriminationability of multi-source complex information and the accuracy of target detection and recognition has also become an interesting challenge. In this paper, taking the mainstream machine learning as the technical background, the BP neural network is considered as the starting point of this research. Based on the analysis of the structure of BP neural network, the iterative learning process of BP network is discussed. In order to improve the accuracy of target detection and recognition, it uses the BP neural network as the base learner, and a target feature fusion model is proposed. Through the construction of this model, the learning performance of target features can be improved to a certain extent, and it also provides a reference for accurate target detection and recognition in complex environment.

ACKNOWLEDGEMENTS

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Selection Method of Robotic Process Automation

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Abstract: The technology of Robotic Process Automation can take on many operation functions of human work, At present, it has been used more and more widely, With the rapid development of RPA products in recent years, it has a certain market share and many application cases, In order to solve the problem of how to choose RPA products, this paper starts from the current situation and characteristics of PRA products, discusses the specific selection indexes from the function, performance and other aspects, as well as the coordination work with AI and OCR, To be used in the selection of appropriate RPA products
Keywords: Process Automation, Indexes, Rpa

1. INTRODUCTION

RPA can undertake many functions of human work, and our cognitive intelligence technology makes information processing more efficient. Different fields will focus on different application scenarios, which requires technologies to cooperate with application scenarios in different ways [1]. At present, after the rapid development in recent years, RPA products in the market have a certain market share, especially in Airlines, telecommunications companies, banks and other enterprises have more application cases. So in the process of using RPA, the first problem to be solved is what kind of product to choose, which product to choose and how to choose. This paper discusses the specialty of RPA products, the requirements that RPA products should meet in terms of function and non-function, so as to use it in the process of selecting appropriate RPA products.

2. Product Status and Features

At present, in the fields of airlines, telecommunication companies, banks and other enterprises, there are some business operations with clear rules, high repeatability and large business volume, which are characterized by high degree of standardization and time-consuming manual processing. However, due to the inconsistency of data interfaces and other problems, information cannot be connected, which can be solved through the application of RPA technology. PA technology is based on computer coding and rule-based program, which automates human activities by performing repeated rule-based tasks [2].Let the robot read the document, process the information, realize the automation of the document information processing, save the human from reading the redundant useless information, people can put their energy into other more complex work [1].RPA technology has the following characteristics:

(1)Automated processing

Simulate the user's manual operation and interaction through user interface or script language. It can perform daily basic operations of users, such as mouse click, keyboard input, copy and paste and a series of daily computer operations [3].

(2)Do not affect the existing system.

It is deployed in the form of plug-in on the customer's existing system, and automatically operates in the user interface based on rules. It is non-invasive and does not affect the original IT infrastructure [3].

(3)Short development time

Low implementation cost, 7 * 24-hour efficient zero error operation Therefore, the introduction of RPA technology can effectively solve the manual operation caused by interface problems in a short time, and further improve the operation automation.

Therefore, the introduction of RPA technology can effectively solve the manual operation caused by interface problems in a short time, and further improve the operation automation. The technology trend of RPA development, on the one hand, is localization, and the market determines the product trend, so the localization of completely independent core technology will become a major trend; on the other hand, RPA will be combined with AI, OCR identification and other technologies in the future. Further improve automation and reduce labor.

In general, the RPA product introduced can realize the automation requirements of the automation scenarios required by the business and other subsequent scenarios, without affecting the existing processes and systems; the RPA product has flexible scalability, which can meet the expansion requirements of centralized management and operation, and meet the security specifications of the enterprise.

3. CONSIDERATION OF FUNCTION

It can be seen from the product characteristics of RPA that its core value lies in the automatic simulation of manual repetitive operation. In order to achieve this goal, we need to investigate from the following aspects:

RPA product automation needs to be reliable and fast to be implemented, because it needs to be able to provide rich automation technology and industry solutions, which can improve work efficiency and

quality.

It can be widely used in common applications and browsers under windows. For mainstream document formats, such as word, Excel, PDF, etc., it is well supported. It can support different resolution, different window size and location.

The designer of the development robot should be easy to use and migrate, so it needs to have a graphical designer interface. The application can be exported as an independent package and directly migrated and imported to another machine. Automatic recording and scripting are supported for processes.

In order to realize manual duty and 7 * 24 non-manual duty, the robot should be able to support the development of two modes: manual execution and timing triggering. Any operation has operation log for reference and audit tracking function.

The robot server can monitor the running status of the robot. The data interface can be opened for the unified operation and maintenance platform to read the robot operation status and monitoring data for further analysis and statistics.

Information security is a very important issue for aviation, telecom banks and other enterprises, which must be supported enough to avoid risks. Therefore, users' passwords need to be encrypted for storage, password strength is verified, and business sensitive data has corresponding encryption storage mechanism.

It needs to have role and permission control functions, which role, which user can create what kind of robot, and what kind of business operation can be carried out for permission control.

Because the robot operates based on fixed rules, when the business scene changes greatly, the robot cannot judge the situation that does not conform to the rules and cannot handle the abnormal events [4]. This requires RPA products to have a better monitoring alarm mechanism or an easy-to-use interface with the monitoring system. In case of any abnormality, the RPA products shall be informed to handle it manually in time.

4. CONSIDERATION OF NON-FUNCTION

In order to make RPA products run reliably, it is necessary to investigate its non-functional indexes.

The product shall support high availability architecture, and be able to realize hot standby of dual hosts, cluster deployment and other modes. In case of hardware failure and other scenarios, it can provide 7 * 24 uninterrupted operation. In addition, in case of abnormal interruption of the server or robot, the work can be resumed automatically after the abnormal condition is recovered. Starting from the breakpoint, the judgment of the breakpoint needs to be accurate to avoid business errors. Because RPA is expected to work continuously for a long time, the service stability of server and client needs to be investigated.

The time required to process RPA tasks, and the efficiency of processing is also an important indicator. In order to provide operation efficiency, PRA needs higher automatic operation efficiency after replacing manual operation.

Multiple robots can work in Windows multi terminal mode at the same time, each terminal runs one robot. To improve computer's resource usage.

RPA should have strong character recognition ability, or have interface with mainstream OCR (optical character recognition) products and ICR products. Through OCR or ICR technology, RPA can help the machine to identify document type, recognize characters, read bill information, interpret handwritten and printed characters, grab screen and pictures, etc., instead of manual input, so as to improve work efficiency.

RPA and artificial intelligence (AI) can replace the original artificial labor to a certain extent, but they are very different. RPA can only rely on fixed scripts to execute commands, and repeated, mechanical labor. Artificial intelligence combines machine learning and deep learning to have autonomous learning ability. The combination of PRA products and artificial intelligence will play a greater role and be applied to more complex repetitive scenes. Therefore, whether RPA products have certain AI functions or can better cooperate with AI products in the interface is also an aspect worthy of investigation.

5. OTHER CONSIDERATIONS

RPA should have strong character recognition ability, or have interface with mainstream OCR (Optical Character Recognition) products and ICR (Intelligence Character Recognition) products. Through OCR or ICR technology, RPA can help the machine to identify document type, recognize characters, read bill information, interpret handwritten and printed characters, grab screen and pictures, etc., instead of manual input, so as to improve work efficiency.

RPA and artificial intelligence (AI) can replace the original artificial labor to a certain extent, but they are very different. RPA can only rely on fixed scripts to execute commands, and repeated, mechanical labor. Artificial intelligence combines machine learning and deep learning to have autonomous learning ability [5].Artificial intelligence combined with machine learning provides functions in RPA. It can process unstructured or semi-structured data, and transform it into structured form, which is then processed by robots [6]. The combination of PRA products and artificial intelligence will play a greater role and be applied to more complex and repetitive scenes. Therefore, whether RPA products have certain AI functions or can better cooperate with AI products in the interface is also an aspect worthy of investigation.

The efficiency of AI is much higher than that of human beings, but communication and communication can not reach the same level as human beings, and can only be carried out according to the set process and plan [7].Natural language

processing (NLP) is a kind of machine language which can be understood by machine after processing the language used by human communication [8]. As an important branch of artificial intelligence, it plays an increasingly important role in the field of data processing. RPA technology is combined with NLP, just like OCR to identify bills, which enables computer to extract information from human language, so as to improve the efficiency of PRA.

6. COMPARISON OF MAINSTREAM PRODUCTS

According to Garter Research Report, the three leading vendors in RPA market are Automation Anywhere, UiPath and Blue Prism.

6.1. Automation Anywhere

It has more than 100 plug-ins, with the largest number in the industry; it emphasizes low code development and ranks first in the industry. Visual recording, easy to develop and be administrated, each console can manage hundreds of robots, KPI tracking each business process, excellent performance. Sustainable iteration and improvement, rapid completion of modeling, configuration, testing and deployment, low requirements for it capabilities, business personnel can quickly adjust the robot. Automation Anywhere's enterprise tools are designed to simulate users by understanding the data and objects (metadata) on the screen, so that they have some stability for application changes. They perform both front-end automation and rule-based processes, as well as cognitive functions of machine learning and natural language processing, to automate tasks through semi-structured data that traditionally requires decision-making. Ha architecture is supported.

6.2. UiPath

The robot implemented through UiPath can be customized and developed according to the needs of the enterprise, and can be deployed in a few weeks generally. Each task step can be recorded and monitored to meet the requirements of compliance audit; without complex system integration or hardware expenditure, it can drive new business innovation.

UiPath has shifted its focus from developing software companies' automated components to deploying RPAS. Their robot can operate the backstage mode or the human assisted backstage mode completely autonomously. Provides recorders and libraries for standard and custom workflow fragments, making them easy to reuse. Robots can run with human agents or on locked desktops. The platform has many built-in modules such as application integration, GUI automation, screen grabbing, data entry, database, web page grabbing, soap / rest API, PowerShell, etc., and many other modules can be downloaded from the online library.

6.3. Blue Prism

In addition to the development of standardized robot modules and programs, the company also emphasizes the maintenance of offline business processing rules and robot operation rules, greatly reducing the maintenance difficulty and cost, and ensuring the timeliness of maintenance.

All configurations are completed in the “blue prism configuration language”, which is code free, visual and logical with the objects in Visio. It can save and reuse objects to perform similar tasks. The integration wizard can connect these objects to commercial software, including mainframe, Java, Citrix, HTML, etc.

7. CONCLUSIONS

In order to make RPA products better applied and help business development, in the process of product selection, it is necessary to investigate functional indicators such as rich business solutions, support for mainstream document formats, convenience of design and development, and ease of migration, as well as non-functional indicators such as high availability and processing efficiency. At the same time, the interface and cooperation with OCR and AI should be considered.

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Users' Personality Prediction Model Based on Multi-Target Regression

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Abstract: The traditional users' Big Five personality prediction models mostly based on classification tasks, The prediction result is a certain personality trait, that is, the class with the highest score, The essence of such methods is to treat each personality trait as an independent variable, But since the personality consists of five traits, the correlation among different traits cannot be ignored, so such methods are difficult to predict the entire structure of the user's personality, This paper treats five personality traits as a quantitative whole, and proposes a user's personality prediction model based on Multi-target regression, This paper edits a personality analysis dictionary to extract text feature, and combines features of users' behaviorto construct a feature vector, and based on the results of the Big Five Inventory, maps the personality traits' score to weight, and constructs a 5-dimensional target vector, Then, base GBDT-Multitarget stacking and BP neural network to construct the Multi-target regression model, incorporate the correlation between one personality trait and another, one personality trait and one feature, one feature and another into the model calculation framework, The entire structure of the user's personality is predicted, and good prediction results are obtained, The result shows that the MSE of the Multi-target regression model is smaller than the Single-target regression model for personality prediction

Keywords: Personality Prediction, Multi-Target Regression, Big Five, Social Network

1. INTRODUCTION

Personality is an individual's stable behavior and internal psychological process. It is stable at any time and space [1]. At present, the most mainstream personality model is the Big Five personality model, which describes personality through five personality traits, including Openness, Extraversion, Neuroticism, Conscientiousness, and Agreeableness [2].

As a new type of information interaction platform, the social network has made it easier for people to express their emotions. People can create, and exchange information on it [3]. The emotions revealed in the social network data are mainly affected by the user's personality, at the same time, the external performance of the user's personality is mainly expressed by the user's emotions [4]. By mining the text information, analyzing the user's personality structure is good for emotional analysis. Therefore, the use of social networks for personality prediction has become a research hotspot in recent years [5-10].

At present, scholars mostly use machine learning to predict user personality. Nostro et al. assessed nine meta-analytically derived functional networks, representing social, affective, executive, and mnemonic systems. RSFC of all networks was computed in a sample of 210 males and 210 well-matched females and in a replication sample of 155 males and 155 females. Personality scores were predicted using the relevance vector machine in both samples [5].Chen T Y et al. combines the naive Bayesian classification algorithm with the feature selection algorithm to produce the best personality type prediction performance with an accuracy rate of 70-80% [6]. Liu Y et al. proposes a new probabilistic topic model (PT-LDA model) to predict the personality traits. Experiment shows PT-LDA is more accurate, efficient and robust [7]. Zahid Halim et al. used four clustering techniques to profile the three data sets, identified two clusters in each data set, and trained the classifiers to predict various personality traits [8]. Farnadi G used the machine learning method to train the model based on the user's social network behavior characteristics, and finds that the user's blog frequency is positively correlated with the degree of openness [9]. Appling et al. used SVM to predict user personality based on text semantics and achieved good results [10].

Users' personality prediction based on social network data is feasible, but most of the current research is to construct a classification task for personality prediction, and the highest score in Self-report inventory is used as the label. This approach treats each personality trait as an independent variable, ignoring the fact that personality is composed of five traits, and does not consider the important trait of correlation between different traits, so traditional methods cannot predict the entire structure of personality [11]. This paper proposes a users' personality prediction model based on Multi-target regression, which quantifies the five personality traits, maps the trait scores into trait weights, and incorporates the correlation between a trait and a trait, a trait and a feature, a feature and a feature into the calculation framework, predicting the users' personality structure and achieving good results.

2. RELATED WORKS

2.1 The Big Five

Allport G W. proposed that the status of traits in the structure of personality is important. The trait is "a general tendency system similar to behavior", which can be considered as the most basic unit of personality structure [12]. The Big Five is the most influential and widely recognized model of personality theory [13]. Its five basic traits are universal, not based on language, culture, and ethnicity [14]. The Big Five personality model consists of five personality traits, which are Openness, Extraversion, Neuroticism, Conscientiousness, and Agreeableness [15].

2.2 Personality Dictionary

There are many open source sentiment dictionaries, but there is no dictionary for personality analysis tasks [16]. Based on the existing open-source sentiment dictionary, this paper constructs a personality analysis dictionary, counting 5132 common words and 191 online buzzwords which are divided into 51 word classes. It should be noted that a word may belong to more than one word class. A part of the content of the Personality Analysis Dictionary is shown in Table 1.

Table 1 Personality dictionary

Word Class	Words
ANXIETY	insomnia, restlessness, overwhelming, shocking, shocked, taut, laborious, trembling, surprised, confused, disturbed, worried, timid, risky…
ANGRY	insult, disturb, ridiculous, jealous, annihilated, arrogant, nausea, confrontation, opposition, contradiction, anger, unwillingness, provocation, unreasonable, stingy, bad…
ACHIEVEMENT	celebrate, appreciate, skill, talent, transcendence, fame, talent, red, purple, peak, top, improvement, elite,…
…	…

3. PREDICTION MODEL BASED ON MULTI-TARGET REGRESSION

The personality prediction model established in this paper mainly includes the following parts, as shown in figure 1.

The main process of the model is: for the collected social network data, at firstwe extract the user behavior information features such as the number of followers, the number of fans, and the frequency of posting. Secondly, we match the constructed personality analysis dictionary to extract the text feature based on the text content. Thirdly, weconstruct the 5-dimensional target vector according to the score of the Big Five Inventory, which corresponds to 5 personality traits. Finally, we construct the Multi-target regression model to predict the user's entire personality structure.

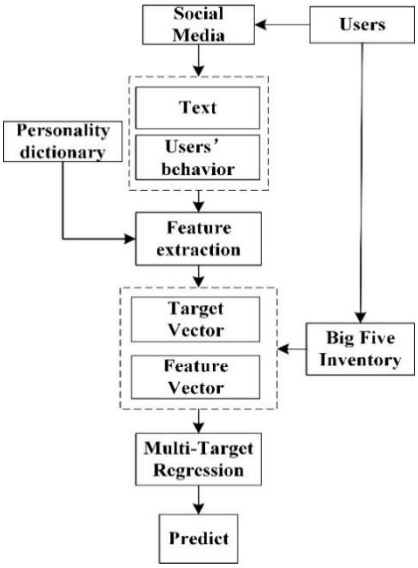


Figure 1 Users' personality prediction model based on multi-target regression

3.1 Data Processing and Feacture Extractiond

(1) Target vector

To achieve the prediction of the users' whole personality structure, the personality is treated as a 5-dimensional vector. Normalize the scores of the five personality traits in the Big Five Inventory, and calculate the proportion of each trait in the personality structure. The calculation formula is

$$p_i = \frac{g_i}{\sum_{i=1}^{5} g_i} \quad (i = 1, 2, \cdots, 5) \tag{1}$$

Where p_i is the proportion of a personality trait, g_i is the personality trait score in the Self-report inventory, P is a 5-dimensional vector describing the personality structure, that is, the regression target vector.

(2) Feature vector

This paper divides the features into two categories: user behavior features and text features. User behavior features include the number of following, the number of followers, frequency of posts, the number of participating topics, the number of @, the number of reposts, and the original proportions to reflect the basic usage of the social network and topic participation. Text features Based on language content extraction, reflecting the user's language habits, expressions and emotional tendencies.

The text features extraction is based on the results of word segmentation, and the matching of emotional word classes is carried out through the personality analysis dictionary [17]. At the same time, when the word segmentation is carried out, many emotional words are split. For example, the online buzzword "日了狗了" is divided into "日/了/狗/了". In order to

retain effective emotional words, we restore the word according to the dictionary.

The frequency of occurrence of 51 words classes in the personality analysis dictionary in the text is calculated as 51 text features.

$$wf_i = \frac{N_i}{N} \quad i = 1,2,\cdots,51 \tag{2}$$

Where wf_i is the frequency at which the i word class appears in the text, N_i is the number of occurrences of the i word class in the text, and N is the total number of words of the text.

7 User Behavior Features and 51 Text Features Constitute a Feature Vector. the Feature Vector Space Model is as Shown Below.

$$\begin{bmatrix} wf_{11} & wf_{12} & \cdots & wf_{1w} & bf_{11} & \cdots & bf_{17} \\ wf_{21} & wf_{22} & \cdots & wf_{2w} & bf_{21} & \cdots & bf_{27} \\ \vdots & \vdots & \ddots & \vdots & \vdots & \ddots & \vdots \\ wf_{s1} & wf_{s2} & \cdots & wf_{sw} & bf_{s1} & \cdots & bf_{s7} \end{bmatrix}$$

In the matrix, each row represents a user's social network, wf_{ij} represents the frequency of the j word class of the i user's social network; bf_{ij} represents the j user behavior feature of the i user's social network; s represents the total number of social network users of the collected corpus, and w represents the number of text features, w=51.

3.2 Multi-Target Regression Model

Personality is composed of five personality traits, corresponding to a five-dimensional vector P. Each dimension is a description of a personality trait. To predict the entire personality structure, a Multi- target regression model is constructed as below.

$X = (x_1, x_2, \cdots x_n)$ is an n-dimensional feature vector, $x_i \in Set_f$, and the target vector is $Y = (y_1, y_2, \cdots y_5)$, ie, vector P. There are 5 targets, and for each target m there is a train set $\{(x_{ms}, y_{ms})\}, m = 1,2,\cdots,5, s = 1,2,\cdots,S$. In the formula, $(x_{ms}, y_{ms}) \in X \times Y$ is the s example in the target m, and S represents the number of samples, $x \subseteq R^n, y \subseteq R^5$.The feature matrix X is

$$X = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ x_{S1} & x_{S2} & \cdots & x_{Sn} \end{bmatrix}$$

Target matrix Y is

$$Y = \begin{bmatrix} y_{11} & y_{12} & \cdots & y_{15} \\ y_{21} & y_{22} & \cdots & y_{25} \\ \vdots & \vdots & \ddots & \vdots \\ y_{S1} & y_{S2} & \cdots & y_{S5} \end{bmatrix}$$

The task of the Multi-target regression model is to predictthe transfer matrix W

$$W = \begin{bmatrix} w_{11} & w_{12} & \cdots & w_{15} \\ w_{21} & w_{22} & \cdots & w_{15} \\ \vdots & \vdots & \ddots & \vdots \\ w_{n1} & w_{n2} & \cdots & w_{n5} \end{bmatrix}$$

Where $y_{ij} = X_{i\cdot} \cdot W_{\cdot j} = \sum_h x_{ih} w_{hj}$, the goal of Multi-target regression is to train the model h that minimizes W, the model inputs X, and outputs Y, [18]n is the number of features in Set_f. In this paper, a Multi-target regression model is constructed based on regression tree and neural network, which are respectively, to verify the prediction result of Multi-target regression.

(1) Multi-target regression model based on GBDT Stacking

Considering the correlation among 5 targets, this paper draws on the stacking generalization idea in multi-label classification [19], and applies it to the GBDT regression tree to achieve Multi-target regression, namely GBDT-MTS(GBDT-Multi Target Stacking), the algorithm flow is:

1). Construct a Single-target regression model, use only part of the sample D_i, and iterate out each target value based on the GBDT. Each target is iterated H times on the regression tree, 5 targets are iterated 5H times, and 5 independent Single target regression model $h_i \to R$ are obtained.

2). Add additional training based on stack generalization, and train H models for each target $y_i$base on the remaining samples D/D_i.

3). Extend the feature vector space, and make the original feature vector together with the 4 targets except the current target to form a new feature vector. The new feature vector is $X = (x_1, x_2, \cdots x_n, y_1, \cdots y_4)$.

4). Update the parameters, retrain the new samples, and obtain H multi-target prediction models [20].

In general, after 5 Single-target regression models are established based on the GBDT regression tree, the model is applied to D/D_i in turn, and the estimated values outside the sample are obtained, the feature vector space is expanded, and the multi-target regression model is trained to predict the entire personality structure.

(2) Multi-target regression model based on BP neural network

The BP network includes input layer, hidden layer and output layer, and its output layer can output multiple variables at the same time [21]. This character makes it meet the requirements of Multi-target regression [22]. It uses a backpropagation strategy that uses the steepest gradient information to find a combination of parameters that minimizes network errors [23]. In this paper, the feature vector is constructed as the model input with the features in Set_f , and the P is constructed as the output of model. The network structure is shown in figure 2.

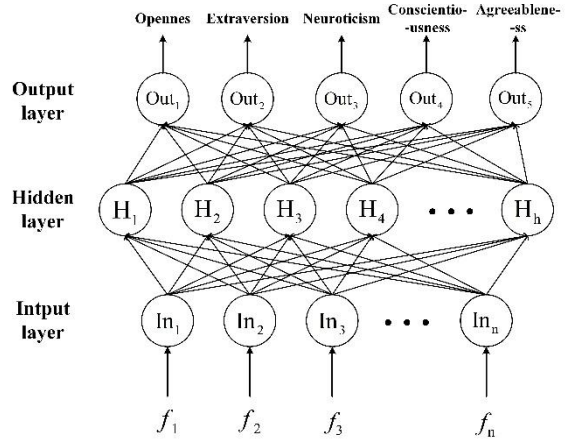


Figure 2 The structure of neural network

4. Experiments and Results Analysis

4.1 Data Collection

In this paper, the standard BFI (Big Five Inventory) is used for thequestionnaire survey. The respondents answer the questions through the online platform, and fill in the Microblog account at the same time. BFI adopts five grades, a total of 60 questions, including five subinventories, corresponding to five personality traits, each of which contains 12 questions. The content of the description is selected according to the actual degree of matching with each other. According to the degree of matching, there are five options: very non-conformity, less inconsistent, difficult to determine, more consistent, very consistent, and the scores are 1 point, 2 points, 3 points, 4 points, 5 points. In each subinventory, 8 questions are positive scores and 4 questions are negative scores. The score $g_i(i = 1,2,\cdots,5)$ of each personality trait is calculated according to the answering situation, and the target vector $P$is constructed.

In the data collection process, a total of 613 questionnaires were received, of which 344 were filled out with Microblog accounts. Considering the quality of the respondents' answers and the quality of Microblog content, further screening is required. The screening criteria are as below.

(1) The answer time is greater than 100 seconds.

(2) The number of blog posts is greater than 200.

When collecting microblog data, according to the principle of collecting 300 pieces per person, less than 300 all collections, 214 valid questionnaires and corresponding Microblog corpus are obtained, and one user's Microblog corpus is one sample. According to the ratio of 3:1, the data set is divided into train set and test set, the train set includes 164 samples, and the test set contains 50 samples.

4.2 Evaluatione Crit

In this paper, the model is evaluated by MSE(Mean Square Error), MAE(Mean Absolute Error), and R^2.

The calculation formula for MSE is

$$E(f;D)=\frac{1}{m}\sum_{i=1}^{m}(f(x_i)-y_i)^2 \quad (3)$$

The calculation formula for MAE is

$$E(f;D)=\frac{1}{m}\sum_{i=1}^{m}|f(x_i)-y_i| \quad (4)$$

The calculation formula for R^2 is

$$R^2=1-\frac{\sum(y_i-f(x_i))^2}{\sum(y_i-\bar{y})^2} \quad (5)$$

Where D is the given sample set, f is the trained model, x_i is the input feature vector,y_i is the true target of x_i, $\bar{y}$is the average of y_i, and m is the number of samples.

4.3 Result Analysis

Experiment 1GBDT-MTS experiment

Based on GBDT-MTS training the Multi-target regression model, and the trained model is tested on the test set to obtain the prediction result.The model evaluation indicators are shown in Table 2.

Table 2 The results of Gbdt-Mts

	MSE	MAE	R^2
Openness	0.001472	0.033219	0.786164
Extraversion	0.000550	0.020428	0.896271
Neuroticism	0.000510	0.019088	0.942535
Conscientio-usness	0.000567	0.020411	0.884785
Agreeablen-ess	0.000557	0.020811	0.801999

It can be seen from the table that the quality of the model is good, and the visualization of the prediction results is shown in figure 3.Among them, the x-label is the number of 50 users in the test set, which is the integer in the interval $[0,49]$, the y-label is the proportion of the five personality traits, and the red solid line is the result of Big Five Inventory , the yellow dotted line is the result of model prediction.As can be seen from the figure, the predicted result is excellent.

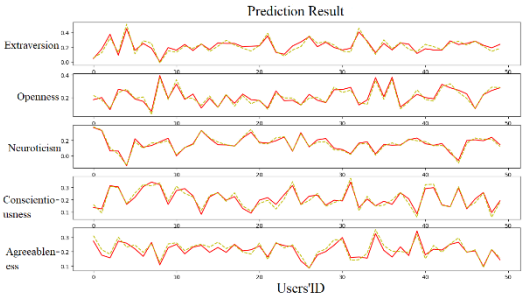


Figure 3 Prediction result based on Gbdt-Mts

Experiment 2Comparative experiment

BP neural network (BP-NN) and linear regression (LR) are used to train the model separately. The multi-output neural network can construct the multi-target regression model. Linear regression is a typical single-target regression model. The evaluation indicators of the three models are shown in Table 3.

It can be seen that for the two Multi-target regression models, the prediction total error based on the GBDT-MTS is less than the BP neural network (BP-NN), but the error of the Extraversion trait is higher than the BP neural network (BP-NN); the prediction errors of the two Multi-target regression

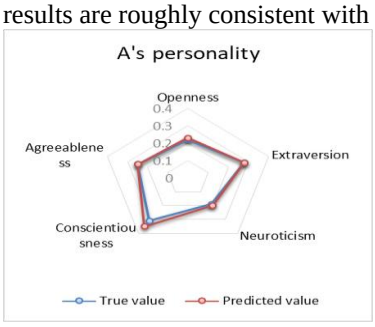
models are all less than a Single-target regression model.

Table 3 The Mse of Three Algorithms

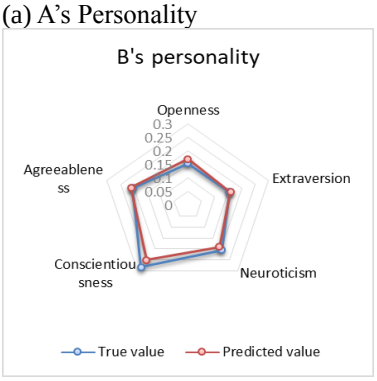
	GBDT-MTS	BP-NN	LR
Openness	0.001472	0.000712	0.005112
Extraversion	0.000550	0.001408	0.010361
Neuroticism	0.000510	0.000916	0.004587
Conscientio-usness	0.000567	0.000992	0.001123
Agreeablen-ess	0.000557	0.001136	0.008956

Experiment 3 Personality structure visualization

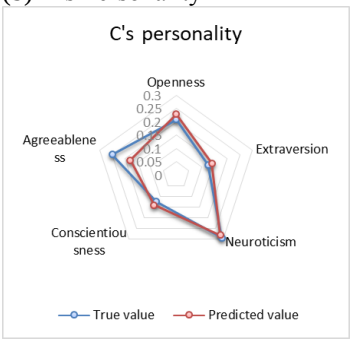
We visualize the personality structures of some users. Here, the personality polarity maps of the three Microblog users are selected for display, and the user's name has been desensitized and replaced by User A, User B, and User C. Each picture contains its true personality structure and predicted personality structure, as shown in figure 4, the model prediction results are roughly consistent with the facts.



(a) A's Personality



(b) B's Personality



(c) C's Personality

Figure 4 Structure of Personality

It can be seen that A's entire prediction error is small, and its four traits of Openness, Agreeableness, Neuroticism, and Extraversion are more balanced, and the Conscientiousness is outstanding, indicating A is confident, responsible, self-disciplined, and cautious; B's entire prediction error is small, the entire personality structure is relatively balanced, indicating that B love life, self-discipline, and do things more carefully, and can actively seek positive emotions; C's Agreeableness prediction error is large, His Extraversion and Conscientiousness insufficient, but the Neuroticism is outstanding, indicating that C is easy to get angry, frustrated, uneasy, self-conscious, impulsive, and prone to get tired of the surrounding things.

5. CONCLUSIONS

This paper implements a users' personality prediction model based on Multi-target regression, which can predict the users' personality structure based on the social network. Starting from the basic point of personality as the whole of five traits, the correlation between one personality trait and another, one personality trait and one feature, one feature and another is fully considered. The Multi-target regression model is constructed by GBDT-MTS and BP neural network respectively. The prediction of the personality structure of users shows that the entire prediction error of the GBDT-MTS is smaller than that of the BP neural network model. At the same time, the prediction errors of the two Multi-target regression models are all smaller than the Single-target regression model.

The languages of social network are very distinctive, usually short text and contain a lot of web images and emoticons, which poses a challenge to the in-depth study of users' personality. How to effectively analyze the pictures, expressions and other information posted by users and further improve the personality prediction model still needs to continue research.

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Research on Information Security and Protection Strategy of Computer Network

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Abstract: the development of computer network information technology is mature, which ensures that it gradually obtains a wide and sufficient practical application space, At the same time, frequent types of network information security events are also inducing the Chinese people to gradually enhance the attention to computer network information security issues, In view of the far-reaching impact of computer network information security on the daily production and life experience of Chinese people, this paper will focus on the topic of computer network information security and its protection strategy, and choose two specific aspects for a brief explanation
Keywords: Computer Network; Information Security; Protection Strategy; Research and Analysis

1. INTRODUCTION

With the development of computer network science and technology, it has gradually obtained a wide and full application space in various fields of social life, playing an extremely important and practical role that can not be ignored. Under the current historical development background, there is a close relationship between computer network technology and the daily work and life experience of Chinese people. On the basis of creating and providing various types of convenient support conditions, it is also facing various forms of network security threats. It needs technical staff in related fields to formulate and apply appropriate strategies Expand resolution disposition. In view of the above research background, this paper will focus on the topic of computer network information security and its protection strategy, and carry out a brief explanation and analysis. Various factors affecting computer network information security:

1 .1Spam

The survey shows that in recent years, the overall amount of spam in China is gradually expanding. The main purpose of its senders is usually to carry out advertising information publicity, or to steal the basic information of computer network users by means of embedding background programs, which to a certain extent results in the insecurity of computer network equipment users Good influence and threat.

At the same time, some of the spam senders are suspected of criminal crimes. They often use the computer information technology system and basic information knowledge to carry out the dissemination of harmful information, and then cause damage to national security, as well as public and personal information security. They need to implement disciplinary intervention in accordance with the relevant legal provisions.

1.2 Malicious attack

At present, malicious attack is a representative factor that can threaten and destroy the security running state of computer network information technology system. Its concrete manifestations include active attack and passive attack.

The so-called active attack is to use various types of technical operation methods to destroy the network information resources. The focus of the destruction is to affect the effectiveness of the existing elements of network information resources [1].

The so-called passive attack means that in the normal and stable operation of the computer network information technology system, under the condition of no need to accept the influence of any external factors, the main purpose of the passive attack is to carry out the deciphering behavior, interception behavior, and theft behavior against all kinds of network information resource elements, which is to obtain all kinds of confidential information or important information in secret.

1.3 Computer virus

Computer virus programs usually hide in some software programs or network data and information resources. Once the computer virus programs are triggered to execute, it will usually lead to the loss of some data and information in the computer equipment [2], and even lead to the damage of computer hardware system, resulting in the overall level of computer network information security Good influence.

1.4 Natural environment factors

The so-called natural environment factors refer to the natural disaster events in the surrounding environment during the concrete operation and use of the computer network information technology system, which cause the computer network information technology system to suffer a certain degree of damage. Although the probability of occurrence of natural disaster events is at a low level, once they occur, they usually lead to more serious damage results, which needs to be paid close attention by technical staff in related fields.

2. PREVENTION STRATEGIES OF COMPUTER NETWORK INFORMATION SECURITY

2.1 IE browser security protection

Under the background of the existing technology

development, the malicious program code contained in the web page is usually spread by java applets program and active X control program, and once the web page is opened, the above program will automatically start running, and then cause damage to the running security state of the network user's computer device system. In order to effectively solve this kind of security problems, we can set up security protection functions for IE browser, such as setting trusted network sites, etc., to avoid various types of information security problems caused by bad programs implanted in computer equipment and operation.

2.2 Construction and improvement of protection technology system

During the operation and use of the computer network information technology system, it is very important to maintain the integrity and stability of the protection technology system at the use function level, which has a practical effect that cannot be ignored [3].

In the background of existing technology development, the main functions of the protection technology system include intrusion detection, vulnerability scanning, virus detection, and network monitoring.

2.3 Install and use anti-virus software

In the process of the concrete operation and use of the computer network information technology system, the installation and use of anti-virus software can effectively realize the detection of virus programs and other malicious programs that invade the related equipment of the computer network information technology system, as well as the cleaning and disposal, and then control and avoid the actual operation of the computer network information technology system to the maximum extent Various types of adverse events, such as information disclosure and information destruction, occur in the process of using rows [4].

2.4 Strengthen and improve user information management

In the process of rapid, stable and continuous development and evolution of modern electronic information science and technology, human spiritual civilization has gradually entered the information age. The account and password information of users of various computer network information technology systems is the most critical type of information elements. To do a good job in security management of such information has an extremely profound practical impact [5].

3. CONCLUDING REMARKS

Focusing on the topic of computer network information security and its protection strategy, this paper selects various factors that affect computer network information security and the prevention strategy of computer network information security. Two specific aspects are briefly explained and analyzed in order to create and provide for researchers in related fields and relevant staff in the field of computer network information technology in China Solid and effective work experience reference support conditions. In order to support and ensure the long-term safe and stable operation of China's computer network technology system, it is necessary to analyze all kinds of subjective and objective factors that affect the safe and stable operation of China's computer network information technology system, and formulate and implement fully targeted computer network information security prevention and control strategies.

ACKNOWLEDGMENTS

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Application of Electronic Diagnosis Technology in the Maintenance of New Energy Vehicles

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Abstract: In the new era, with the rapid development of society and economy in China, the quality of life of residents has been improved significantly, Automobile has become an important tool for daily travel of residents, but the amount of automobile exhaust emissions will have a huge impact on the urban environment, In this context, new energy vehicles should be born, which has become the development trend of automobile manufacturing industry, and its maintenance is also affected by the public and society High attention. This paper mainly analyzes and explores the application of electronic diagnosis technology in the maintenance of new energy vehicles, hoping to give some reference to the relevant industries in China

Keyword: Electronic diagnosis technology; New energy vehicle maintenance; Application; Analysis

Under the new situation of China's economic development, the living standard of residents has been significantly improved, and automobiles have become an important means of travel for modern residents. However, fuel vehicles will emit a lot of automobile exhaust during operation, which will cause pollution to the urban environment. Under the guidance of the concept of building an ecological society, the automobile manufacturing industry has gradually tended to develop in the direction of ecology. New energy vehicles as environmental protection and energy conservation Products, which can reduce emissions, reduce environmental pollution, in line with the concept of ecological and environmental protection. There are great differences between new energy vehicles and fuel vehicles. They are driven by new energy, and their internal structures are slightly different. In the process of maintenance, maintenance personnel need to explore new maintenance technologies, so as to ensure the safety and stable operation of vehicles, and provide security for residents to travel.[1]

1. ELECTRONIC DIAGNOSIS TECHNOLOGY

Electronic diagnosis technology refers to the use of electronic equipment or instruments to troubleshoot auto parts and components, and then find fault problems in time, providing convenient new fault diagnosis technology for maintenance personnel. The application of this technology can make a detailed and comprehensive inspection of the car without disassembling it, and improve the efficiency of fault diagnosis and maintenance quality. The internal equipment and parts of new energy vehicles are more complex, and the same part has many functions. If the previous diagnosis technology is used, it is not only difficult to find the fault quickly, but also easy to lead to diagnosis errors. Therefore, in the maintenance of new energy vehicles, the maintenance personnel should recognize the advantages and value of electronic diagnosis technology, and timely find out the fault and carry out the maintenance work on the premise of ensuring that the vehicle is not disassembled.

2. ADVANTAGES OF APPLYING ELECTRONIC DIAGNOSIS TECHNOLOGY IN THE MAINTENANCE OF NEW ENERGY VEHICLES

2.1 Save Maintenance Resources

In the past, the maintenance technology is mainly aimed at fuel vehicles, there is a certain blind area in the maintenance of new energy vehicles, and a lot of useless work will appear in the actual work, which not only increases the maintenance cost, but also wastes the maintenance resources. The application of electronic diagnosis technology can discover the problems and faults of the vehicle in time, monitor the operation of the vehicle dynamically and comprehensively, prevent the reactive operation problems and save the maintenance resources of the vehicle.

2.2 More Comprehensive Maintenance

There are some differences between new energy vehicles and fuel vehicles in terms of maintenance. In carrying out maintenance work, it is necessary to develop maintenance plans in combination with fault records, vehicle travel, program management and parts procurement, so as to ensure the comprehensive and targeted maintenance. In the past, it is difficult to obtain vehicle maintenance records effectively, which makes maintenance work more difficult. The application of electronic diagnosis technology can effectively obtain the relevant content and information of the car, and give users the corresponding authority, provide convenience for the maintenance work, but also improve the comprehensive maintenance.[2]

2.3 Improve Maintenance Accuracy

At present, in the maintenance of new energy vehicles, maintenance personnel mainly carry out relevant work in the past way, and rely more on their own experience

in judging faults. They have higher requirements on the knowledge level, professional skills and work experience of maintenance personnel. If their technical level is not enough or their maintenance experience is not enough, they are prone to misjudgment and low maintenance accuracy Potential safety hazards are buried in normal operation. Electronic diagnosis technology adopts advanced electronic equipment and instruments. Maintenance personnel can quickly find and determine the fault location by using oscilloscope or diagnostic instrument, and carry out targeted maintenance to improve the accuracy and effectiveness of maintenance work.

3. SPECIFIC APPLICATION OF ELECTRONIC DIAGNOSIS TECHNOLOGY IN THE FAULT MAINTENANCE OF NEW ENERGY VEHICLES

3.1 Specific Application in Engine Diagnosis

The engine is the key part of new energy vehicle manufacturing, and it is also the most prone part to failure. If the engine fails, it will have a direct impact on the vehicle braking, and bury hidden dangers in safe driving. Due to the different brands and types of new energy vehicles, there are also differences in their engine types. In the past diagnosis and maintenance, the maintenance personnel need to determine the brand and type of the engine first, and then carry out the maintenance work, extending the maintenance time, which brings inconvenience to the owners. The application of electronic diagnosis sheet technology can accurately determine the location and cause of engine failure. First of all, electronic diagnosis technology can dynamically monitor the oil pressure of the car, and effectively analyze the oil pressure situation, and then make a scientific maintenance plan; second, electronic diagnosis technology can monitor the oil pressure, sensors and power system of the car, find the engine fault in the running of the car, and transmit the fault reason and type to the operation interface. It provides convenience for maintenance personnel.[3]

3.2 Specific Application in Power Battery Diagnosis

The power system of new energy vehicle is composed of motor controller, motor and power battery. The power battery is the key part of power supply. At present, the main power battery in the market is fuel, NiMH, lead acid and lithium battery. It has the characteristics of short charging time, high durability, etc., but it is also prone to various failures in use. The maintenance and maintenance is an important part of new energy vehicle maintenance. After the application of electronic diagnosis technology, the relevant data can be read through the driving computer to find out the cause of the power battery failure and inform the owner of the failure. For example, during the charging process, the ambient temperature should be between 0 ° C and 50 ° C, if it exceeds this range, the power battery cannot be charged.[4]

3.3 Specific Application in Circuit Diagnosis

Compared with fuel vehicles, the electronic system of new energy vehicles is more complex, more intelligent and more information-based. As a key part of the internal structure, the circuit is very prone to various failures in the driving process. After the current circuit system fails, it will cause the internal functions of vehicles and some components can not be used normally. Therefore, circuit diagnosis is also a new energy vehicle important contents of vehicle maintenance. The previous circuit maintenance technology takes a long time, so it is difficult to judge the circuit parts in time. The application of electronic diagnosis technology can monitor the circuit system in a comprehensive and detailed way. The maintenance personnel can use relevant instruments and equipment, and can generate the fault parts and causes in the operation interface. The maintenance personnel can master the fault code in combination with the interface prompts or warning points, and then timely solve problems and eliminate potential safety hazards.[5]

4. CONCLUSION

All in all, in the new situation of social development in China, the quality of life of residents has been significantly improved, and the number of cars is increasing. As the future development trend of automobile industry, new energy vehicle can effectively alleviate urban pollution and save non renewable energy, but its internal structure is relatively complex, which adds some difficulties to the maintenance work. The application of electronic diagnosis technology can improve the efficiency and accuracy of troubleshooting and diagnosis, provide convenience for maintenance personnel, and ensure the driving safety of car owners.

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Design of Tobacco Curing Control System in Intensive Curing House

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Abstract: The traditional tobacco curing control system in artificial curing barn is inadequate. In view of the characteristics of tobacco curing in intensive curing barn at present, the tobacco curing control system in intensive curing barn is studied and designed. The controller of this system adopts PIC18F45K20 chip, while the temperature and humidity sensors adopt DS18B20 chip, and the tobacco curing control in intensive curing barn is studied and designed. The system can automatically control the temperature and humidity of tobacco leaves according to their baking conditions. It does not need to be monitored manually during the whole baking process. It improves the stability and controllability of tobacco leaf baking, and realizes the automation, intellectualization and standardization of tobacco leaf baking. Finally, the system is tested on the spot to achieve the expected goal.

Keywords: Arm, Barn, Baking, Research, Design

1. INTRODUCTION

The production process of tobacco includes four processes: tobacco curing, threshing and redrying, silk making and wrapping. In the whole process, the quality of tobacco leaves directly depends on the baking[1]. With the development of computer and control technology, the automatic baking technology is gradually introduced in the tobacco baking process. The emergence of this system greatly reduces the workload of the staff and the use of fuel. It can automatically control the temperature and quality of tobacco baking in the tobacco baking process, and gradually replace the traditional tobacco baking mode. The traditional mode of tobacco leaf baking consumes a lot of energy, has a high intensity of work, and has a low economic benefit[2]. Therefore, the development of tobacco leaf baking is restricted. The system can overcome the shortcomings of the traditional mode, standardize the tobacco leaf baking process, and improve the level and quality of tobacco leaf baking.

2. BAKING PRINCIPLE AND TECHNOLOGY OF INTENSIVE BAKING ROOM

2.1principle of Intensive Baking Room

The heating room and the tobacco loading room form a dense baking room. The main equipment of the dense baking room includes the heating equipment of tobacco leaves, the ventilation equipment of moisture removal, the temperature and humidity control equipment, etc[3]. According to the circulation direction of hot air in the loading room, we can divide the intensive baking room into air flow up baking and air flow down baking. At present, air flow up baking is widely used, as shown in Figure 1 is the sectional structure diagram of intensive baking room.

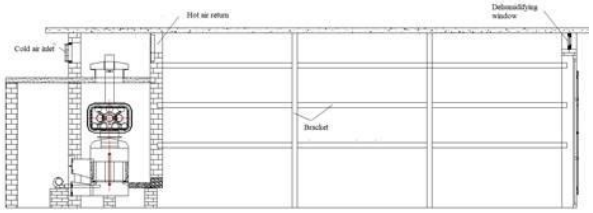

Figure 1 Sectional structure of intensive baking house

2.2 Baking Technology in Intensive Baking Room

At present, the relatively mature tobacco curing process mode is three-stage baking, which mainly includes three stages: yellowing stage, color fixing stage and dry gluten stage.

2.2.1 Yellowing stage

In the yellowing stage, it is mainly to realize the yellowing of tobacco leaves and the proper dehydration of tobacco leaves. In this stage, the degree of yellowing of tobacco leaves should be strictly controlled. If the humidity in the intensive baking room is too high, the baking room needs to be drained in time.

2.2.2 Color fixing stage

In the fixed color stage, it can ensure timely moisture drainage, so that the tobacco leaves gradually reach the drying of leaves, parts and veins, ensure that the yellow of tobacco leaves can be fixed, and prevent tobacco leaves from becoming brown.

2.2.3 Dry reinforcement stage

In the dry gluten stage, the main veins of all tobacco leaves should be fully dried, and the wet bulb temperature should be between 40 °C and 42 °C[4].

3. HARDWARE DESIGN

The hardware design part of the system mainly includes the hardware design of the main control module of the oven control instrument, the hardware design of the temperature and humidity acquisition module, and the design of the heating and dehumidification module.

3.1 Design of the Main Control Module of the Control System of the Baking House

The main functions of the main control module of the baking room control system include: circulating fan

function, LCD backlight function, battery electric display function, LCD display and key scanning function, blower start and stop control function, cold air inlet control module, circulating fan module, sound and light alarm module[5]. The design diagram of the main control circuit of the oven controller is shown in Figure 2.

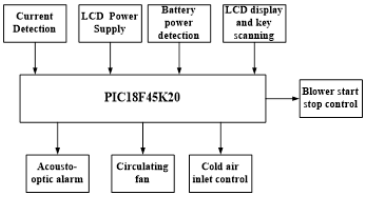

Figure 2 Design diagram of main control circuit of oven controller

3.2 Design of Temperature and Humidity Collection Circuit

DS18B20 chip is used for temperature and humidity acquisition module, and single bus structure is used for circuit design. Two groups of dry and wet balls are used to detect the temperature and humidity in intensive baking room. The circuit design diagram of temperature and humidity acquisition module is shown in Figure 3.

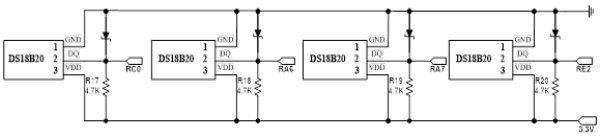

Figure 3 Circuit design of temperature and humidity acquisition module

3.3 Design of Heating and Dehumidification Module

The combustion fan is opened and closed by controlling the solid-state relay through the I / O interface of the controller. If the temperature collected by the sensor is higher than the expected temperature, the arm controls the solid-state relay to close the combustion fan. The working principle diagram of the blower is shown in Figure 4.

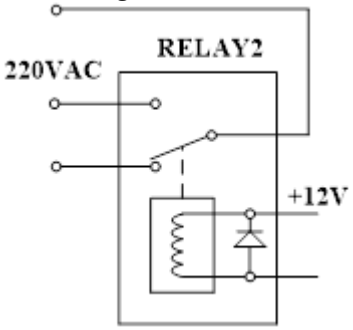

Figure 4 Working principle of blower

The cold air inlet is controlled by DC. The terminals at both ends of the DC motor are connected to the 2-hole connector. The I / O port control relay of the single-chip microcomputer supplies positive 12V power to the DC motor, so that the air door can be opened at a certain angle or fully opened for moisture removal[6]. When the humidity in the baking room is less than a certain value of the set target humidity, the I / O port control relay of the single-chip microcomputer supplies negative power to the DC motor12V power, damper closed. The schematic diagram of damper control is shown in Figure 5.

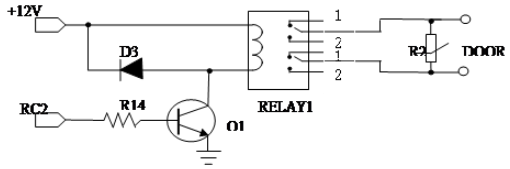

Figure 5 Schematic diagram of damper control

4. SOFTWARE DESIGN

4.1 Overall Structure of Software Design

The software design of tobacco curing control system based on arm includes initialization program design, interruption program design, control program design, and temperature and humidity sensor data collection design[7]. The overall structure of the software design is shown in Figure 6.

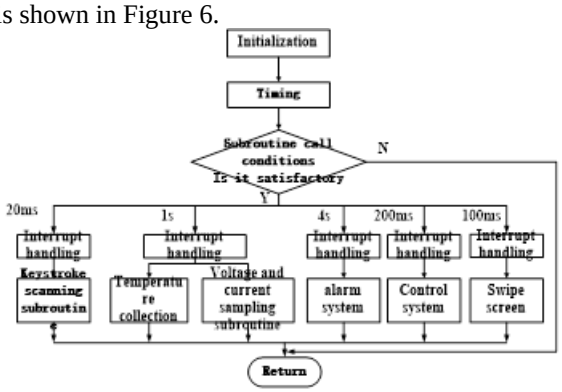

Figure 6 Overall structure of software design

4.2 Initialization Programming

The initialization program design includes global variables, I / O devices, interrupt programs, data buffer areas, temperature and humidity sensors, timers and other initialization designs. The initialization program design flow chart is shown in Figure 7.

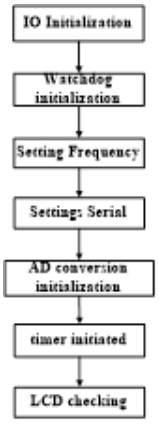

Figure 7 Flow chart of initialization program design

4.3 Interrupt Programming

The interrupt program is mainly used to control the execution sequence of each module. The time slice rotation control method is adopted. The interrupt program design flow chart is shown in Figure 8. The distribution table of interrupt program subroutines is shown in Table 1.

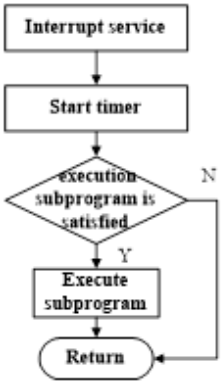

Figure 8 Interrupt program design flow chart

Table 1 Subprogram distribution table

Time slice	Subprogram function
25ms	1, timing (including key press and release for 40 ms); 2. the damper motor starts (25ms);
95ms	1, timing (3S); 2. exit history query timing (20s); 3, damper operation and control timing (200ms); 4, screen timing (95ms);
2s	1. read the temperature and humidity in the baking room; 2. detect the voltage and current of the system;
1min	1. store the data every other minute; 2. record the operation time of the system;

4.4 Control Module Programming

After entering the system control module, check the temperature and humidity value every second. According to the detected temperature and humidity value, control the system temperature and humidity by adjusting the cold air door and blower.

4.5 Data Acquisition Design of Temperature and Humidity Sensor

The temperature and humidity sensor in this design adopts DS18B20 chip with simple hardware structure. Due to the serial transmission mode, it is necessary to strictly ensure the reading and writing sequence of data in the design. The data transmission mode between the host and the temperature and humidity sensor is from low bit to high bit.

5. CONCLUSION

The tobacco baking control system of intensive curing house fully combines the actual situation of tobacco baking in our country. In the design process of the system, the practicability of the system is fully considered. Through the intelligent collection of temperature and humidity, it can realize the automatic control of circulation fan and blower, and meet the demand of tobacco automatic baking. The system is simple, easy to operate, intelligent and parametric customization and other advantages.

ACKNOWLEDGMENT

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Research on the CCTV's Front-End Location of Railway Station and Carriage

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Abstract: The front-end location of the CCTV plays an important role in video analysis of the whole video monitoring system, and there are not too many application researches on the railway infrastructure system in this field. In this paper, according to the building structure of railway station and carriage, the minimum number and maximum coverage models are used to analyze the camera location, and the effectiveness of the two models is verified.
Keywords: Front-end location; Railway station and carriage; CCTV

1. INTRODUCTION

Railway infrastructure system refers to the comprehensive system of facilities, equipment and their components that meet the most basic operation of the railway system. Each component of the system is concentrated in three physical spaces: station, train and line. Railway infrastructure system is an important part of the whole national economic operation system. Once it is damaged, its repair process often costs a lot of time and resources. Therefore, with the increase of social mobility, the new changes of public security situation and the influence of international political and economic pattern, the safety protection of railway infrastructure focuses on prevention. At the whole level of social security prevention, using video monitoring system to assist big data and artificial intelligence application has become the current mainstream technology prevention means. In the process of railway infrastructure protection, video monitoring system has already been used.

The most basic equipment in the video monitoring system is the front-end camera. The point layout scheme of the camera has a direct impact on the later data availability and effect. The research in this field at home and abroad is basically consistent in the initial thinking, that is, the camera is regarded as a special sensor, and the scientificity of camera layout is demonstrated from the perspective of sensor coverage and layout [1]. At present, there are few researches on the front-end camera layout of the video monitoring system in China, mostly from the perspective of sensor coverage model and camera layout density. For example, literature [2] studies the factors that affect the camera coverage model in the public security video network, and concludes that the height of the pole, lens focal length and imaging chip (target size) are the influencing factors. Factors are taken into account in the front-end ground cover model. There are few research results on the layout of video monitoring front-end of railway system in China. Usually, the research combines the characteristics of specific railway scenes and adopts the traditional coverage model for analysis. For example, literature [3] takes the video monitoring front-end of railway terminal station as the research object, and designs a new layout from the perspectives of protection area outline, passenger flow line and protection level requirements Release plan. In foreign countries, the layout of video surveillance front-end cameras started earlier, and the research results are more abundant. The earliest research started from the treatment of art gallery guard problem, which was proposed by Klee in 1974, and discussed how many cameras are needed to complete the monitoring of an art gallery with n walls [4]; later, more factors, such as photography, were gradually considered in the research of this problem The predefined performance standards and certain layout constraints of the camera, such as the clarity must meet the technical index requirements of human image recognition (FOV), the coverage impact caused by redundancy or obstacles caused by overlap must be considered in layout, and the cost investment should be considered when increasing the number of cameras, etc. such problems with objective functions and multiple constraints can be solved Over linear programming and optimization algorithm [5-8].

Due to the wide distribution of railway infrastructure, and the mutual influence of various components of the system, it is only considered from the perspective of the number of cameras, performance index requirements, cost, etc. The monitoring points in the infrastructure should be hierarchical, and the front-end coverage of different levels of points should be carried out in different degrees; the classification of each point should be evaluated according to the vulnerability of the infrastructure and the degree of the possibility of attracting attacks.

2. COVERAGE THEORY OF RAILWAY INFRASTRUCTURE

According to the literature 错误!未找到引用源。, from the perspective of coverage theory, the problem of camera layout can be divided into two situations: one is to minimize the total cost of the camera, and to cover all areas requiring fortification as far as possible; the other is to cover as wide as possible on the premise of a fixed number of cameras. For the

prevention work of railway infrastructure, due to the loose installation space, shooting space, power supply and other conditions on the station and the line, the distribution adaptability of the cameras is better, so it is more suitable to use the first case for coverage analysis; while in the compartment, due to the limited installation space, power supply and shooting space, the privacy protection of passengers should be considered at the same time This is suitable for the analysis of coverage characteristics in the second case. In addition, the risk level of the observed part should be considered in the coverage analysis, and the risk level coefficient should be taken as the parameter of the objective function.

In the horizontal coverage analysis, the camera parameters can be divided into coverage angle θ and coverage radius γ; the infrastructure area should be segmented according to a certain step size step, as shown in Figure 1.

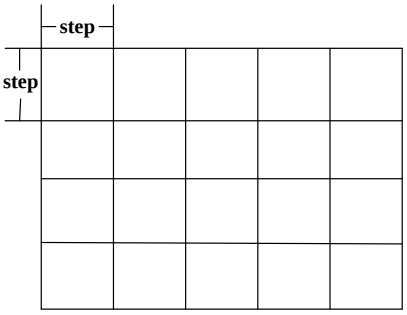

Figure 1 Infrastructure discretization

In the first case, the horizontal coverage model is shown in formulas (1) and (2):

$$num = Min \sum_{i \in PoC} CA_i \tag{1}$$

$$\sum_{i \in PoC, j \in P} CA_i gC_{ij} \geq 1 \tag{2}$$

After the infrastructure area is divided, the shape is divided into several points, each point is represented by a number of points with value j, and the set of these points is P

CA_i Indicates whether the camera is placed at point I. if the camera is placed, it is 1. Otherwise, it is 0.

PoC the set orientation of all cameras with camera installation conditions, which is related to the type of camera, $PoC = 360^o \div \theta gj$ 。

C_{ij} is the coverage state parameter, when camera i covers point j, it is 1, otherwise it is 0

Formula (2) is the objective function, which represents the minimum number of all cameras required. At the same time, the constraint of formula (2) must be met, that is, each camera must be able to cover at least one point.

The first layout is applicable to the camera distribution of station square, waiting hall, and each section of the line. In these places, the camera is required to cover all points to be covered with a minimum number of cameras.

In the second case, the horizontal coverage model is shown in formula (3)-(5):

$$area = \max \sum_{j \in P} p_j \tag{3}$$

$$\sum_{i \in PoC, j \in P} CA_i gC_{ij} \geq p_j \tag{4}$$

$$\sum_{i \in PoC} CA_i = num \tag{5}$$

Formula (3) is the objective function, which means to obtain the maximum number of coverage points, in which ifj point is covered by a camera, $p_j = 1$. Formula (4) and formula (5) are constraints. Formula (4) indicates that each point is covered by at least one camera. Formula (5) indicates that the number of cameras must be a given value ‘num’.

The second case is mainly applicable to the space in the car. The car is mainly for passengers with no difference in safety level. At the same time, the number of cameras installed is limited. At this time, a limited camera needs to be used to cover the passenger area in the whole car as much as possible.

3. EXPERIMENT

We test the two coverage models, and choose the waiting hall of high-speed railway station and cr400 high-speed railway carriage. The waiting hall is used to test the coverage model in the first case, and the carriage is used to test the coverage model in the second case. The core (TM) general-purpose computer with dual core 2.4G main frequency and 4GB ram is used to complete the test under win10 operating system.

The central area of the waiting hall is relatively open, which is the chair for passengers to rest. The East and west sides are the entrance, the north and south sides are the lifters. The key area for monitoring is the central area, and the camera installation position is the white point, which is located on the walls of the north and south sides, and the middle main passage, as shown in Figure 2,

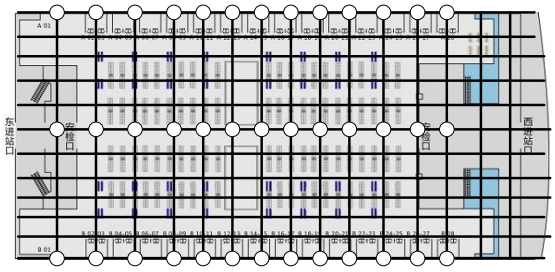

Figure 2 available camera positions and coverage points in railway station

196 points are used to discretize the central area, and two kinds of cameras are used for experiments. The first kind of camera has a variable angle of 90 degrees and an effective radius of 15 meters; the second kind of camera has a variable angle of 180 degrees and an effective radius of 15 meters. The

experimental results are shown in Table 1.

Table 1 Layout experiment of waiting hall

Camera Type	Number	Coverage points	Rate
$\theta = 90, r = 15$	9	196	100
$\theta = 180, r = 15$	7	196	100

From the experiment, it can be seen that when the first camera is used, nine cameras are needed to complete the coverage task of all points. If the camera with a large angle change of the pan tilt is used, the number of cameras needed can be reduced, but it can be observed that it does not change according to the ratio of multiple angles.

For high-speed rail carriage, due to the power supply limitation, only the two ends of the car and the roof have the installation conditions, and the installable positions are shown in the white spots in Figure 3.

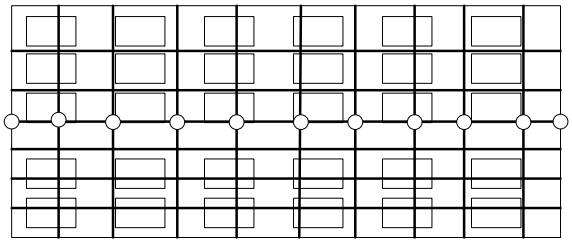

Figure 3 available camera positions and coverage points in carriage

After the discretization of the carriage, there are 40 points to be monitored. The camera adopts two types: 180 degree variable pan tilt and 360 variable pan tilt. The effective visual distance is 15m. The experimental results are shown in Table 2

Table 2 layout experiment of carriage

Camera Type	Specified Camera numbers	Specified location	Coverage points	rate
$\theta = 180, r = 15$	2	Left and right sides	40	100
	4	Two points in the middle	40	100
	6	Three points in the middle	40	100
$\theta = 360, r = 15$	1	The Middle point	32	80
	2	Two points in the middle	40	100
	4	Four points in the middle	40	100

It can be concluded from the experiment that no matter which kind of camera is used in the interior of the car, only two cameras are needed to complete the coverage of all points, and then adding cameras is a waste of resources.

4. CONCLUSION

According to the characteristics of high-speed railway infrastructure, this paper studies the layout of cameras in the waiting hall and the carriage. According to the characteristics of the infrastructure, it designs the coverage model of minimizing the number of coverage and maximizing the coverage of coverage points. Through the experimental verification, the coverage model can better analyze and evaluate the layout of cameras, and play a role of reasonable allocation of camera resources Effect.

ACKNOWLEDGMENT

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On the Enlightenment of Confucian Harmonious Thought to the Construction of Modern Harmonious Society

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Abstract: "harmony" is not only the characteristic of Confucian culture, but also the essence of Confucian culture. The construction of a harmonious socialist society is closely related to the "harmony" thought emphasized by Confucian culture. The "harmony" culture in Confucian culture includes harmony between man and nature, between man and man, between man and society, and between man's body and mind. At present, the social development of our country is in the period of transformation. It will be of great significance for us to construct a harmonious socialist society to rationalize and explore the harmonious thoughts of Confucianism and draw on the resources of the harmonious thoughts of Confucianism scientifically.
Key words: Confucianism; harmonious thought; harmonious society

Whether a kind of thought, theory or spirit can get people's favor and become popular, especially whether a traditional ideological heritage can serve the real society, realize its historical value beyond time and space, and play a positive role in promoting social progress depends on the objective needs of the times and society.

The construction of a socialist harmonious society is the mainstream consciousness of Chinese society today. It meets the objective requirements of the key period of China's reform and development, and embodies the fundamental interests and common aspirations of the masses. The connotation of a harmonious society is to build a democratic and legal system, fairness and justice, honesty and friendship, full of vitality, stability and order, and a harmonious society between man and nature. The theory of building a harmonious society is not accidental, it not only comes from the traditional Chinese harmonious thought, but also develops and innovates the traditional Chinese harmonious thought, especially the ancient Chinese Confucian harmonious thought. Ancient Chinese Confucians have rich harmonious thoughts. The pursuit of universal harmony is the essence of Confucian civilization and the main value goal of modern civilization. In today's construction of a socialist harmonious society, it is undoubtedly of great significance to comb and examine the harmonious thoughts in Confucian culture.

Confucianism is one of the core categories of Chinese classical philosophy, while harmony is the essence of Confucianism, and harmony is an important thought of Chinese traditional culture. Confucius said: "the use of propriety, harmony is precious." Mencius said, "time is not as good as land, and land is not as good as harmony." It can be seen that Confucianism attaches great importance to harmony. After thousands of years of continuous development, Confucian harmonious thought contains rich contents, involving all aspects of nature and human society.

1. HARMONY BETWEEN MAN AND NATURE

In the aspect of the relationship between man and nature, it advocates the idea of "the unity of man and nature". The thought of "the unity of man and nature" first considers that "man and nature are an organic and interactive unity of life", and that man and all things in the world are generated by the same Qi, are interdependent, have the same root, integrity and equality. Man and nature are one, so man cannot live without nature, and nature is the basis of human existence; on the other hand, nature loses its value and significance as nature. The so-called "neutralization, the position of heaven and earth, the cultivation of everything" and "the change of life" all emphasize the symbiosis, common prosperity and harmonious unity of man and nature. Man and nature are not only organically unified, but also all things born in nature are equal, that is, "all things are one, all things are one". Every life has its own existence value; secondly, Confucianism emphasizes that human beings should not only actively understand nature, but also care for nature and save ecological resources. The so-called views of "kindred and benevolent people, benevolent people and loving things", "people, my compatriots; things, I and you" are the love for all things born from "lover", which concentrates the spirit and emotion of benevolence on all things in nature. In terms of saving resources, "Xunzi believes that human survival depends on all kinds of material resources provided by nature, and only when we love material conservation, can we have enough food, use, material and other resources to support human beings, and maintain the long-term stability of society." These views are undoubtedly the ideological basis of Confucian ecological ethics; thirdly, Confucianism also emphasizes that nature has its inherent regularity, that is, "there is a constant nature, not for Yao, not for Jie.". This law is not

transferred by human will. Only on the premise of knowing and mastering the laws of nature and consciously following the laws of nature, can human make rational use of nature, transform nature and adapt it to the needs of human survival and development.

People always live in a certain ecological environment, and need to constantly communicate with nature in terms of materials, energy and information, and meet their own needs by transforming nature and using nature. It can be said that the natural environment is not only the necessary condition and premise for the survival and development of human society, but also the important material basis for building a harmonious society. However, over the years, the development of social economy is to some extent at the cost of resources and environment. Due to the unrestrained transition of human development of nature, the contradiction between human and nature is intensified, which leads to the deterioration of ecological environment, the shortage of water resources, the serious pollution of water quality, the acceleration of land desertification and the destruction of the sustainable development of human society. Therefore, in the face of many survival crises, we can only get out of the predicament by returning to nature. This requires a new understanding and understanding of the laws of nature, a new reflection on the relationship between man and nature, and the establishment of Confucian ecological ethics and the concept of coordinated development of "unity of man and nature" such as "knowing heaven and fearing life", "caring for people and things", "benefiting without paying", "not violating farming time". While maintaining the survival and development of human society, we must protect and improve the ecological environment, develop the circular economy with the concept of scientific development, constantly improve the utilization rate of resources, build a resource-saving and environment-friendly society, strive to achieve the "unity of man and nature" at a higher level of science and technology, and truly realize the coordinated development and harmonious coexistence of human social system and natural ecological system Place.[1]

2. HARMONIOUS INTERPERSONAL RELATIONSHIP

Confucian interpersonal relationship is maintained by five Lun and ten Yi. The so-called "five Lun" refers to the five most typical interpersonal relationships among couples, fathers and sons, brothers, monarchs and ministers, and friends. It advocates the virtues of mutual respect, filial piety, brotherhood and brotherhood, monarchy, righteousness and official conduct, and making friends and trusting, so as to get along harmoniously with each other and achieve social harmony and stability. The so-called ten righteousness refers to the benevolence of the monarch, the loyalty of the officials, the kindness of the father, the filial piety of the son, the brothers and friends, the courtesy of the younger brother, the righteousness of the husband, the obedience of the wife, the sincerity of the friends and the faithfulness of the friends. Although Wulun and Shiyi reflected the specific political relations at that time, they stipulated the basic moral standards that everyone should abide by to maintain good interpersonal relations from the perspective of human relations in terms of social life. It requires us to be lenient, to coordinate interpersonal relationships, to have more kindness and care, to have more honesty and trust, to have more comity and tolerance, to have more anti bowing and introspection, to do what we don't want to do to others, to be safe for the old, to believe in our friends, to have less of it, to stand up for ourselves, and to reach our goal, which is the basic state of Confucianists towards interpersonal harmony Degree.

As the basic element of social existence, human beings have a very close relationship with social development. Even all kinds of social contradictions are ultimately manifested through the relationship between human beings. Therefore, the core of a harmonious society lies in the harmony between people and the harmony of various social relations between people. Only by dealing with the relationship between good people and people, so that everyone can live in harmony, the whole society can be in a harmonious state. At present, with the increasing differentiation of all social strata and the diversification of economic interests, people's income and distribution show great differences, resulting in various social conflicts, abnormal tension between people, seriously affecting the normal life and work order. Therefore, the handling of the relationship between people becomes the key to building a harmonious society. In this respect, "Confucianism takes" benevolence "as its core, extends self-consciousness of morality and kinship with parents, brothers and sisters to fraternity with others, advocates" harmony is the most important thing ", advocates harmony, unity and cooperation among people, and also puts forward moral standards of benevolence, righteousness, etiquette, courtesy, leniency, faith, sensitivity, benefit, wisdom, courage, loyalty, forgiveness and filial piety to maintain interpersonal relations." It is of great practical significance for us to effectively coordinate the interests of all aspects in the process of building a socialist harmonious society today, properly handle the interests of different classes and different aspects of the masses, strive to form the interpersonal and social relations of equality between men and women, respect for the old and love the young, poverty alleviation and poverty relief, comity and tolerance, and truly realize a stable and United harmonious society.

3. PHYSICAL AND MENTAL HARMONY

Confucianism attaches great importance to the harmony between human body and spirit, that is, the harmony between human body and mind. It regards the harmony between human body and mind as the key and starting point of a harmonious society, and holds that "the harmony between human body and mind is the basic condition of a harmonious society. If human body and mind are not harmonious, there will be no good morality, no moral norms and codes of conduct that meet the requirements of the society." Confucian thought that "the task of music lies in harmony with the heart", and "harmony with the heart" refers to the harmony of human mind and spirit. Confucianism advocates the harmony of human body and mind. It often maintains a peaceful and tranquil mind and correctly deals with the relationship between ritual and desire. Confucianism affirms people's legitimate pursuit of material interests and their legitimate desires. Confucius once said, "wealth and dignity are what people want.". If you don't get it by its own way, you can't get it anywhere. "Confucius affirmed that wealth is everyone's desire, but we must use proper means to obtain it. He added: "I can ask for wealth, and I will do it even if I am a whip man. If you can't ask, do what I want. "If you think wealth is available, you are willing to work in low-level jobs. He also said: "drinking water, drinking water, bending your arms and resting on your pillow are also among them. Unjust and rich and expensive, to me like clouds. Confucius stressed: "a gentleman benefits without expense, is old without resentment, wants without greed, is peaceful without arrogance, is powerful without ferocity." Against indulgence, emphasizing that people's body and mind should always be in a state of neutralization. Today, China is in the period of social transformation, which has resulted in the diversified pattern of subject interests and value orientation, and different groups and strata formed by different interest subjects. There must be conflicts and opposites among these special interest subjects, and the consciousness of individual subject standard is prominent. How to coordinate the material value with the spiritual value and promote the all-round development of human body and mind, Confucian spirit can be our valuable reference.[2]

4. HARMONY BETWEEN PEOPLE AND SOCIETY

Confucianism advocates "harmony but not Sameness" and opposes "sameness but discord". This is consistent with the proposition that "harmonious society is a pluralistic society" that we put forward today. Harmonious society is not to enter the realm of no difference. The premise of building a harmonious society is that China has gone from single to multiple. If there is no diversity and diversity, there is no need to talk about harmony. Therefore, the purpose of building a harmonious society is to achieve a higher level of diversity and diversity.

The early record of "harmony but difference" can be found in the book "national language · Zheng language". According to Shi Bo, the historian of the Western Zhou Dynasty, "the same husband and the real creature do not continue. In this way, Shi Bo distinguishes the different functions of "he" and "Tong" in the formation and development of things. Yan Ying, a famous statesman in the late spring and Autumn period and the Warring States period, inherited the thought of Shi Bo. In response to the question of "harmony and similarity are different", Yan Ying said, "differences are like soup." "Five flavors of soup preparation", that is to say, in order to cook a delicious soup, it is necessary to have a variety of raw materials; musicians need to integrate different musical elements, cooperate with different characteristics of musical instruments, in order to create a wonderful music. "Sound is also like taste. One breath, two bodies, three categories, four things, five sounds, six rhythms, seven sounds, eight winds and nine songs are formed by each other. This thought was later absorbed by Confucianists, and put forward a famous conclusion in the book "the Analects of Confucius" that "gentlemen are harmonious but different, while villains are the same but not the same". The Confucian thought of "harmony but difference" fully respects creativity and difference. Confucianism believes that only when we are good at dealing with all kinds of complicated contradictions, learn from different opinions widely, absorb all kinds of advantages, can we finally achieve the ideal state: harmony. One voice is not beautiful, one color is not colorful, one taste is not delicious, one thing is not comparable. Only by admitting the difference can we achieve "mutual success" and "succession". This thought treasure of Confucianism is of great significance for us to build a harmonious society today. Harmonious society is not a society without difference and contradiction. The harmony in Confucianism is not only the harmony in diversification, but also the harmony in differentiation. In different stages of socialist development, the nature and forms of social conflicts are different, so the problems faced by building a harmonious society, the degree of social harmony, its forms of expression, and the ways and means to achieve a harmonious society are different. Therefore, a harmonious society should not be concrete. It is impossible to have an abstract and suitable model of a harmonious society and the means and methods of building a harmonious society. Therefore, we should respect Confucius' idea of "harmony but difference", respect creativity and difference, and create a harmonious society with Chinese characteristics. It really makes "harmony but not uniform, different but conflicting with each other; harmony grows with symbiosis and complements each other with difference."

In ancient Chinese society, Confucian harmonious thought has always played an important role. It is a

great treasure house of thought, which will constantly provide human with wisdom of life. Confucian harmonious thought belongs to both China and the world. In the thousands of years of historical evolution, Confucianism has had a significant impact on the psychology, customs, values, systems and many other aspects of the Chinese nation, and it is still the precious cultural heritage of our nation. The Confucian concept of harmony has played a positive role in the survival and development of our nation, shaped the spiritual character of Chinese culture, and has universal value. At present, China's reform and development is in a critical period. In order to seize and make good use of the important strategic opportunity period and realize the grand goal of building a moderately prosperous society in an all-round way, we must correctly deal with these contradictions and problems, spend more efforts to properly coordinate the interests of all aspects, correctly deal with various social contradictions, and take social harmony as an essential value orientation. We emphasize that we should take a scientific attitude and use scientific methods to strengthen the excavation, collation and research of Confucian culture, closely combine the research of Confucianism with the construction of advanced socialist culture, and serve the society. In the period of reform and development and social transformation in China, it is of great enlightenment and far-reaching practical significance to fully explore, absorb and apply the harmonious thought of Confucianism for the construction of a harmonious socialist society.

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Sentiment Analysis of Weibo Text Based on Emotional Fusion and Multidimensional Self-Attention Mechanism

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Abstract: Integrating word vectors into emotional information and effectively extracting the network structure of text features is the key to improving the accuracy of sentiment analysis, The traditional word vector does not make full use of the emotional features of the emoticons in Weibo, and the models for extracting features are usually based on convolutional neural networks (CNN) and cyclic neural networks (RNN), which are difficult to overcome locality and cannot be parallelized, This paper proposes a microblog text sentiment analysis model E-DiSAN based on emotion fusion and multi-dimensional self-attention mechanism, The model combines the semantic synthesis vector of emoji as the input layer of the network, and extracts the high-level text feature training classifier by using the multi-dimensional self-attention network of fusion location information, which realizes the establishment of the dependence relationship between words in the text and the multi-angle emotional semantic information, The acquisition, and the effectiveness of the model is proved by comparative experiments.
Keywords: Word Vector; Emotion Fusion; Multidimensional Self-Attention; Text Sentiment Analysis; Deep Learning

1. INTRODUCTION

Weibo is popular among the majority of netizens because of its short and rich content, strong timeliness and wide range of communication. It has gradually become a way for people to express their opinions and vent their emotions. The main purpose of sentiment analysis of Weibo text is to mine the opinions and attitudes of users on product, news, hot events and other commentary information from Weibo text. It is also the analysis and attention of users' thought activities and emotions. And sensational monitoring and other fields have important significance [1].

With the significant progress in deep learning in the field of image and speech recognition, more and more researchers have applied deep learning to emotional analysis tasks. In recent years, because the attention mechanism uses the hidden layer to calculate the class distribution of elements in the input sequence to reflect its importance weight, it has gradually become one of the most important core methods in deep learning. Recurrent Neural Network, RNN) and Convolutional Neural Networks (Convolutional Neural Network, CNN) A model combined with attention mechanisms The type can get better results in natural language processing. However, since RNN is difficult to parallelize for sequential calculations, CNN is limited by the word distance in the sequence and it is difficult to process variable length sequences, so the model combined with the attention mechanism still faces the same problems as RNN and CNN. Therefore, Google's Vaswani et al. It is proposed to use only the attention mechanism to construct the sequence to sequence (seq2seq) model, and apply the model to machine translation to refresh the highest accuracy. The attention mechanism is more flexible in sequence length than RNN and CNN, solving the problem of sequential calculation and locality. Later, some researchers proposed a kind of DiSAN (Directive Self-Attention Network for RNN/CNN-FreeLanguage Understanding) model, which does not use any RNN and CNN structures, but uses self-attention mechanisms and directional information to generate sentence feature codes, semantic similarities and sentences. Good results have been obtained on data sets such as classification [2].

2. E-DISAN MODEL

2.1. Constructing an Emotional Semantic Matrix

In order to make the original semantic representation matrix of Weibo text contain rich emotional information, this paper makes full use of the features of emoji to construct emotional semantic matrix. Using word2vec training, the word vector with the dimension d corresponding to the emoji and the participle is obtained, and the emoji word vector is taken out and spliced to form the emotional space matrix $E = [\alpha 1, \alpha 2, ..., \alpha m]d \times m$, m is the emoji The number. The word vector corresponding to each participle in any microblog sentence is taken out and spliced to form the original semantic representation matrix of the microblog text $M = [\beta 1, \beta 2, ..., \beta n]d \times n$, n is the participle of the microblog sentence number. The Emotional Semantic Feature Representation Matrix $EM \in Rn \times m$ can be constructed by using the matrix E and the matrix M. The construction method is to calculate the similarity value between the emoji and each participle in the Weibo sentence by using the (5) similarity function [3].

2.2. Multidimensional Self-Attention Calculation

Incorporating Location Information

Chinese words usually have the characteristics of polysemy. The word vector learned through a large number of texts contains the semantic features of the words in different contexts. In order to obtain more and more effective features of each participle in Weibo sentence, this paper adopts the multi-dimensional self-attention mechanism performs attention calculation for each dimension of each word segmentation vector. The specific method is to replace the query vector q of f(xi,q) in the addition model with the segmentation vector in the microblog statement. And replace the parameter vector v with the parameter matrix V.

3. EXPERIMENT AND ANALYSIS

3.1. Test Subject

The experimental data set consists of two parts: Part of the 400,000 microblog texts containing emoji for the unsupervised training word vector, which is de-duplicated and filtered from 10 million Weibo texts. The other part is a microblog text containing positive and negative emotion labels for supervised training sentiment analysis models. At present, there is not enough public data sets for Chinese microblogs to train samples, so this article randomly extracts and performs emotional annotation in the above 10 million microblog texts, and finally gets 20,000 microblog text data sets, of which There are 10,000 microblogs with negative sentiment, and the average length of microblog text in this data set is 38. 5 words with a vocabulary of 560,000 words. The division ratio of the training set and the test set is 8:2.

3.2. Test Subject

The model of this paper is tested on the microblog dataset with the following four models. Except for the fourth method, the input layers of other methods are word vectors of fused emoticons.

CNN. Adopt the most basic CNN model in the literature.

Long Short-Term Memory (LSTM). Use the LSTM model in the literature.

CNN and LSTM combined network (C-LSTM). Use the C-LSTM model in the literature.

DiSAN. Using the model in the literature, the semantic word vector is used as input. The accuracy of the model and the comparison of the four models are shown in the figure.

4. CONCLUSIONS

This paper presents a deep learning model for sentiment analysis tasks. E-DiSAN combines the semantic synthesis vector of emoji as the input layer of the network and uses the directional multi-dimensional attention mechanism to obtain the words in the text. The interdependence and multi-angle information effectively extract the high-level features of the text. The effectiveness of the model in the Chinese microblog sentiment analysis task is proved by experiments. It also proves that the self-attention mechanism is not only in the machine translation task. It is able to achieve better results than other models and is also superior in sentiment analysis tasks. The next step is to conduct a sentiment analysis on a topic for a period of time, so as to grasp the development trend of the key events.

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Influencing Factors and Countermeasures of Rebound Method for Testing Concrete Strength

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Abstract: Concrete is a kind of building material widely used in modern construction engineering, Therefore, the compressive strength of concrete is related to the safety quality of engineering, The rebound method is a non-destructive testing method for testing the compressive strength of concrete, Due to its low cost, The operation is simple and fast, so it is widely recognized by engineering inspectors, Based on the analysis of the experimental data of the rebound method, there are still many problems in this method, which leads to the low accuracy, This paper starts with the principle and steps of the rebound method, and analyzes the factors affecting the compressive strength of concrete through the rebound method, Corresponding countermeasures are proposed for this problem to improve the detection process
Keywords: Rebound Method, Concrete Strength, Accuracy, Countermeasure

1. INTRODUCTION

The rebound method is a non-destructive testing method for the concrete compressive strength test. This method does not cause concrete damage, can ensure the integrity of the concrete and repair the damaged concrete structure in time. This method is economical, simple and accurate, and is better than many others. But in the actual experimental operation, there are still many problems in the method. External factors of the environment, such as the concentration of CO2, ambient temperature, curing environment, etc.; human factors during measurement, the measurement angle is unreasonable, the operation is not standardized; the concrete production process is improper. The surface is not flat, the water-cement ratio is unreasonable, the amount and type of cement are improper. The error of the instrument itself is not strictly tested before the test, the calculation method of the data has error, the rebound value is not corrected. The measurement area and improper selection of test surface, resulting in inaccurate experimental data [1]. How to make the accuracy more accurate, is a concern of construction engineers. This article will be from the management of Remove 3 maximum values and 3 minimum values for each measurement area and find the average of the remaining 10 rebound values as equation (1).

$$R_{m\alpha} = \frac{\sum_{i=1}^{10} R_{mi}}{10} \quad (1)$$

experimental personnel, concrete sample testing, core drilling method, rebound correction, etc. In terms of their own thinking, propose ways and suggestions for improvement [2].

2. HOW THE REBOUND METHOD WORKS

The rebound method adopts the principle of energy conversion. Through the stretching of the spring, the hook is detached, and the elastic potential energy is converted into the kinetic energy of the hammer. The impact hammer hits the impactor rod contacting the concrete surface, and the hammer is rebounded. The rebound value is reflected as the hardness of the concrete surface. The greater the hardness, the larger the rebound value, and combined with the carbonization depth, the compressive strength of the concrete surface is obtained. The rebounding measuring instrument is a rebounding hammer, and the rebounding hammer is mainly composed of a spring, a hook, a hammering rod and a hammer.

3. DETECTION METHOD OF REBOUND METHOD

Extending the impact rod to make contact with the concrete surface to ensure that the hammer hits the hook.

Push the rebound hammer to the concrete surface and the spring begins to stretch.

When the spring is stretched to the limit, the hook is released, and under the action of the spring, the hammer is unhooked and hits the impact bar.

The hammer hits the impact bar and is rebounded to record the rebound distance of the pointer slider rebounded by the hammer.

According to the concrete surface and the angle of the rebound hammer and the surface, the rebound value is corrected, and the carbonization depth is combined to convert the compressive strength of the concrete surface.

4. TEST DATA ANALYSIS

Such as table 1 show, the data is a rebound value obtained by measuring the non-pumped concrete by the rebound method. A total of three measurement zones are measured, and each measurement zone has 16 measurement points, and the known carbonization depth is 3 mm.

Substitution formula can obtain uncorrected rebound value: measurement area 1, Rma1 = 22.8; measurement area 2, Rma2 = 21.6; measurement area 3, Rma3 = 22.3.

Table 1 Test data

Rebound value																
Testing zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	22.4	16.8	21.8	20	20	22.6	22.2	24	28	21.6	31	26	26	20	26	21.2
2	22.4	22.6	16	21	22	24	20	18	26.2	24	24.2	22	28	18	20	16.4
3	18	20	21	20	22	25.8	18.4	24	21.6	18.6	28	24.6	30	22	26	22

Since the angle of the rebound is different, the rebound value needs to be corrected. The data is measured at -90 degrees, according to Table 2, correct the rebound value.

Table 2 90 Degree Angle Correction Table (Partial)

Rebound value	Correction value
20	4.0
21	4.0
22	3.9
23	3.9

Correction formula: Rm=Rmα+Raα

Measurement area 1: Rm1=22.8+3.9=26.7

Measuring area 2: Rm2=21.6+3.94=25.54

Measuring area 3: Rm3=22.3+3.9=26.2

According to the non-pumping test area concrete strength conversion table, such as figure 2, calculate the intensity conversion value of each measurement area

Table 3 Non-pumping survey area concrete strength conversion table

Average rebound value R_m	Conversion value of concrete strength in survey area f_{cu}^c (MPa)												
	Average carbonation depth value d_m (mm)												
	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	⩾6
25	16.2	15.9	15.4	14.9	14.3	13.8	13.3	12.8	12.5	12	11.7	11.3	10.9
25.1	16.3	16	15.5	15	14.4	13.9	13.4	12.9	12.6	12.1	11.8	11.4	11
25.2	16.4	16.1	15.6	15.1	14.4	13.9	13.4	13	12.6	12.1	11.9	11.5	11
25.3	16.6	16.3	15.8	15.3	14.6	14.1	13.6	13.1	12.8	12.3	12	11.6	11.1
25.4	16.7	16.4	15.9	15.4	14.7	14.2	13.7	13.2	12.9	12.4	12.1	11.7	11.2
25.5	16.8	16.5	16	15.6	14.8	14.3	13.8	13.3	13	12.5	12.2	11.8	11.3
25.6	16.9	16.6	16.1	15.7	14.9	14.4	13.9	13.4	13	12.5	12.3	11.8	11.3
25.7	17.1	16.8	16.2	15.8	15	14.5	14	13.5	13.1	12.6	12.4	11.9	11.4
25.8	17.2	16.9	16.3	15.8	15.1	14.6	14.1	13.6	13.2	12.7	12.5	12	11.5
25.9	17.4	17	16.5	16	15.3	14.8	14.3	13.7	13.4	12.9	12.6	12.1	11.6
26	17.5	17.1	16.6	16.1	15.4	14.9	14.4	13.8	13.5	13	12.7	12.2	11.6
26.1	17.7	17.2	16.8	16.3	15.6	15	14.5	13.9	13.6	13.1	12.8	12.3	11.7
26.2	17.8	17.4	16.9	16.4	15.7	15.1	14.6	14	13.7	13.2	12.9	12.4	11.8
26.3	17.9	17.5	17	16.5	15.8	15.2	14.7	14.1	13.8	13.3	13	12.5	11.9
26.4	18	17.6	17.1	16.6	15.8	15.3	14.8	14.2	13.9	13.4	13.1	12.6	12
26.5	18.2	17.8	17.3	16.7	16	15.5	14.9	14.3	14	13.5	13.2	12.7	12.1
26.6	18.3	17.9	17.4	16.8	16.1	15.6	15	14.4	14.1	13.6	13.3	12.8	12.1
26.7	18.5	18.1	17.5	17	16.3	15.7	15.2	14.5	14.2	13.7	13.4	12.9	12.2
26.8	18.6	18.2	17.7	17.1	16.4	15.8	15.3	14.6	14.3	13.8	13.5	12.9	12.3
26.9	18.8	18.4	17.9	17.3	16.5	16	15.4	14.7	14.5	13.9	13.6	13	12.4

From table 3, can obtain the concrete strength as follows,

$$f_{cu-1}^{c}=15.2MPa,\ \ f_{cu-2}^{c}=13.84MPa,$$

$$f_{cu-3}^{c}=14.6MPa$$

The average concrete strength of the survey area can be calculated according to the concrete strength conversion value of each survey area. When the number of measurement areas is 10 or more, the standard deviation of the strength should be calculated. The average value and standard deviation should be calculated as equation (2) and (3).

$$m_{f_{cu}^{c}}=\frac{\sum_{i=1}^{n}f_{cu-i}^{c}}{n} \qquad (2)$$

$$S_{f_{cu}^c} = \sqrt{\frac{\sum_{i=1}^{n}(f_{cu-i}^c)^2 - n(m_{f_{cu}^c})^2}{n-1}} \quad (3)$$

In the formula, $m_{f_{cu}^c}$ is the average value of the concrete strength conversion value of the structure or component survey area. *n* is a single detected component, take the number of zones of one component; for the component of batch inspection, take the sum of the zones of the sampled component. f_{cu}^c is conversion value of concrete strength in the survey area. $S_{f_{cu}^c}$ is the standard deviation of the concrete strength conversion value of the structure or component survey area.

When the number of measurement areas is 10 or less, the minimum value of each measurement area is taken. Since the number of measurement areas in this test is 3, the minimum value is $f_{cu}^c = 13.84MPa$.

From the experimental data and working principle analysis of the rebound method, it is extremely limited to use the rebound distance to calculate the strength of the concrete. The rebound hammer can only act at a certain point on the concrete surface, so the comprehensive performance of the concrete surface near the impact point It has a great influence on the rebound value [3]. If the hit point is just hitting a harder aggregate, the rebound value will be very large. Similarly, if it is just hitting a lower hardness, the bomb value will be smaller.

If there is a carbonized layer on the concrete surface, it has a large density and high hardness, so the rebound value is also large. The rebound value of the dry concrete surface will be greater than the rebound value of the wet concrete surface. The texture of the concrete surface is also It will lead to inaccurate experimental data. If the surface is rough, there may be small cracking and fragmentation on the surface during the bombing process, and the rebound value will become smaller, resulting in the measured strength being different from the actual strength [4]. The difference in angle affects the absorption of kinetic energy by concrete, which results in different rebound values. Therefore, the same concrete structure, the intensity measured by normal incidence and oblique incidence is different. At the moment of impact, the structure will vibrate and stability will be being destroyed, this will affect the absorption of kinetic energy to a certain extent, thus affecting the rebound distance and affecting the measurement results.

5. INFLUENCING FACTORS OF REBOUND METHOD

5.1. Human uncertainty

At present, most of the rebound method detection relies on labor, and the manual itself is an uncertain factor. The inspectors will have irregular operation, freely choose the data, and the understanding of the specification is incorrect, resulting in inaccurate rebound value [5].

5.2. Instrument error factors

The rebound hammer is composed of a hammer, a hammer, a spring, etc. The technical performance of these components will affect the rebound value. The instrument is subjected to strict inspection at the factory, and in the long-term use, due to dust and impurities. Contamination usually causes the performance of the instrument to deviate from the standard state and affect the rebound value.

5.3. Concrete factors to be measured

The surface of the concrete often has floating pulp and coating, which will cause the surface to be uneven, affecting the rebound value, and smoothing the surface, otherwise the experimental results will be small. On the basis of leveling and cleaning, the moisture content of the concrete is also Will affect its rebound value, when the concrete moisture content is higher, its hardness will be reduced, the rebound value is too small. Therefore, the concrete in the humid environment should be dried, and then the rebound measurement [6]. In addition, the mortar content of concrete is also an important factor. It is well known that concrete consists of stone and mortar. The elasticity of the stone is much larger than that of the mortar, and the strength affects the plastic deformation of the mortar. In modern engineering buildings, pumping concrete is currently used in large quantities. This kind of concrete is made up of pebbles, large sand rate and high cement. The rebound value is generally low when measuring [7]. When pouring concrete, the concrete tends to stratify and isolate, and the upper stones are less. Misunderstanding of the intensity is low.

5.4. External environment and conservation factors

For concrete members, due to the combined effects of hydration and the external environment, the degree of maintenance, the surface strength and internal strength of concrete vary greatly. Under normal conditions, the surface concrete is greatly affected by the curing conditions. It is protected by damp heat, the surface concrete is hard and the rebound value is too large. If the components are unintentionally exposed to water after pouring, the maintenance is not comprehensive and the surface cement is not hydrated. The concrete strength is reduced and the rebound value is small.

Concrete carbonization refers to the reaction of calcium hydroxide formed by hydration of cement with carbon dioxide in the air to form calcium carbonate with higher strength, which makes the surface hardness of concrete become larger and the rebound value becomes larger. Therefore, when calculating the compressive strength of concrete. The effect of carbonation depth on strength must be accurately considered and measured [8].

6. COUNTERMEASURES TO IMPROVE THE

DETECTION ACCURACY OF REBOUND METHOD

According to the influencing factors of the rebound method mentioned above, it is not difficult to find that there are many problems in the rebound method. In all aspects, it affects the accuracy in the engineering measurement process. It is necessary to pay attention to these problems, pay attention to the angle and the correction of the concrete detection surface. It combines with ultrasonic testing, core drilling method, etc., adopts necessary personnel management measures, and strictly controls the quality of concrete samples to improve its detection accuracy.

6.1 Improve the personnel management system

In order to avoid artificial instability, it is necessary to strengthen the project management system, constrain the daily behavior and work attitude of the staff, and cultivate artificial self-management awareness [9]. The perfect system includes: work standards, work content, job responsibilities, and reward and punishment system. The supervisory system should pass the professional training recognized by the construction department and obtain the professional certificate. It is recommended to form a rebounding professional discussion group. When the professional deficiencies are found in the project, the team should discuss and propose to improve the problem. At the same time, the countermeasures and the rebound hammer must also have dedicated personnel to test in order to validate the verification period.

6.2. Control of concrete sample to be tested

In order to ensure the reliability of the rebound method to measure concrete strength results, the selected concrete members must be representative, and the components must be carefully selected to make them look intact. However, this is often overlooked during the inspection process. Concrete components with surface defects are used for testing. The internal and external properties of the sample vary greatly, directly affecting the final result of the test.

When measuring the carbonation depth of concrete, it cannot be estimated by the sense. It should be accurate and reliable according to the specifications. For the carbonization depth of individual components, the average value should be taken to calculate the carbonization depth. For concrete members with short age or wet surface, the surface concrete strength is low and the rebound value is too small. The surface should be dried before testing [10].

6.3. Using the core method combined with the rebound method for detection

When testing concrete for pumping concrete, it is necessary to consider the influence of mortar content. The core method is the same as the rebound method. It is the two methods commonly used in engineering. The rebound method is nondestructive testing, and the core method has certain Destructive, often taking concrete sampling, therefore, two methods are used in the project [11]. Since the plywood formwork in the project will produce tiny pores on the concrete surface, sampling directly through the core method will reduce the rebound method. The detection result, so the inner and outer strengths can be detected when the core method is sample, and the two methods can be unified.

6.4. Correction of concrete rebound value

Due to the large fluidity of the pumped concrete, the aggregate particle size is small, the concrete mortar is thick, the hardness of the concrete surface is reduced, and the test results are not accurate. In order to improve this problem, when using the rebound method to test the concrete strength, first it is necessary to understand the concrete pouring method used by the construction unit. Secondly, if the rebounder is found to be in a non-horizontal direction or the test surface is a non-concrete side during the test, it is necessary to correct the rebound value of the concrete in this state, and then according to the angle. To correct the rebound value and correct the rebound value of different casting surfaces, it must be ensured that the order of the two corrections cannot be reversed, otherwise it will adversely affect the subsequent strength calculation, which will affect the identification of the final result [12].

7. CONCLUSION

The engineering quality of concrete is an important part of construction engineering. The rebound method is one of the commonly used methods for testing the compressive strength of concrete. In order to improve the accuracy of its detection, the inspectors should fully consider the influencing factors and propose corresponding solutions. Correct the result according to specifications to ensure the reliability and accuracy of test results.

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Li-Yorke Chaotic Operators on FrÉChet Spaces

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Abstract: In this paper, Li-Yorke chaotic operators on Fréchet spaces are researched, Firstly, irregular vectors are characterized and Li-Yorke chaos in terms of the existence of irregular vectors are studied, Then, the relationship between hypercyclicity and Li-Yorke chaos about continuous linear operators on a Fréchet space is given, Latstly, Li-Yorke chaos is equivalences for and, here is a ontinuous linear operators on a Fréchet space and is a positive integer.

Keywords: Li-Yorke Chaos, FrÉChet Spaces, Irregular Vectors, Hypercyclic Operators

1. INTRODUCTION

Probably the notion of chaos in relation to a dynamical system defined by a continuous map was first used by Li and Yorke [1]. Since then the research on chaos has had a great influence on modern science including natural science and many humanities. Furthermore, many rigorous definitions of chaos have been proposed [2-4]. Each of these definitions try to describe some kind of unpredictability in the evolution of the system. The theories and applications of chaos have been extensively developed [5-9]. In the present work we shall concentrate on Li-Yorke chaos and some of its variants.

Let (X,d) be a metric space. A continuous map $f:X\to X$ is called Li-Yorke chaotic if there exists an uncountable subset $\Gamma\subset X$ such that for every pair $x,y\in\Gamma$ of distinct points, we have $\liminf_{n\to\infty} d(f^n(x),f^n(y))=0$ and $\limsup_{n\to\infty} d(f^n(x),f^n(y))>0$. In this case, Γ is a scrambled set and $\{x,y\}\subset\Gamma$ a Li-Yorke pair. We say that f is densely Li-Yorke chaotic if the set Γ may be chosen to be dense in X.

We also recall that, an operator T is hypercyclic if there exists $x\in X$ such that the orbit $Orb(T,x)=\{T^n x:n=0,1,2,\cdots\}$ is dense in X. In such a case, x is called a hypercyclic vector for T. The set of hypercyclic vectors for T is denoted by $HC(T)$. T is called topolog ically transitive if for any pair U,V of nonempty open subsets of X, there exists some $n\geq 0$ such that $T^n(U)\cap V\neq\varnothing$. During the last decade hypercyclicity and topological transitivity have been thoroughly investigeted by several authors [10-16]. The two definitions are independent in general. Nevertheless, under some additional assumptions, the two definitions are equivalent. In fact, we have the following Birkhoff transitivity theorem [17]. Let T be a continuous map on a separable complete metric space X without isolated points. Then T is hypercyclic if and only if it is topolog ically transitive. In that case, the set $HC(T)$ of hypercyclic vectors is a dense G_δ-set.

The following concept was introduced by Beauzamy [18] from operator theory. Let X be a Banach space, $T:X\to X$ is a bounded operator, a vector $x\in X$ is said to be irregular for T if $\liminf_{n\to\infty}\|T^n x\|=0$ and $\limsup_{n\to\infty}\|T^n x\|=\infty$. Although the origin of this concept was completely independent of Li-Yorke chaos, surprisingly enough both concepts turn out to be equivalent for T.

The purpose of this paper is to study the above defined notions for continuous linear operators on Fré chet space. That is, a vector space X endowed with an increasing sequence $(\|\cdot\|_k)_{k\in N}$ of seminorms that defines a metric

$$d(x,y):=\sum_{k=1}^{\infty}\frac{1}{2^k}\frac{\|x-y\|_k}{1+\|x-y\|_k}\quad(x,y\in X)$$

under which X is complete.

In 2011, Bermúdez, Bonilla, Maíınez-Giménez and Peris gave some equivalent conditions for Li-Yorke chaotic operators and obtained a few sufficient criteria for Li-Yorke chaotic operators in Banach space [19]. In 2013, Bernardes Jr, Bonilla, Müller and Peris characterized distributional chaos for linear operators on Fréchet spaces in terms of a computable condition, and also as the existence of distributionally irregular vectors [20]. In this paper, we get the results about Li-Yorke chaotic operators on Fréchet spaces. We get that if T is hypercyclic, then for every $x\in HC(T)$, x is an irregular vector for T. So T is a Li-Yorke chaos. We also give some classes of operators that are Li-Yorke chaotic.

Throughout this paper, unless otherwise specified,

X will denote an arbitrary infinite-dimensional separable Fréchet space. Moreover, $B(X)$ will denote the set of all continuous linear operators $T: X \to X$. The set of all natural numbers is denoted by N.

2. Main Results

Definition 1 Let $T \in B(X)$. A vector $x \in X$ is said to be irregular for T if there are $m \in N$ and increasing sequences $(n_k)_k$ and $(j_k)_k$ of positive integers such that $\lim_{k\to\infty} T^{n_k} x = 0$ and $\lim_{k\to\infty} \left\| T^{j_k} x \right\|_m = \infty$.

The above concept is generalization to Fréchet spaces of the one introduced by Beauzamy for Banach spaces.

Definition 2 Let $T \in B(X)$ and $x \in X$. The orbit of x is said to be near to 0 if there exists an increasing sequence $(n_k)_k$ of positive integers such that $\lim_{k\to\infty} T^{n_k} x = 0$. We say that x has an unbounded orbit if there exist $m \in N$ and an increasing sequence $(j_k)_k$ of positive integers such that $\lim_{k\to\infty} \left\| T^{j_k} x \right\|_m = \infty$. Whenever we need to emphasize the number m in question, we say that x has a m-unbounded orbit.

With these definitions we have that a vector $x \in X$ is irregular if and only if its orbit is both unbounded and near to 0.

Proposition 1 Let $T \in B(X)$ and $m \in N$. Then the following assertions are equivalent:

(1)there exist $\varepsilon > 0$, a sequence (y_k) in X such that $\lim_{k\to\infty} y_k = 0$ and for every $k \in N$, there exists an increasing sequence (n_j^k) of positive integers such that $\left\| T^{n_j^k} y_k \right\|_m > \varepsilon$ for all $j \geq p_k$, p_k is some integer;

(2)there exists $y \in X$ with m-unbounded orbit;

(3)the set of all $y \in X$ with m-unbounded orbit is residual in X.

Proof. (3) $\Rightarrow$ (2):Trival.

(2) $\Rightarrow$ (1): Let $y \in X$ be a vector with m-unbounded orbit. By definition, there exists $(n_j) \subset N$ such that $\lim_{j\to\infty} \left\| T^{n_j} y \right\|_m = \infty$ Set $y_k := k^{-1} y$. Then $\lim_{k\to\infty} y_k = 0$. For each $k \in N$, let $(n_j^k) = (n_j)$. Choose $\varepsilon > 0$ arbitrary. For each $k \in N$, there exists $p_k \in N$, such that $\left\| T^{n_j^k} y_k \right\|_m > \varepsilon$ for all $j \geq p_k$.

(1)$\Rightarrow$ (3): For each $k \in N$, let $M_k := \{x \in X : \exists n \in N \text{ with } \left\| T^n x \right\|_m > k\}$, then M_k is open. We show that M_k is dense. Let $x \in X$, $\delta > 0$ and $m_1 \in N$. By (1), there exists $u \in \{y_1, y_2, \cdots\}$ and $p \in N$ such that $\|u\|_{m_1} < C := \frac{\delta\varepsilon}{2k^2}$ and $\left\| T^{n_j} u \right\|_m > \varepsilon$ for all $j \geq p$. Consider the vectors $u_s = x + \frac{s\delta}{kC} u \ (s = 0,1,2,\cdots,k-1)$, we have $\|u_s - x\|_{m_1} < \delta$ for all s. For all $j \geq p$ and for all $s,t \in \{0,1,2,\cdots,k-1\}$, if $s \neq t$, then $\left\| T^{n_j} u_s - T^{n_j} u_t \right\|_m = \frac{|s-t| \left\| T^{n_j} u \right\|_m}{kC} > 2k.$ We have that $\left\| T^{n_j} u_s \right\| > k$ or $\left\| T^{n_j} u_t \right\| > k$. So $u_s \in M_k$ or $u_t \in M_k$, then M_k is dense. Thus $\bigcap_k M_k$ is a residual subset of X. Let $x \in \bigcap_k M_k$. For each $k \in N$, there exists $n_k \in N$ such that $\left\| T^{n_k} x \right\|_m > k$. We have $\lim_{k\to\infty} \left\| T^{n_k} x \right\|_m = \infty$, so x has m-unbounded orbit.

Proposition 2 Let $T \in B(X)$, then the following assertions are equivalent:

(1) there exist $\varepsilon > 0$, a sequence (y_k) in X such that $\lim_{k\to\infty} y_k = 0$. For every $k \in N$, there exists an increasing sequence (n_j^k) of positive integers such that $d(T^{n_j^k} y_k, 0) > \varepsilon$ for all $j \geq p_k$, p_k is some integer;

(2) there exists $y \in X$ with unbounded orbit;

(3) the set of all $y \in X$ with unbounded orbit is residual in X.

Proof. (3) $\Rightarrow$ (2): Trival.

(2) $\Rightarrow$ (1) and (1) $\Rightarrow$ (3): Follow from the previous proposition .

Proposition 3 Let $T \in B(X)$ and suppose that there exists a dense subset X_0 of X such that the orbit of each $x \in X_0$ is near to 0. Then the set of

all vectors with orbits near to 0 is residual.

Proof. For each $k,m \in N$, let $M_{k,m} := \{x \in X : \exists n \in N \text{ with } \|T^n x\|_m < k^{-1}\}$. Clearly each $M_{k,m}$ is open and dense. So the set $\bigcap_{k,m} M_{k,m}$ is residual and consists of vectors with orbits near to 0.

Definition 3 Let $T \in B(X)$. We say that T satisfies the Li-Yorke Chaotic Criterion (LYCC) if there exist sequences $(x_k),(y_k)$ in X such that:

(a) There exists an increasing sequences of integers (m_j) such that $\lim_{j\to\infty} T^{m_j} x_k = 0$ for all k.

(b) $y_k \in \overline{span\{x_n : n \in N\}}$, $\lim_{k\to\infty} y_k = 0$. There exist $\varepsilon > 0$ and for each $k \in N$, there exists an increasing sequence (n_j^k) of positive integers such that $d(T^{n_j^k} y_k, 0) > \varepsilon$ for all $j \geq p_k$, p_k is some integer.

We shall now show that the Li-Yorke Chaos Criterion characterizes Li-Yorke chaos

Theorem 1 Let $T \in B(X)$, then the following assertions are equivalent:

(1) T satisfies (LYCC);

(2) T has an irregular vector;

(3) T is Li-Yorke chaotic;

(4) T admits a Li-Yorke chaotic pair.

Proof. (1) ⇒ (2): Let $X_0 := \{x \in X : \lim_{j\to\infty} T^{m_j} x = 0\}$, then X_0 is a subspace of X, $T(X_0) \subset X_0$ and $T(\overline{X_0}) \subset \overline{X_0}$. Moreover, $x_k \in X_0$ and $y_k \in \overline{X_0}$ for all $k \in N$. By Proposition 3, the set of all vectors $x \in \overline{X_0}$ with orbits near to 0 is residual in $\overline{X_0}$ .By Proposition 2, the set of all vectors $x \in \overline{X_0}$ with unbounded orbits is residual in $\overline{X_0}$. So the set of all irregular vectors is residual in $\overline{X_0}$. In particular, there exists an irregular vector.

(2)⇒ (3): Let $u \in X$ be an irregular vector, then $\{\lambda u : \lambda \in K\}$ is an uncountable scramble set.

(3)⇒ (4): Trivial.

(4)⇒ (1): Let $(x, y) \in X \times X$ be a Li-Yorke chaotic pair for T and let $u := x - y$, then there exist $\varepsilon > 0$ and increasing sequence (m_j) and (n_j) of positive integers such that $\lim_{j\to\infty} d(T^{m_j} u, 0) = 0$ and $\lim_{j\to\infty} d(T^{u_j} u, 0) = 2\varepsilon > 0$. For each $k \in N$, let $x_k := T^k u$, then $\lim_{j\to\infty} T^{m_j} x_k = 0$. Choose s_k such that $\|T^{s_k} u\|_k < k^{-1}$ and let $y_k := T^{s_k} u$, then $y_k \to 0$. For every $k \in N$, let $(n_j^k) = (n_j - s_k)$, then there exists some integer p_k such that $d(T^{n_j^k} y_k, 0) > \varepsilon$ for all $j \geq p_k$.

Definition 4 Given $T \in B(X)$, a vector subspace Y of X is called uniformly irregular manifold for T if there exists $m \in N$ such that the orbit of every non-zero vector y in Y is simultaneously m -unbounded and near to 0.

The following theorem is similar with Theorem 15 in [20], and the proof is similar, we omit the proof.

Theorem2 Let X be a separable Fréchet space . Suppose $T \in B(X)$ satisfies $T^n x \to 0$ for all $x \in X_0$, where X_0 is a dense subset of X . Then the following assertions are equivalent:

(1) T is a Li-Yorke chaos;

(2) T is a densely Li-Yorke chaos;

(3) T admits a densely uniformly irregular manifold;

(4) T admits a unbounded orbit.

Hypercyclic operators play a very important role in operator theorem. For a long time, operator theorists have been studying them in connection with the invariant subspace problem. By irregular vectors, we get

Proposition 4 Let $T \in B(X)$. If T is hypercyclic, then for every $x \in HC(T)$, x is an irregular vector for T . So T is a Li-Yorke chaos.

Proof. Since X is a Fréchet space, there exists a translation-invariant metric d on X that is induced by a countable family of increasing semi-norms $\{\|\cdot\|_n : n \in N\}$. Let $x \in HC(T)$, then for every $n \in N$, $B(0, \frac{1}{n}) \cap Orb(T, x) \neq \varnothing$, there exists an increasing sequence (m_k) of positive integers such that $T^{m_k} x \to 0$. For every $m \in N$ and $n \in N$, let $U_n^m := \{x \in X : \|x\|_m > n\}$, U_n^m is open in X . So $U_n^m \cap Orb(T, x) \neq \varnothing$ for every $n \in N$. Then there exists an increasing sequence (n_k) of positive integers such that $\|T^{n_k} x\|_m \to +\infty$, x is an

irregular vector for T. So T is a Li-Yorke Chaos. Hypercyclic vectors are irregular, but a hypercyclic operator can have irregular vectors that are not hypercyclic and an operator can have a huge number of irregular vectors and no hypercyclic one [21]. So there exists a Li-Yorke chaos that is not hypercyclic.

Remark 1 In the proof of Theorem 1, (4) ⇒ (1), we defined that $x_k = T^k u$, $k = 0,1,2,\cdots$. Let $X_0 = \overline{\{x_k : k = 0,1,2,\cdots\}} = \overline{Orb(T,u)}$. If X_0 is a subspace of X, then u is a hypercyclic vector of T in X_0. By Birkhoff transitivity theorem, the set of all hypercyclic vectors is residual in X_0. Then the set of all irregular vectors is residual in X_0.

Proposition 5 Let $T \in B(X)$, then x is an irregular vector of T if and only if x is an irregular vector of T^m for every $m \in N$.

Proof. Let x be an irregular vector of T. Then there is a sequence k_n such that $T^{k_n} x \to 0$. Let $k_n = mq_n + r_n$, with $r_n \in \{0,1,\cdots,m-1\}$. Since there are only m choices for r_n, one of the values repeats infinitely many times. Therefore we can assume, without loss of generality, that $r_n = r$ for every n. Thus $T^{mq_n + r} x \to 0$ and hence $T^{m-r}(T^{mq_n+r}x) \to 0$ which means that $T^{m(q_n+1)} x \to 0$. There is also a subsequence l_n and $m \in N$ such that $\left\|T^{l_n} x\right\|_m \to \infty$. Let $l_n = mq_n + r_n$, with $r_n \in \{0,1,\ldots,m-1\}$. Since there are only m choices for r_n, one of the values repeats infinitely many times. Therefore we can assume, without loss of generality, that $r_n = r$ for every n. Since T is an operator, so T^r is an operator, too. Then there are $n \in N$ and $M > 0$ such that $\left\|T^r(T^{mq_n}x)\right\|_m \le M\left\|T^{mq_n}x\right\|_n$. Then $\left\|T^{mq_n}x\right\|_n \to \infty$, so x is an irregular vector of T^m.

The converse is obvious.

By the above proposition, we can get.

Theorem 3 Let $T \in B(X)$. The following are equivalent:

(1) T is Li-Yorke chaotic.

(2) T^m is Li-Yorke chaotic for every $m \in N$.

Let X and Y be Fréchet spaces with defining increasing sequences of seminorms $(p_n)_n$ and $(q_n)_n$,respectively, then $X \oplus Y := \{(x,y) : x \in X, y \in Y\}$ will be endowed with the seminorms $(x,y) \to p_n(x) + q_n(y)$, $n \ge 1$, which induce the product topology on $X \oplus Y$. This space then becomes a Fréchet space, which is separable if X and Y are.

Definition 5 Let $S : X \to X$ and $T : Y \to Y$ be operators on Fréchet spaces X and Y. Then the operator $S \oplus T$ is defined by

$$S \oplus T : X \oplus Y \to X \oplus Y, (S \oplus T)(x,y) = (Sx, Ty).$$

Proposition 6 Let $S, T \in B(X)$, then $S \oplus T$ is Li-Yorke chaotic if and only if at least one of S or T is Li-Yorke chaotic.

Proof. (⇒) If $S \oplus T$ is Li-Yorke chaotic, let (x,y) be an irregular vector of $S \oplus T$. Thus there is a sequence $(k_n)_n$ such that $(S \oplus T)^{k_n}(x,y) \to 0$. This means that $(S^{k_n} \oplus T^{k_n})(x,y) \to 0$ which means that $(S^{k_n}x, T^{k_n}y) \to (0,0)$ and this implies that $S^{k_n}x \to 0$ and $T^{k_n}y \to 0$. In the same time, there is a sequence $(l_n)_n$ such that $\left\|(S \oplus T)^{l_n}(x,y)\right\|_m \to \infty$ which means that $\left\|S^{l_n}x\right\|_m + \left\|T^{l_n}x\right\|_m \to \infty$. This implies that at least one of them has a subsequence converging to ∞. Therefore either S or T has irregular vectors, at least one of S or T is Li-Yorke chaotic.

(⇐) If S is Li-Yorke chaotic, then there is an irregular vector x of S. Then $(x,0)$ is an irregular vector of $S \oplus T$. $S \oplus T$ is Li-Yorke chaotic.

Recall that T is weakly mixing if $T \oplus T$ is topologically transitive on $X \oplus X$.

Proposition 7 Let T is weakly mixing, then T is a densely Li-Yorke chaos.

Proof. Let d is the translation-invariant metric on X. Since T is weakly mixing, $T \oplus T$ is hypercyclic on $X \oplus X$. Thus $T \oplus T$ is Li-Yorke chaotic. By Proposition 6, T is Li-Yorke chaotic on X. By Birkhoff transitivity theorem, $HC(T \oplus T)$ is dense in $X \oplus X$. For every point $(x,y) \in HC(T \oplus T)$, $x \ne y$, there is a sequence $(k_n)_n$ such that

$(T \oplus T)^{k_n}(x, y) \to 0$. This means that $T^{k_n} x \to 0$ and $T^{k_n} y \to 0$. So $\liminf_{n\to\infty} d(T^n x, T^n y) = 0$.

Let $U_n = \{x \in X : d(x,0) < \frac{1}{n}$, $V_n = \{x \in X : d(x,0) > 1\}$. For every $n \in N$, $U_n \oplus V_n$ is an open set in $X \oplus X$. Since $(x, y) \in HC(T \oplus T)$, there is a sequence $(l_n)_n$ such that $(T \oplus T)^{l_n}(x, y) \in U_n \oplus V_n$. This means that for every $n \in N$, $T^{l_n} x \in U_n$ and $T^{l_n} y \in V_n$. So lim $\limsup_{n\to\infty} d(T^n x, T^n y) > 0$. Thus $\{x, y\}$ is a Li-Yorke pair. So T is a densely Li-Yorke chaos.

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Research on Application of Artificial Intelligence in Stakeholder Economic Crime

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Abstract: At present, the stakeholder economic crime has represented the characteristics of a large amount of money involved, a wide range of victims and even the organized criminal gangs along with the rapid development of intelligent and big data technologies, thus posing new challenges to the crackdown and prevention of the current public security agencies, If we rely solely on the traditional experience and responsive-based working pattern to crack down on the stakeholder economic crimes, it will lead to the inefficiency in dealing with cases for public security organs, thereby falling into the passive position, In fact, the rapid innovation of artificial intelligence technology has brought new opportunities for the prevention and crackdown of stakeholder economic crime, Specifically, with the integration of artificial intelligence technology into the stakeholder economic crime, it not only can realize the real-time monitoring of cases to conduct the early warning in advance and further reduce cases, but carefully analyze and judge the case information and the persons involved in the cases, in order to improve the efficiency of cases handling and better save police resources
Keywords: Stakeholder Economic Crime AI; Deep Learning; Machine Learning

1. INTRODUCTION

Currently, stakeholder economic crime, especially illegal fund raising and Internet pyramid schemes have shown the booming development. Due to the convenience and rapidity of information dissemination in the Internet era, it will cause large-scale visits of groups whose interests get damaged if such cases are not handled carefully, which can further lead toe great harms to social and economic order, and become the important factor to endanger social stability. Facing the high-incidence trend of the stakeholder economic crime, it is of great significance and has far-reaching influence to deeply and fully integrate the prevention strategies of the economic crime cases with artificial intelligence in the era of artificial intelligence.

2. NEW FEATURES OF STAKEHOLDER ECONOMIC CRIME IN THE AGE OF ARTIFICIAL INTELLIGENCE

The current integration between intelligent technology and economic society has caused the rapid growth of data, making the widespread use of information technology bring about profound changes in the payment and transaction methods, as well as lifestyles of people. In view of the close relationship between social economic activities and economic crimes, information technology has also brought about profound changes in the stakeholder economic crime and further shown some new characteristics, including the following aspects.

2.1. Spreading from the Traditional Industry to the Emerging Industry in the Crime Field

In the past, the stakeholder economic crime mainly involves the traditional industries, including the agriculture, aquaculture, health care product, securities industry and real estate, but the current stakeholder economic crime mainly includes the online lending platform, crowd funding, investment and wealth management, as well as some emerging Internet finance areas. During the traditional period, the stakeholder economic crime often not only utilized the names of after-sales leaseback, cooperative development, shop investment and purchase of original shares to conduct fund-raising fraud, but the concepts of overseas gold speculation in futures and actual to raise leverage prices, implement contract fraud or even carry out illegal business activities. At present, however, they usually rely on a “legal” of Internet finance, e-commerce and P2P platform to illegally set up fund pools, illegally absorb public deposits or raise funds for fraud, especially making pyramid selling method change from the traditional to Internet selling.[1] In addition, the illegal operations have also been extended to new fields. Usually, the traditional illegal operations mainly include common crimes of salt, tobacco and alcohol, labor service and bill, but currently, they can also include the operations of gold, refined oil, foreign exchange and other crimes.

2.2. Enhanced Concealment, Deception and Seductiveness of the Means of Crime

In reality, those criminals often cover the purpose of illegal fund-raising by conducting the seemingly legal transactions, which means they utilize the so-called Internet finance, entrusted wealth management and other emerging investment models to deceive investors under the guise of high-tech, new economy and advanced marketing models. Some fundraisers even invite some people with certain financial and legal knowledge to be the “consultant” and “adviser” and further design some means which are difficult to be detected to circumvent the law, including the

non-fixed interest rates and withdrawing cash back of intermediary agents. However, some new Internet pyramid selling crimes even deceive victims by using the names of government support projects, overseas projects and fake charities [2].

2.3. A Wide Range of Criminal Cases and Huge Amounts Involved

The most obvious feature of the stakeholder economic crime case is the large number of victims involved ranging from hundred, several thousand to even tens of thousands, for example, the case in Yilin of Beijing involved more than 20,000 people. In addition, some people were originally victims and aimed to conduct the investment, but in the later period, they would help the principal criminals to make up lies and fictional facts to turn them into criminals for their own economic benefits. In terms of personnel composition, it usually includes workers, farmers, individual owners, professional managers and even some highly educated intellectuals.

In addition, most economic crimes are the criminal amount, which takes the larger amount as one of the conditions for the establishment. Compared with general crime, the stakeholder economic crime mainly focuses on a large number of victims with the large criminal amount, specifically including the prominent illegal fund raising crime and illegal pyramid scheme. However, other cases, including the insurance fraud and illegal operation security, usually involve more than one million yuan. The largest amount of stakeholder economic crime is usually beyond the reach of other general crimes.

2.4. Well-organized Criminal Organizations Involved in Stakeholder Economic Crimes

Most of the stakeholder economic crimes include joint offence, gang crime and even group crime. Among the stakeholder economic crimes in recent years, the criminal organization usually has more rigorous structure and clearer division of labor, which can be reflected in the strict and orderly relationship of interests. For example, in order to maximize the amount of money collected, the criminals of illegal pyramid selling would follow a reward mode in a certain order to develop the "upper levels" through the "higher levels", and also cultivate a certain number of "backbones", in order to take the high amount of reward as a stimulus means to increase the enthusiasm of criminals. In addition, these members involved in the stakeholder economic crimes include the relationships of father-son, husband and wife, or brothers, sisters and siblings, thus making the special blood relationship further strengthen the criminal organization structure.

3. DIFFICULTIES IN THE INVESTIGATION OF THE STAKEHOLDER ECONOMIC CRIME

The acceleration of the pace of economic reform has made the stakeholder economic crime exert greater harms to the social economic order and economic development. In addition, the new characteristics of the current stakeholder economic crime also have posed new difficulties for the crackdown and prevention of public security organs.

3.1. Difficulty in the Early Warning and Discovery

At this stage, the stakeholder economic crime often utilizes the seemingly legal companies and legal economic models to cover their illegal activities. Generally, existing in specific fields and groups, participants in this kind of crime can get the corresponding benefits at an early stage, but it is basically difficult for them to detect and realize the early warning. Only when facing the broken capital chain and being impossible to pay high interests and return the principals can the victims realize the actual situation, but it has caused larger losses at this time. Secondly, under the guise of hi-tech and new economy, criminals often carefully packaged and planned the whole projects, making it difficult for participants to distinguish. Finally, as the stakeholder economic crime has undergone the long-term operations of criminals, including four stages of budding, gradual change, accumulation and outbreak, criminals would take various measures to conceal their criminal acts and make public security agencies difficult to find criminal behaviors in the early stage before its outbreak [3].

3.2. Difficulty in Obtaining Evidence

In view of that the evidence collection is the core of investigative, the characteristics of the stakeholder economic crime can determine the difficulty in obtaining evidence. Firstly, it is difficult to collect the verbal evidence. Considering that the stakeholder economic crime often has a long time span, the accuracy of verbal evidence would be decreased along with the passage of time. What's more, the organization of stakeholder economic crime can effectively avoid the attacks of investigating authorities by setting corresponding levels and utilizing the asymmetry of information, thus making it difficult to collect the whole verbal evidence. Secondly, it is also very difficult to collect the electronic evidence. Due to the characteristics of being easier to be modified and lost, it always takes a long time for investigating agencies to handle cases and fix the conviction and sentencing evidence especially facing the complex and large amounts of relevant evidence in the stakeholder economic crimes[4].

3.3. Difficulty in Recovering Stolen Money to Avoid the Losses.

Due to the long incubation period of the stakeholder economic crime, criminals often use the stolen funds to pay back the principal and high interest in the previous period. In the early stage, the fundraisers can generally pay high interest and repay the principal on schedule to maintain the illusion of good reputation, in order to gain the trust of the participants. But in the later period, the excessive higher costs of fundraisers have made it almost impossible to maintain

high-interest redemption for a long time, thus inevitably leading to the collapse of the capital chain. After witnessing the broken capital chain, it was too late for the participants to realize that they were deceived. When the judiciary getting intervened, the case has been into the criminal proceedings, meaning the funds that have been stolen have often been squandered and repaid high interest rates by the fundraisers, and thus making those fundraisers almost impossible to repay their economic losses. What's more, as some fundraisers usually had the purpose of illegal possession at the beginning, and failed to open the account to form the messy management of the funds, it often can be very difficult to find out their transferring direction.

4. PRACTICAL EXPLORATION OF ARTIFICIAL INTELLIGENCE IN STAKEHOLDER ECONOMIC CRIME

The rapid development of artificial intelligence technology has brought new characteristics to the stakeholder economic crime, and also proposed new challenges to the crackdown of public security. On this basis, those public security organs must focus on intelligent technology to break the traditional model, further achieve the efficient early warning, automatic monitoring, and intelligent investigation and judgment of those economic crimes by relying on artificial intelligence technology[5].

4.1. To improve the early warning abilities for suspicious cases with the artificial intelligence

Based on the analysis of the technical system of the stakeholder economic crime, artificial intelligence technology usually has two characteristics of terminal cut-in and back stepping, which mainly interact with the reality through the following two aspects. On the one hand, the risk-aware identification technology can help build a risk-based economic crime model to automatically collect intelligence clues, and further conduct the preliminary screening of the clues that have been obtained. And based on the characteristics of the websites involved, the multidimensional automated system can have the preliminary investigation and judgment of the target system to mark the suspicious index, conduct the categorized and model classifications for the potential risks, as well as timely identify the urgency, in order to better perform automatic intelligent alarming. In addition, in the complex cases, it is also feasible to first use artificial intelligence technology to implement the terminal processing and evaluation, then make the corresponding analysis, calculation and decision-making for external information and data, as well as further take corresponding measures to deal with and automatically form a preliminary research report. To enhance the early warning capability of the stakeholder economic crime with the application of artificial intelligence, it is very important to first break the tradition model only limited to the alarms and post-event responses, and then form the intelligent analysis capabilities and intelligent thinking of the equipment and facilities. With the help of the data processing capabilities of artificial intelligence technology, and based on historical data and newly collected clues to monitor the situation, it can help conduct the real-time analysis and early warning for potential crime risks and timely conclude the characteristics of the cases, thus forming the early warning system integrated with strong applicability and suitability through the deep quantitative analysis and emotional judgment , and gradually achieving the self-improvement during the application process[6].

4.2. To iteratively optimize the knowledge rules of stakeholder economic crime with the artificial intelligence

As an iterable system project, and with the combination of supervised and unsupervised algorithms, artificial intelligence technology, on the one hand, can detect the characteristics of new stakeholder economic crimes and iteratively optimize the evaluation model of those suspicious cases. On the other hand, with the help of the newly acquired features detected by the algorithm and the multi-classification model, it also can intelligently identify the types of the stakeholder economic crimes and further strengthen their suspicious evaluation model to further better identify suspicious cases. In addition, the artificial intelligence model also can be beneficial to the knowledge base of the stakeholder economic crimes to realize knowledge accumulation, in order to iteratively optimize the rules system and realize the corresponding closed-loop optimization system. According to the explored technical process of the knowledge rules of artificial intelligence, the knowledge reasoning process of the stakeholder economic crime can be described as the following five phases:

Phase one is the accurate identification, which means to establish an artificial intelligence identification model through reviewing cases, greatly improve the identification accuracy of the stakeholder economic crimes, the positioning of suspicious cases and further optimize the allocation of review resources by utilizing more accurate abilities of the high-dimensional discrete features.

Phase two is the assisted review, which means to transform the model features identified through artificial intelligence technology into supporting information for cases determination after business and engineering analysis. In addition, the modeling data can also become important statistical analysis information of transaction cases through data processing.

Phase three is the accumulation of knowledge, which means to introduce more artificial intelligence technologies to strengthen the abilities of business assistance of artificial intelligence. For example, with the introduction of the knowledge map technology and the data of third-party institutions, it can be

beneficial to intelligently identify the data and further carry out effective use in a targeted manner. However, the introduction of natural language processing technology and text recognition technology can provide early warning analysis for the monitoring of the stakeholder economic crimes.

Phase four is the exploration of new knowledge, which is also iterative exploration of artificial intelligence model. In the horizontal dimension, a multi-classification model can be established and the key stakeholder economic crimes also should be classified based on the artificial intelligence model. In the vertical dimension, the refined model for identifying suspicious cases in stakeholder economic crimes can help better establish the classification through the sufficient data accumulation, in order to provide knowledge reserves for subsequent identification.

Phase five is the knowledge reasoning, which aims to use the artificial intelligence technology to further explore the knowledge rules of the stakeholder economic crimes, as well as analyze their future modes through existing data and identifiable patterns. For example, the use of link prediction technology in the knowledge map can reasonably learn about future crime models and provide a scientific basis for preventing more complex the stakeholder economic crime models.

4.3. To analyze the community relation between the criminal gang with the artificial intelligence

Those scientists have been utilizing computer algorithms to map criminal networks or to speculate where and when crimes might occur for many years, which also can be called predictive policing. However, there are few studies on analyzing the correlation between past crimes and criminal gangs. Concerning the identification of the stakeholder economic crime gangs, it is very necessary to try to apply artificial intelligence algorithms to construct the related technologies that can identify gang crimes, especially the technology can be very conductive to analyzing the characteristics and the organizational structure of gangs before a comprehensive investigation, thereby changing the ways of public security organs.

In addition, it is also necessary to apply the association map to explore the relationship between the organizational structure and association of the gangs involved from a technical perspective. In the stakeholder economic crimes, those suspects often show the characteristics of gang crimes, making the association map becomes the very effective means. As we all know, those researches often focus on the properties of the single point information in the general machine learning situation, but there is another effective association information in the suspects exploration of the stakeholder economic crimes. Different from general numerical information, this kind of association information actually has the structural characteristic. Based on these association relationships, they can be expressed in graphs and shown in figure 1.

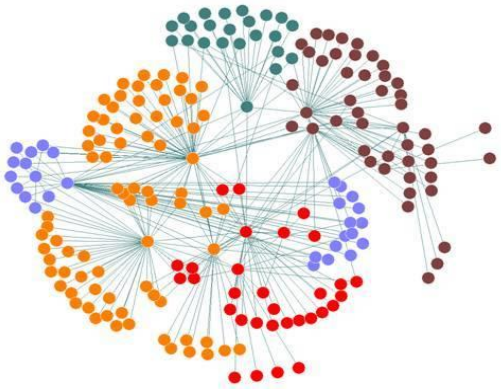

Figure 1 Diagram of association relationship

Thus forming an association graph and sometimes called a social network. In the gangs analysis of the stakeholder economic crimes, the association graphs or social network analysis are more important and effective methods for finding these gang relationships compared with other conventional methods. As an emerging discipline and the theoretical basis of the social network method, graph theory actually has many branches, including the geometric graph theory, combinatorial graph theory, algorithmic graph theory, random graph theory and algebraic graph theory. Though those people majored in computer science often start with the combinatorial graph theory when learning the graph theory, the algebraic graph theory also has important applications in the field of artificial intelligence. Generally, a social network or graph can be composed of nodes and edges, while a matrix can be used to represent the adjacency relationship between nodes in mathematics, which is also called adjacency matrix, thus transforming a combinatorial mathematical problem into a matrix or linear algebra question. There are many methods for the association graph analysis, which are mainly divided into two categories. One is the direct extraction of network features, especially the acquired centrality or first-degree second-degree association features can be used by the upper-level rule systems or risk assessment models, which indicates that the stakeholder economic crime has a high demand for real-time decision-making and timely extraction of these indicators. Specifically, some indicators, such as the second degree of correlation, generally have the high computational complexity, therefore, it is necessary to adopt some approximate algorithms and estimated calculation in the case of dynamic graph. And it is necessary to carefully explain the second degree association. In this way, the research of some simple indicators, such as the normal operation of the first-degree or the second-degree association nodes, is very significant in the actual structure exploration of the stakeholder economic crime gangs.

4.4. To realize situation awareness of stakeholder economic crime with the artificial intelligence

Based on the security of big data, situation awareness, being an environment-based, dynamic and comprehensive ability to understand security risks, aims to improve the abilities to discover, identify, understand, analyze and respond to security threats from a global perspective, in order to promote the decision-making and action, as well as the security capabilities. Specifically, the situation awareness in the stakeholder economic crime refers to the possibilities to predict future case trends in advance, and to have a deep understanding of the mechanisms underlying this trend by analyzing historical data and related clues data, which is also the process of understanding and prediction. And it can be said that the predication, always being the core application of artificial intelligence technology, has played an important role in many fields and also provided great convenience for people's daily life. In the application field of the stakeholder economic crime, it can be reflected in the advance perception of criminal behaviors, meaning the perception of criminal situation. In view of that the prevention is the best way to combat crimes, situation awareness is to realize the active investigation of the stakeholder economic crimes, in order to further predict the trends and results. From the perspective of technical concepts, this kind of situation awareness is to realize the crime prediction through a series of technical means of data modeling and data mining, and the prediction principle relies on the analysis of association relationship to “discover and predict the present and future by summing up and exploring the laws of the past”[7]. And this kind of law often can be represented as a relatively stable correlation from the perspective of big data due to the unique characteristics of crimes, which means the continuous changes in the crime itself and the surrounding environments can help form a new and better understanding in perceiving the development trends of crimes in advance once they can be captured. What’s more, this situation awareness often focuses more on the prediction of the laws and characteristics of the stakeholder economic cases.

Another aspect is that the situation awareness can help investigative agencies form the abilities to apply artificial intelligence technology into collecting and analyzing data of some potentially high-risk groups in their prediction of crime activities. It should be emphasized that the analysis and collection of personal data must consider the protection of citizens' personal rights, therefore, in order to avoid the abuse of public security resources, the big data detection and early warning should be applied to the those crimes that pose a major threat to political security and social stability, such as the stakeholder economic crime.

5. ANALYSIS OF THE APPLICATION PROSPECTS OF ARTIFICIAL INTELLIGENCE IN STAKEHOLDER ECONOMIC CRIME

There is no doubt that the emergence of artificial intelligence will bring a lot of convenience to the economic development and social life, especially our modern people would unconsciously deal with artificial intelligence when they utilize the map software to carry out the path selection, accept the music radio recommendations, online shopping and other activities. However, it cannot be denied that new crimes also may be generated during the application process of artificial intelligence technology, which may make the technology itself become the object of crime prevention. At present, however, most artificial intelligence applications mainly focus on the field of weak intelligence degree and only giving the instructions and orders to machines according to specified procedures, seriously lacking the consciousness and behavior of humans. In this way, the increasingly stronger artificial intelligence skills still have more powerful limitations to only become the supplementary means, but failing to be a qualified regulator independently. However, along with the rapid development of science and technology, the new generation artificial intelligence will reach a higher level and further promote its development in the field of crime prevention. And we can fully believe that it will realize the qualitative leap of the existing artificial intelligence to prevent the stakeholder economic crimes if the criminal data can be timely processed. Therefore, in the future, it still has a long way to go in the depth of artificial intelligence technology and the stakeholder economic crime, especially the effective combination of the artificial intelligence analysis technology, machine learning and deep learning algorithm technology can expand the vertical extension of artificial intelligence technology, as well as build a more powerful new prevention model of artificial intelligence + the stakeholder economic crime by integrating systems and tools of multiple perception technology and analysis technology. At the same time, the artificial intelligence also has entered a new stage of development. On the one hand, the network-based intelligence has emerged and constantly transformed from emphasizing the personal intelligence simulation of experts to the swarm intelligence, from the logical and monotonous design intelligent system to the open and autonomous constructive smart environments, from “machine-centric” intelligent computing model to “swarm computing”, as well as from the closed and planned to the open and competitive model. This means that the investigation thinking mode of the stakeholder economic crime can transform from the traditional empirical research to the intelligent development, which means more prior knowledge and knowledge principles will be integrated as models for the deeper understanding of the public security organs, in order to further improve the efficiency of analysis and judgment greatly. In addition, the necessary information resources for the artificial intelligence

also have achieved the booming development under the greater support of the Internet of Things technology connecting everything together, which has not only provided more possibilities for the deep exploration and effective aggregation of the stakeholder economic crimes, but the technical foundation and environment for the fully application of the swarm intelligence. In detail, the combination of the two technologies and their application in the prediction and early warning mode of the stakeholder economic crimes will significantly improve the abilities to collect the related information of such crimes, and further better meet the dynamic prediction and prevention demands in reality. In this way, public security organs must rely on a benign scientific and technological innovation ecological environment to realize the swarm intelligence of the stakeholder economic crimes across time and space, and further efficiently reorganize the collective intelligence by aggregating the “human power” into “intelligence” and focusing on platforms and applications, in order to extensively and accurately release of the energy of swarm intelligence in the prediction and early warning model of artificial intelligence + the stakeholder economic criminal .

Up to now, the development of artificial intelligence has reached a high technology level, and we have every reason to believe that the technology products brought by artificial intelligence in the future will be the “containers” of human intelligence. Based on the information process simulation of the human consciousness and thinking made by artificial intelligence, in the future, the intelligence of human beings in a certain field or exceeding that of humans can be generated. In addition, in terms of crackdown and prevention of the stakeholder economic crimes, considering that criminals would also use artificial intelligence technology to expand the field of crime, as well as make more concealed and scientific criminal models, the artificial intelligence confrontation will undoubtedly become possible. Therefore, the level of artificial intelligence technology will not only determine the direction of social public safety and become an important foundation for maintaining the balance of social public order, but become the crackdown ground for future stakeholder economic crimes.

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An Improved Connected-Component Labeling Algorithm for 3d Binary Images

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Abstract: 3D images have played very important roles in many fields and attracted many attentions, This paper presents an improved connected-component labeling algorithm for 3D binary images, According with the discipline for checking neighbors in the mask, we propose an algorithm which gives two different procedures for labeling a current foreground voxel in 3D images, Two examples and the variable ACN shown that the proposed algorithm is more efficient than conventional algorithms
Keywords: 3d Binary Inage, Connected-Component Labeling, Labeling Algorithm, Computer Vision

1. INTRODUCTION

Connected-component labeling in a binary image is indispensable for pattern recognition, pattern analysis, computer (robot) vision, and machine intelligence [1]. By connected-component labeling, we can transform a binary image into a symbolic image in which all pixels belonging to a connected component, which is also called an object, are assigned a unique label. Then, by use of the symbolic image, we can further extract the features of those connected components.

With the development of image acquisition and manipulation technologies, Connected-component labeling for 3D binary images have attracted many attentions [2-5]. From the eighties of last century, many researchers have begun to study how to label connected components in 3D binary images, and proposed many algorithms [6-10]. The algorithm proposed [10] is the most efficient algorithm because it gave an optimal order for checking the voxels in the mask when labeling a foreground voxel. The algorithm can avoid checking redundant voxels. However, some voxels that have been checked during processing the previous voxel might be checked again.

This paper presents an improvement of the above algorithm proposed [10]. For convenience, we denote the algorithm proposed [10] as VCL algorithm. By use of the information obtained during processing the previous voxel, the proposed algorithm can further reduce the number of voxels to be checked for processing a foreground voxel. Thus, the efficiency of connected-component labeling can be improved largely.

2. IMPERFECTION OF CONNECTED COMPONNT LABELING ALGORITHM FOR 3D BINNARY IMAGES

For a $U \times V \times W$-size 3D binary image, we use v (x, y, z) to denote the voxel at (x, y, z) in the image, where $1 \le x \le U$, $1 \le y \le V$, and $1 \le z \le W$. For convenience, we also use v (x, y, z) to denote the value of itself. Without loss of generality, we will only consider 26-connectivity in this paper, because the other cases, i.e., 6-connectivity and 18-connectivity, are the sub-cases of 26-connectivity.

For a voxel $v(x, y, z)$, the 26 voxels $v(x \pm i, y \pm j, z \pm k)$ where i, j, k might be 0 or 1 except $i = j = k = 0$, is said to be its neighbors. Two foreground voxels p and q in a binary image are said to be 26-connected if and only if there is a path which consists of foreground voxels $v_1, \ldots, v_n$ such that $v_1 = p$, $v_n = q$, and for $1 \le i <$ n, v_i and vi+1 are 26-neigbhor for each other. A connected component in a binary image is a maximum set of object voxels in the image such that any of two voxels in the set are 26-connected. The mask with 26-connectivity for 3D binary images is shown in figure 1.

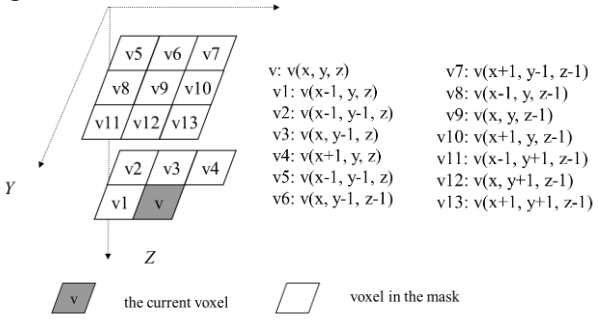


Figure 1 Mask with 26-connectivity

The VCL algorithm would check voxels in the mask in the order of $v_9 \rightarrow v_3$, $v_6 \rightarrow v_1$, $v_8 \rightarrow v_{10} \rightarrow v_2$, v_5, $v_{12} \rightarrow v_4$, $v_7 \rightarrow v_{11} \rightarrow v_{13}$. There are some voxels, i.e. v_2, v_3, v_5, v_6, v_8, v_9, v_{11} and v_{12}, while belong to the mask of v_1 and that of v at the same time, they may be checked again for labeling the current voxels v, even if they had been checked for labeling the left voxel v_1. Obviously, if we can avoid the abound checking for neighbor voxels in the mask, we can largely improve the

efficiency of connected-component labeling.

Based on the imperfection of the VCL algorithm for 3D binary images, we present an efficient method for improving the efficiency of connected-component labeling for 3D binary images.

3. THE PROPOSED METHODS FOR 3D BINARY IMAGES

The voxel in binary images is a foreground voxel or a background voxel. V_1 is the previous voxel of the current voxel v, if v_1 is a foreground voxel and v_1 must be the one last labeled voxel when the current voxel v is labeled, and the configuration v_1 is known, the label of v_1 can be directly assigned the current voxel v if v_1 is a foreground voxel. Therefore, v_1 can be deleted from the mask with 26-connectivity shown in Figure1, and the new mask with 26-connectivity used in the proposed algorithm is shown in figure 2. There are 12 neighbor voxels in the new mask of the proposed algorithm.

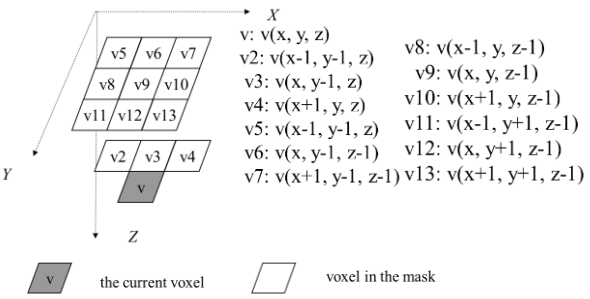


Figure 2 Mask with 26-connectivity for 3d binary images in the proposed algorithm

For labeling the current voxel, when v_1 is a background voxel, it does not need to be labeled, therefore, nothing needs to be done, and all of the neighbors of v_1 in the mask must not be checked, we denote them except v_1 as uncertain voxels in the mask which configurations are unknown, and when v_1 is a foreground voxel, one or more neighbors in the mask must be checked for labeling v_1, we denote these checked neighbors as certain voxels which configurations are known. Based on the different configurations of v_1, we propose two procedures, i.e., LP1 and LP2, for labeling the current foreground voxel, where v_1 is a background voxel in LP1, all neighbor voxels in the mask are not checked, the neighbor voxels in the mask are all uncertain voxels, and v_1 is a foreground voxel in LP2, there are some neighbor voxels had been checked for labeling v_1, for these certain voxels, they would not be checked again for labeling the current voxel v. By this method, we can reduce the number of times for checking the neighbors in the mask and improve the efficiency of Connected-Component Labeling for 3D binary images.

3.1. Labeling the Current Foreground Voxel in LP1

In this procedure, v_1 is a background voxel, and all neighbors of the current voxel v in the mask are uncertain voxels, therefore, checking neighbors in the mask is a necessary processing. 12 neighbor voxels in the mask need to be checked, the number of possible checking orders will be 12! Different checking orders might lead to different efficiency. We optimized the order of checking neighbor voxels with same ideas proposed in the VCL algorithm. The proposed algorithm checks neighbors in the mask in the order of $v_9 \rightarrow v_6 \rightarrow v_3 \rightarrow v_8 \rightarrow v_{10} \rightarrow v_5 \rightarrow v_{12} \rightarrow v_2 \rightarrow v_7 \rightarrow v_4 \rightarrow v_{11} \rightarrow v_{13}$, although v_6 and v_3 have the same number neighbors in the mask, v_6, which is the voxel in the previous layer in 3D image, was labeled earlier than v_3, therefore v_6 is checked before v_3. There is the same principle for confirming the checking order between v_5, v_{12} and v_2, and for that between v_7 and v_4.

3.2. Labeling the Current Foreground Voxel in LP2

Different from the processing in LP1, v_1 is a foreground voxel and was labeled just now, we firstly assign provisional label of v_1 to the current foreground voxel v, and then combine the equivalent labels between the labels of voxels in the mask. Checking the neighbor voxels is the necessary processing for combining the equivalent labels.

In the mask shown in Figure 1, v_1 is neighbored with v, v_2, v_3, v_5, v_6, v_8, v_9, v_{11} and v_{12}, we can conclude their represented labels are equal, but v_1 is not neighbored with v_4, v_7, v_{10} and v_{13}, which are neighbors of v. The equivalent labels would be happened between v_1, v_4, v_7, v_{10} and v_{13}. Based on the analysis, and the voxels, i.e., v_4, v_7, v_{10} and v_{13}, are not only uncertain voxels but also the key voxels for solving label equivalences in LP2.

As the principle proposed in the VCL algorithm, the voxel has greater number of neighbor voxels is earlier checked than other neighbors in the mask. The number of neighbor voxels of both v_4 and v_7 is five, that of v_{10} is ten and that of v_{13} is three, therefore, the proposed algorithm checks voxels v_4, v_7, v_{10}, v_{13} in the order of v_{10} □ v_7□□ v_4□□□v_{13}.

4. Performance Analysis

We utilize two examples and the variable ACN (Average Checking Numbers) to show that, for connected-component labeling processing in 3D images, the proposed method will be more effective than the conventional method.

4.1. Examples for analyzing the efficiency between the proposed algorithm and the VCL algorithm

In LP1, the proposed algorithm used the optimal order for checking the neighbor voxels in the mask. The number of times for checking neighbors in the proposed algorithm is one less than that in the VCL algorithm.

In LP2, we firstly assign provisional label of v_1 to the current foreground voxel v, and then, we resolve the question for combining the equivalent labels by checking the neighbors in the mask.

According to 26-connectity, v_1 and the voxels in the set of $\{v_4, v_7, v_{10}, v_{13}\}$ are all connected each other whenever v is a foreground voxel. Because before v is labeled, v_1 and the voxels in the set of $\{v_4, v_7, v_{10}, v_{13}\}$ may be belong to different connected component,

their representative labels may be different. We should check the voxels in the set as the order given in the third section, and combine the equivalent labels as long as the equivalent labels are checked.

There are two examples shown in Figure 3, such as Figure 3 (a) and Figure 3 (b).

The first example shown in Figure 3 (a), where v_1, v_5, v_{10}, and v_{11} are the foreground voxels contained in the mask. As the proposed algorithm, the label of v_1 is assigned to the current voxel v. v_{10} is the firstly be checked voxel in the set of $\{v_4, v_7, v_{10}, v_{13}\}$, and v_{10} is a foreground voxel in the given example. If the representative label of v_{10} is different from that of v_1, then we combine the equivalent labels, else nothing needs to be done because v_{10} is 26-connectity with v_7, v_4, and v_{13}. In the VCL algorithm, although the order of checking the neighbor voxels has been optimized, it still needs to check v_9, v_6, v_3, v_1, v_{10} as the given order. In the example in Figure 3 (a), the number of times for checking neighbors is 4 less than that of time in the VCL algorithm.

The second example shown in Figure 3 (b), where v_1, v_5, v_7, v_{11}, and v_{13} are foreground voxels in the mask. With the same processing in the example shown in Figure 3 (a), firstly, the label of v_1 is assigned to the current voxel v. Then v_{10} is checked, and it is a background voxel. Then, with the optimal order for checking neighbor voxels, v_7 is the secondly checked voxel, it is a foreground voxel, where v_4 is 26-connectity with v_7, and is not 26-connectity with v_{13}, therefore, v_{13} needs to be checked. Obviously, the number of times for checking the neighbors in the proposed algorithm is three. In the VCL algorithm, the neighbor voxels in the mask need to be checked one by one as the optimal order given in the second section. for the example in Figure 3 (b), the number of times for checking neighbor voxels is 9 less than that in the VCL algorithm.

By the above analysis, for the examples shown in figure 3 (a) and (b) separately, the number of times for checking neighbor voxels by the proposed method is obviously smaller than that of times by the conventional method.

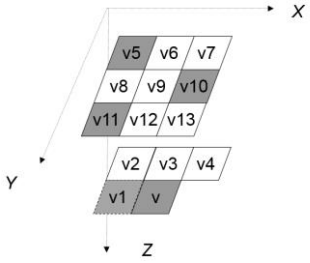
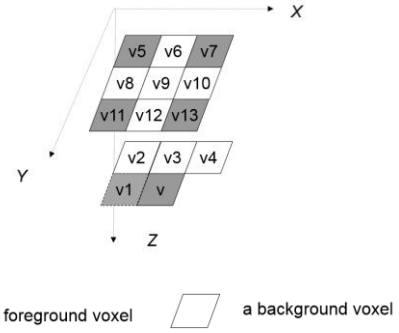


Figure 3(a) V_1, V_5, V_7, V_{11} and V_{13} Are Foreground Voxels in the Mask



(b)

Figure 3(b) V_1, V_5, V_7, V_{11} and V_{13} are foreground voxels in the mask

4.2. Variable ACN for analyzing the efficiency between the proposed algorithm and the algorithm VCL

Variable ACN is the average number of times for checking neighbors in the mask, we utilize ACN to prove that the proposed algorithm is much more efficient than the conventional algorithm. Because v_1 is a background voxel in LP1 and it is a foreground voxel in LP2, v_1 does not need to be checked again when the current foreground voxel v is labeled in the proposed algorithm.

Variable ACN can be calculated by the following formula (1):

$$\mathrm{ACN}=\sum_{i=1}^{n} p_i c_i \qquad (1)$$

Parameter i is one of the configurations which shown the neighbor voxels in the mask must be checked for labeling the current voxel v, different configuration has different neighbor voxels need to be checked, n is largest number of the configurations, P_i is a probability value of configuration i happened, P_i is $1/n$ in uniform probability condition, C_i is the number of times for checking neighbor voxels in the ith configuration.

For any foreground voxel which needs to be labeled, the VCL algorithm should check the neighbor voxels as the given optimal order. There are 25 kinds of configurations, and 216 times for checking neighbor voxels at total. Therefore, the CAN of the VCL algorithm is always 8.6.

The ACN values of the proposed algorithm in LP1, LP2 and average case are shown in Table 1, where the ACN values are 8.1, 2.6 and 5.3 separately.

We can draw the conclusion from Table 1, the ACN values of the proposed algorithm are all smaller than the ACN of the VCL algorithm.

Table 1 The acn values of the proposed algorithm

	Numbers of configurations	Numbers for checking neighbor voxels	ACN
LP1	22	179	8.1
LP2	3	8	2.6
Average			5.3

In this section, we confirm the proposed algorithm is more efficient than the conventional algorithm by the

two examples and the variable ACN.

5. CONCLUSIONS

This paper discussed the key factors which influenced the efficiency of connected-component labeling in 3D binary images, and proposed an efficient algorithm by reducing the number of times for checking the neighbor voxels in the mask. For future work, we will apply our method in practice, such as medical diagnosis, mineral exploration etc. and on the other hand, we will plan to extend the proposed algorithm to be implemented by parallel architectures.

ACKNOWLEDGMENTS

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Design and Simulation of Multi-Posture Lower Extremity Rehabilitation Exoskeleton Structure

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Abstract: In view of the fact that most medical rehabilitation training devices are fixed or horizontal, the patients in the early stage of training do not have the problem of standing ability. According to the gait characteristics of the human body, a multi-posture rehabilitation training lower extremity exoskeleton is designed. The whole set includes two parts: lower extremity exoskeleton and multi-posture standing bed: lower extremity exoskeleton including hip joint and knee joint, driven by motor and reducer, driven by bevel gear, industrial coil spring used in ankle joint to ensure flexible connection multi-position erecting bed uses an industrial electric push rod to achieve 0-90° rotation of the bed, which can effectively prevent the occurrence of orthostatic hypotension. A three-dimensional model of the lower extremity exoskeleton was established, and the simulation analysis was performed using the dynamic simulation software ADAMS. The simulation results verify the rationality of the theoretical model structure design and provide a theoretical basis for the later physical prototype experiments.

Keywords**:** lower limb exoskeleton; multi-posture; simulation analysis

1. INTRODUCTION

According to the National Guidelines for the Prevention and Treatment of Blood Pressure in Chinese Stroke, issued by the National Health and Family Planning Commission in May 2017, cerebrovascular disease is the first cause of disability and death in China. According to the results of the study, hypertension is the first risk in the risk of stroke. Factors, and with the development of science and technology and the improvement of living standards,[1][2] more and more people own private cars, which has led to frequent traffic accidents in recent years. More and more patients with lower limbs or lower limb paralysis due to illness or traffic accidents. Lower extremity rehabilitation exoskeleton can accurately and repeatedly train the patient for a long time, and complete the training purpose while solving the drawbacks of traditional rehabilitation therapy.

At present, experts and scholars at home and abroad have conducted a lot of research on extremity rehabilitation of lower limbs. The United States, the United Kingdom, Japan and other countries have already made great progress in this regard. Many types of lower extremity rehabilitation exoskeleton have been designed and gradually commercialized. Among them, the representative products are Israel's ReWalk series and Japan's HAL [3] BLEEX [4] series from Berkeley Bionics, USA. There are also scientific research units in China engaged in the research of lower extremity exoskeleton walking robots, which are basically in the trial stage, and there is still a certain distance from practical applications.[5]

In order to help the lower limbs of patients with hemiplegia to carry out early leg rehabilitation training to prevent the occurrence of orthostatic hypotension, this paper designed a multi-posture lower limb rehabilitation exoskeleton based on the analysis of the lower limb movement mechanism of the human body, which can realize flat lying and inclined bed. Standing and waiting for training without posture, dynamic modeling and simulation analysis of lower extremity exoskeleton robots. [6-7]

2. STRUCTURAL DESIGN

The lower extremity exoskeleton is attached to the erecting bed, and the patient is lie flat, slant bed, standing (0-90°) and other different postures by controlling the electric push rod under the standing bed.

Considering the compatibility of the body when designing the exoskeleton, the thigh structure, calf structure, and cross structure of the exoskeleton need to be adjusted in length. Therefore, the thigh length adjustment structure, calf length adjustment structure, and mobile cross mechanism are designed for different groups.$\Delta l_{calf} = 60mm, \Delta l_{thigh} = 40mm$

The measurement data is set according toGB10000-1988 "Chinese adult human body size", the average length of the thigh structure is 518mm, the average length of the calf structure is 416 mm, and the exoskeleton structure is designed according to this data, [8] as shown in Figure 1 . The legs have three degrees of freedom, which are the flexion and extension of the hip joint, the flexion and extension of the knee joint, and the flexion and extension of the ankle joint. The freedom of joint movement is shown in Table 1.

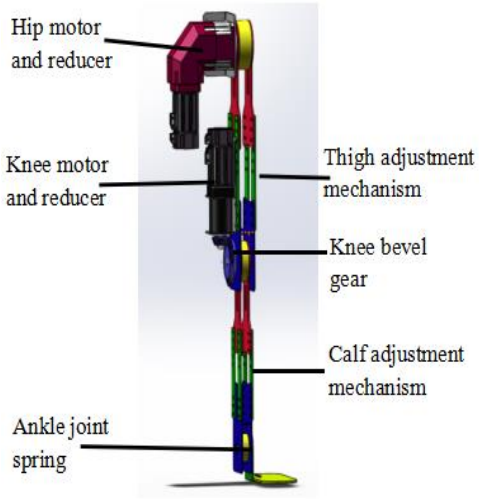
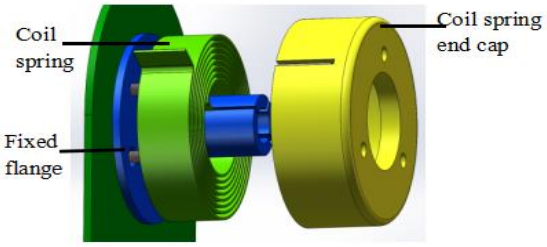


Figure 1. Lower extremity exoskeleton composition

Table 1 Degree of freedom of each joint and its activity

joint	freedom	Actual range of motion/°	Achieve range of motion/°
hip joint	flexion and extension	0~120	0~40
knee joint	flexion and extension	0~130	0~45
ankle joint	flexion and extension	0~90	0~60

In order to make the structure of the lower extremity exoskeleton simple, the movement reliable data is easy to collect and easy to control, the hip joint and the knee joint are driven by the motor with the reducer, and the knee joint needs to change the



transmission direction, and a pair of bevel gear meshing transmission with the transmission ratio i=2 is used. .

Figure 2. Ankle joint spring structure

An industrial coil spring structure is used at the ankle joint. Due to the small rotation of the ankle joint, the stable and flexible movement of the ankle joint of the human body can be approximated by means of the motion inertia, as shown in Figure2. The spring connection of the transition plate is connected to the rotating shaft by the ankle joint coil spring. The tension is applied to the spring by the flexion and extension of the lower leg, and the tension of the spring drives the rotating shaft in the transition plate to drive the foot plate. In order to ensure the patient's comfort and rationality, a rubber sole and a sole elastic plate are added to the sole of the foot. This structure is not designed with the drive of the previously driven motor or the push rod motor. The force generated by the bending of the lower leg drives the movement of the foot plate, which avoids the reduction of the previous heavy-duty drive and cost.

3.KINEMATIC ANALYSIS

The kinematics of the lower extremity exoskeleton is to establish the positional relationship between the distal ankle and the joint relative to the basic coordinate system. According to the established positional relationship equation, the forward and reverse operations can be quickly performed by the program to control the joint motion and the position of the distal ankle joint, so that the movement of the exoskeleton can be coordinated with the walking gait of the person to achieve better training effect.[9]

For the sake of simplicity of calculation, the simplified model of the lower limbs of the human body is analyzed. In the sagittal plane, the upper limbs, the left and right thighs, and the left and right calves can be seen as bones connected, and the left and right feet and the left and right calves are seen as a whole, ignoring the role of the ankle joint during walking, while ignoring the effect of muscle on movement. This results in a simplified model of the human body. According to the exoskeleton and D-H linkage coordinate system establishment rules, the coordinate system shown in Figure 3 is established, and the hip joint coordinates $O(x_0,y_0)$ knee joint coordinates $C(x_1,y_1)$, and ankle joint coordinates $D(x_2,y_2)$ are set.[10]

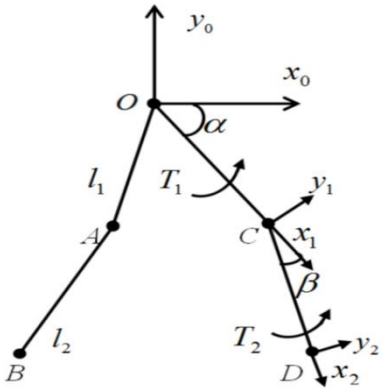


Figure 3. Lower limb D-H linkage coordinate system (O point is at the hip joint, A and C are at the knee joint, and B and D are at the ankle joint)

T_{n+1}^{n} can describe the homogeneous transformation of the linkage coordinate system relative to translation and rotation. The link coordinate system parameter and the transformation matrix T_{n+1}^{n} have a conversion relationship as shown in the equation (1).

(

$$T_0^2=\begin{bmatrix}\cos(\alpha+\beta) & -\sin(\alpha+\beta) & 0 & l_1\cos\alpha+l_2\cos(\alpha+\beta)\\ \sin(\alpha+\beta) & \cos(\alpha+\beta) & 0 & l_1\sin\alpha+l_2\sin(\alpha+\beta)\\ 0 & 0 & 1 & 0\\ 0 & 0 & 0 & 1\end{bmatrix} \quad (1)$$

Obtain the end ankle joint coordinate $D(x_2,y_2)$ as

$$\begin{cases}x_2=l_1\cos\alpha+l_2\cos(\alpha+\beta)\\ y_2=l_1\sin\alpha+l_2\sin(\alpha+\beta)\end{cases} \quad (2)$$

Solving the inverse motion

$$\begin{cases}\alpha=\arctan\dfrac{y_2}{x_2}+\arccos\dfrac{x_2^2+y_2^2+l_1^2-l_2^2}{2l_1l_2\sqrt{x_2^2+y_2^2}}\\ \beta=\pi-\arccos\dfrac{l_1^2+l_2^2-x_2^2-y_2^2}{2l_1l_2}\end{cases} \quad (3)$$

4. SIMULATION ANALYSIS

Using SolidWorks to establish a three-dimensional model of the lower extremity rehabilitation exoskeleton, then import the 3D model into Adams through the seamless interface of SolidWorks and Adams,[11][12]adding the human leg model to couple the human leg to the lower extremity exoskeleton . Set the material and quality attributes of the model, add the joint rotation pair, add the drive to the motor, and establish a virtual prototype of the upper limb rehabilitation exoskeleton, perform system simulation, enter the post-processing module for curve processing, collect experimental data, and obtain hip and knee joints. Torque map, motion angle curve and simulation graph.

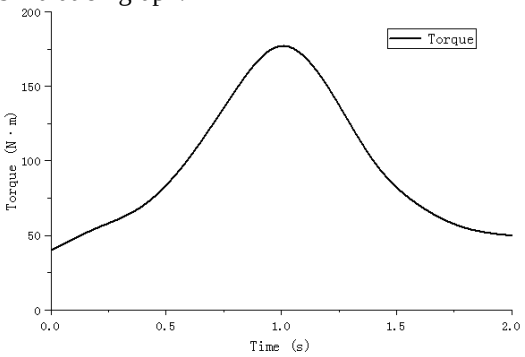


Figure 4 hip torque diagram

It can be seen from Figure 4 to Figure 7 that the lower exoskeleton joint has good flexibility during the movement process, the walking process is relatively stable, and there are not many large vibrations, and the actuator has no running dead point. The simulated movement angles of the hip joint and the knee joint are within the error range, that is, the walking gait of the recovered exoskeleton is basically the same as the normal gait of the human body. [13]

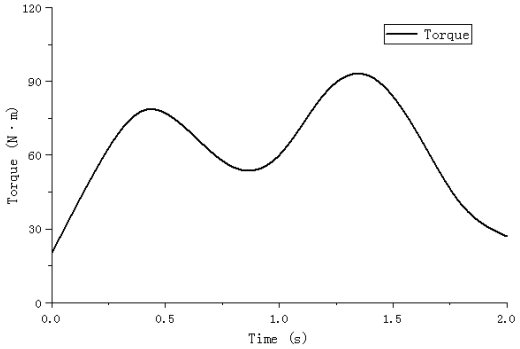


Figure 5 knee joint torque diagram

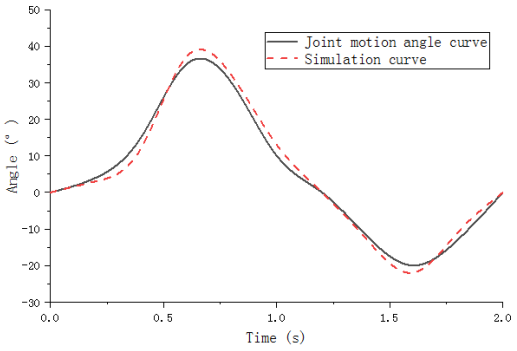


Figure 6 hip joint angle curve and simulation curve

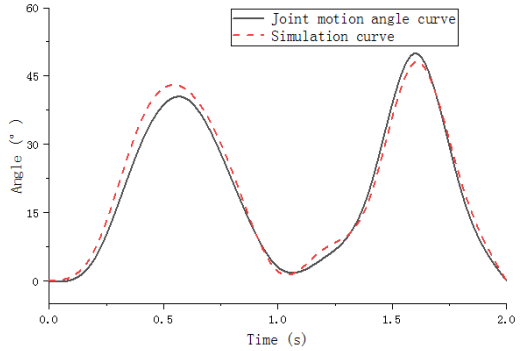


Figure 7 knee joint angle curve and simulation curve

5. STATIC ANALYSIS

The static modal analysis of ANSYS is mainly carried out under the Mechanical module. Firstly, the 3D model established in SolidWork software is imported into the finite element software to form a finite element model. Then the aluminum alloy material setting features are selected to define the contact mode. In order to make the calculation result more accurate, manually

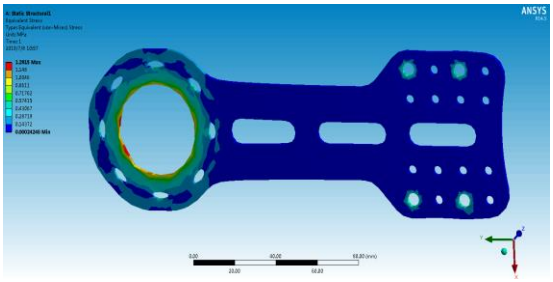


Figure 8 thigh sheet metal stress analysis chart

change the grid size to 5mm, add loads and constraints according to the actual working conditions, click solve to solve, and finally view the results and analyze, the analysis results are shown in Figure 8, 9.

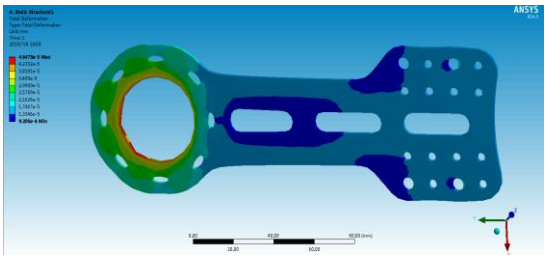


Figure 9thigh sheet metal deformation cloud map

As shown in Figures 8 and 9, the main parts of the exoskeleton have a more uniform stress distribution except for the screw holes under the load pressure. The screw holes of the exoskeleton are set to adjust the structure length for wearers with different body shapes. Cannot be canceled; the maximum stress of the main components of the exoskeleton is generated at the upper side of the thigh, which is 1.29151MPa; the maximum deformation is also generated here, which is 4.6473e-5mm, and the maximum stress of the hip joint rotating part is 14.156MPa. Below the yield limit of aluminum alloy, the effect of deformation on the accuracy of exoskeleton movement can be ignored, so the strength of exoskeleton meets the requirements.

6. CONCLUSIONS

A multi-posture medical rehabilitation lower extremity exoskeleton was designed, and the basic structure design of the standing bed and the lower extremity exoskeleton was completed. The design of the span adjustment mechanism and the leg adjustment mechanism was applicable to people of different body proportions. According to the actual application environment, the single leg support period is simulated. According to the actual application environment, the interface-based collaborative simulation technology is combined with the ADAMS software to simulate the external bones,[14]and the hip and knee joint torque data are obtained. The simulation results are obtained. It proves the rationality of the exoskeleton structure of the lower extremity and provides a certain theoretical basis for the experiment of the physical prototype in the later stage.

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An Image Schema Analysis and the Semantic Extension of Through, Over, and Across

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Abstract: This study is a tentative exploration on image schema of three frequently used preposition: Through, Over, Across and explain how their meanings are extended from the prototypical schemata with the example sentences from the Oxford Dictionary and Longman Dictionary. With the relevant terms Trajector, Landmark and Path, the process of their meanings will be shown in figures. As for image schema, because of the metaphorical extension, there are various forms of image schemata appearing in one preposition, while the state of them appears to be static or dynamic. It will provide some insights for word teaching and learning.
Keywords: image schema; through; over; across

1. INTRODUCTION

1.1. Research questions

This study tries to explore the polysemy of these three prepositions from the perspective of image schema and compare the image schemata of these three prepositions. It helps to explore people's cognitive patterns and rules, and provide inspiration for the dictionary compilation and vocabulary teaching.

It will focus on the following questions: (1) What are their prototypical image schemata? (2) What are their image schemata in metaphorical extension. (3) What differences are there between image schemata of different metaphorical meanings?

1.2. Literature review

Several theory founders of cognitive linguistics, such as Lakoff, Langacker, Johnson, Taylor and so on. Langacker placed emphasis on the study of cognitive grammar. Lakoff and Johnson concerned more about the study of cognitive metaphor. American cognitive linguist Lakoff(1987)put forward more than 20 kinds of image schemata in the analysis of preposition "over", which included Container Schema, Part-Whole Schema, Link-Schema, Center-Periphery Schema and so on. Dewell (1994) generalizes Lakoff's image schema as Trajector and Landmark and sets specific parameters according to the characteristics of Trajector, including the location, quantity, and views of observers. In 1997, Kreitzer (1997) holds that image schemata proposed by Lakoff can be replaced by three layers, they are component level, relational level and integrated level. Tyler and Evans (2003) proposed that there is an image schema abstracted from a large number of repeated concrete space scenes in every preposition. [1]

Chinese scholar Li Fuyin (2007) discussed the characteristics of image schema in detail. He argued that image schema organized in concrete experience and abstract concept in mind. Wang Yin (2002) introduced cognitive semantics from experience, concept, encyclopedic view, prototypical view, image schema, metaphorical view, metaphor, iconicity as well as cognitive model. Zhu Guilan (2004) thinks that the key to improving listening comprehension ability is to help the listener use the image schema to transform the voice signal into a dynamic schema via brain associations. Wang Shaohua (2005) figures that in the reading process, the image schema can be used to organize the concept knowledge, which plays an important part in the comprehension of metaphorical meaning.

Numerous studies have been laid on lexical analysis of words. Nie Yaning (2001) analyzes the mapping of the preposition "beyond" from the spatial domain to conceptual metaphorical meaning such as degree or time domain. Liu Yan and Li Jinping (2011) have used empirical methods to verify that the image schema is more beneficial to improve the teaching efficiency in comparison with the traditional teaching model.

2. DEFINITION OF IMAGE SCHEMA

Image and schema are two separate concepts at the very beginning. Image is a cognitive ability to form mental representation, that is, even the overall image of the object can be obtained through psychological cognition Schema is dynamic framework formed in the touch with the exterior world. Kant emphasizes that the schema is the concept existing in the human brain. (Kant, 1990) Lakoff and Johnson introduce the concept image schema on the basis of metaphor, which is closely linked with image schema. Johnson claimed that "an image schema is a recurring, dynamic pattern of our perceptual interactions and motor programs that gives coherence and structure to our experience".(Johnson,1987:xiv) [2]

3. IMAGE SCHEMA ANALYSIS OF PREPOSITIONS OVER, THROUGH AND ACROSS

3.1. The image schema of through

3.1.1. The first image schema

In Oxford Dictionary, the meaning of through is "into one side or end of an entrance, passage, hole and out of the other side or end", this is dynamic. It shows the movement in spatial experience. Therefore, it can be inferred that the basic image schema of through is "trajector-path-landmark" which is similar to "Source-Path-Destination Schema" proposed by

Lakoff (1987). When new concept or meaning appears, people will make sense through the image schema and iconicity and prompt associations. The prototypical schema can be given as follows:

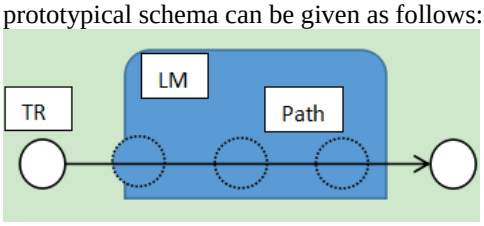

Figure 1. "Source-Path-Destination" schema

In Figure 1, the white circles represent the Trajector (TR), which is the main part of process, the blue area is the Landmark (LM), it is related to spatial domain, and the black arrow represents the Path.

For example.

The rain poured through the roof of the Liverpool Playhouse.

The thief got in through the window.

In these sentences, the Trajector (TR) are "the rain"and "the thief" respectively, the Landmark (LM) are "the roof" and "the window" correspondingly, and the path is the movement of Trajector from the start point in the spatial range.

3.1.2. The second image schema

The second meaning of through is "moving throughout", its schema can be shown in Figure 2. Similarly, the white circle is TR, the blue area is still the LM and it represents an infinite range and the black arrows are the Path. The multiple arrows around the TR represents the connotation "all around". This can be explained in detail in the following sentences.

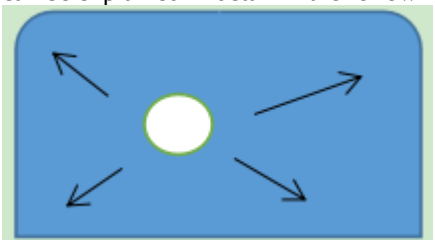

Figure 2. "moving throughout" schema

There is water through the floor.

I toured through Europe last summer.

In the sentences above, the TR are "water", "I", The LM are "the floor" and "Europe", the Path describes the state of "water", "I" in the space. The direction of movement is arbitrary.

3.1.3. The third image schema

The third meaning of through is "from the beginning to the end of an experience" in Oxford Dictionary, the schema can be shown as Figure 3 The TR moves along the path within the LM from the starting point to the ending. The key is that both the starting point and the ending point are within the certain setting range that is the same as Figure 2. The TRs are "a man" and "cold weather". The landmarks are "life" and "the spring". They reveal the moving in the limited time. A person's life and spring can never be eternal,

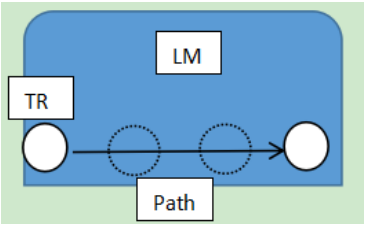

Figure 3. "from the beginning to the end" schema

A man's biggest fear is going through life without a purpose or anybody remembering him.

The cold weather continued through the spring.

3.1.4. The fourth image schema

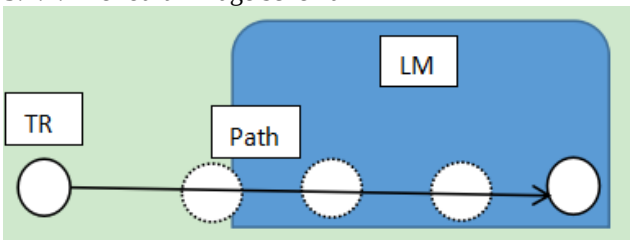

Figure 4. "outside-inside" schema

As can be seen from Figure 4 that the TR moves from the outside of the landmark to the inside, and the ending point serves as a signal to remind the finishing of the movement process. In these sentences, The TRs are "the book" "the bus" , the Landmarks are "the whole procedure", "New York". It is similar to Figure 1 and Figure 3, but the starting point of the TR is different. All four figures possess the common feature of "passing through". However, the location of the source and the path are different.

The book guides you through the whole procedure of buying a house.

This bus goes through to New York.

3.1.5. The metaphorical meaning extension

Lakoff (1978) classified conceptual metaphors into three branches: structural metaphor, orientational metaphor and ontological metaphor. Structural metaphor is to use one concept to construct another concept, two concepts belong to different cognitive domains but the structure is the same.Orientational metaphor aims at conceptual system, such as "up/down", "inside/ outside". For example, good or bad mood can be represented by "up" and "down". Ontological metaphor transforms abstract concept to a tangible entity. For example, "the rapid transmission of information highway" can be called "information highway"

The static metaphorical meaning is derived from the four dynamic image forms. That is namely "thoroughness and completeness." It is used to express the degree and the dynamic spacial concept was extended to the "degree domain". In the sentences below, "read through"mean "thoroughly".

(13)As you read through some of these descriptions, you might have recognized a few traits within your own organization or project.

The dynamic schema of through also extends the meaning to express "by virtue of, by means of". In the

following sentences, through is to express the way of act.

(14) She got her first job through an employment agency. [3]

3.2. The image schema and extension of Over

3.2.1. The first image schema

Over, as a polysemous preposition, possesses a wide range of complicated network in different collocation. Its prototypical schema is also on the spatial level. According to its meaning, this article classifies it into static and dynamic. Unlike Through, its prototypical schema is static, which can be indicated in Figure 5. The TR is above the landmark LM, without touching. This is only to express the orientational relationship with no moving path between the TR and the LM. In these three sentences, there is spatial relations between the TR and LM.

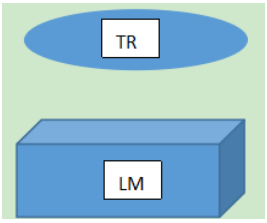

Figure 5. "orientational relationship" schema

(15)A lamp hung over the table.

(16)A helicopter flies low over the harbour.

3.2.2 The second image schema

Another schema, derived from the first schema, is used to express "coverage" in Figure 6. It can be seen that the TR touches with the LM. There is also no moving path. In the two sentences, "jacket" covers the sweater and the "tablecloth" covers the table.

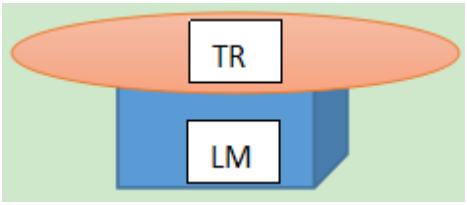

Figure 6. "coverage" schema

(17)She wore a large jacket over her sweater.

(18)Throw a tablecloth over the dinning table.

3.2.3 The third image schema

The dynamic meaning is "from one side to the other side", as in Figure 7. In the schema, TR "flies" above the LM to the other side. In the two sentences, the moving path is above the LM.

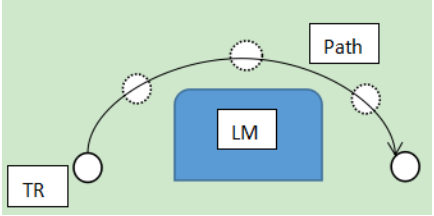

Figure 7. "from one side to the other side" schema

(19)Somehow the sheep had jumped over the fence.

(20)The road over the mountains is steep and dangerous.

3.2.4. The fourth image schema and the extended meaning

Sometimes, the preposition over means "overturn" in Figure 8 below. According to the spatial schema, the metaphorical meaning is extended to the quantity domain to express a general quantitative sense, which means "beyond". The same mapping process also lies in its meaning of the time domain, which refers to "during". These mapping relations can be illustrated in the following sentences. In the first sentence, "over" means "more than", in the second sentences, it means "during".When mapping to the degree domain, over possesses the implications of "end" or "recover from".

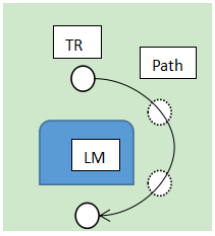

Figure 8."overturn"schema

(21)This is a social club for the over-60s.

(22)Will you be home over the summer vacation?

3.3. The image schema of across

3.3.1. The two main image schemata

Compared with the image schemata of through and over, the image schema number of across is less than those of the other two ones. the basic meaning of across is "on the opposite side", the spacial position of two objects can be described in the following schema.

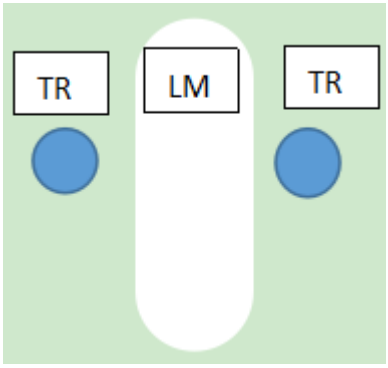

Figure 9."on the opposite side" schema

On both sides of the LM are TRs, the path is 0. It is quite different from that of through and over. The dynamic schema generates from daily life. In Figure 9 and Figure 10. The two schemata are different from those of over. The position relations between two Trajectors is opposite. In the following sentences, across in the first one is static, whereas in the second one, it is dynamic. [4]

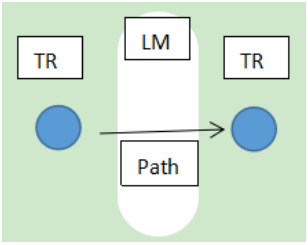

Figure 10.opposite position schema

(23)They parked across from the Castro Theatre.

(24)He watched Tom run across the street to his mom.

3.3.2. The metaphorical meaning extension

The static scheme of across is also used to extend its meaning to numeric domain to indicate "wideness". For example: This plate measures 14 inches across. The plate is 14 inches wide. In Oxford Dictionary, there is an extended meaning "when something happens across a place or organization, it happens depending everywhere within it". For example: The film opens across the country on December 11th. That is the film was released across the country on December 11. Another implication is "toward", for example, He walked across to where I was sitting, that is to say he walked toward me. These implied meanings are the results of mapping process in long term use. [5]

4. CONCLUSION

In this study, the image schemata of three polysemy prepositions have been explored according to example sentences collected from dictionaries. The author tried to expound the conversion and mapping process between exterior world and cognitive domains. As for the preposition through, four kinds of abstract schema have been reflected in the meanings. They have different meanings respectively, they are "into one side or end of an entrance, passage, hole and out of the other side or end", "moving throughout", "from the beginning to the end of a experience" , "moving until to the end" the image schemata manifested in these three meanings are dynamic. There are metaphorically extensions, which are assumed to be static. The differentiation between dynamic and static condition is quite distinct. However, some static metaphorical extended meanings are hard to be manifested in graphics or figures. [6]

About the preposition over, similarly, there are four image schemata, two of them are dynamic, the others are static. Over means "more than", "during" or "recover from" in different context or situation. With regard to across, two image schemata and three extended meanings appear in this word usage. About image schema, the differences of these three words are expounded clearly. In this way, English learner cannot be confused about their usage in sentence. Daily experience is integrated with SLA. Boring recitation will be replaced by semantic deduction. Language meaning and form will be easier to grasp.

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Analysis of Influencing Factors of Molten Steel Deoxygenized Alloy Based on Grey Prediction

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Abstract: Through the comparative analysis of 1700 experimental data of "deoxidization and alloying" of molten steel, we try our best to exclude the influence of human and other unrelated factors, and use the grey correlation analysis to analyze the factors affecting the conversion efficiency of C element and Mn element, and then give some suggestions.
Keywords: Data Standardization; Pauta Criterion; Grey Relation Prediction

1. BACKGROUND

Iron and steel is one of the most important resources in industrial manufacturing. As a large industrial country, China's iron and steel output has been the first in the world for more than 10 years since the end of last century. However, the quality of steel is sometimes unsatisfactory, and deoxidization and alloying is an important link in steel refining, which plays an important role in the quality of steel. So in order to improve the quality of steel, how to optimize the deoxidization and alloy link and reasonably reduce the cost to improve the quality of steel has become a very important issue in recent years[1].

In order to better improve the conversion efficiency in industrial production, we use the gray correlation analysis to analyze and process 1717 experimental data in the actual production process, study the C and Mn elements in them, find out the factors that have the greatest impact on the conversion efficiency and give some suggestions[2].

2. CLEANING OF ORIGINAL DATA

Due to the huge amount of 1717 pieces of original data, which would be affected by a large number of unrelated factors, the data deviation of different experimental results is very large, so we need to clean out more typical data[3].

First of all, K-S normal test should be carried out for C content and Mn content at the end of original data transfer furnace (Table 1) [4]

Table 1 single sample Kolmogorov Smirnov test

		End point of C	End point of Mn
N		1627	1627
Normal parametera,b	Average	0.0006361	0.001026
	standard deviation	0.00020648	0.0002389
The most extreme difference	Absolutely	0.079	0.085
	Positive	0.040	0.085
	Negative	-0.079	-0.083
Test statistics		0.079	0.085
Asymptotically significant (two tailed)		0.000c	0.000c
a. Verification distribution is normal.			
b. Calculate from data.			
c. Lilliefors Significant correction			

According to table 1, the gradual significance is 0.00, indicating that the final content distribution of the two elements in different experiments is normal. In order to get the best result, this paper uses the "Pau ta criterion" to screen the experimental data, that is, after the data is standardized, according to the result,the part of the converter end-point of C and Mn data score less than - 3 or greater than 3 is removed, and 1616 sample data are left after the removal[5-6].

3. CALCULATION OF HISTORICAL YIELD

$$\text{Amount of alloy added} = \frac{\omega_{B,\text{middle limit}} - \omega_{B,\text{remainder}}}{\omega_{B,\text{alloy}} \times \eta_B} \times \text{Tapping quantity} \quad (1)$$

From the above formula, it can be concluded that in the normal industrial production process, workers will add a large number of alloys to the molten steel by experience. Therefore, under the condition that the specification limit and tapping amount are determined, the input amount of alloy should also obey the normal distribution.

$$\eta_i^{\alpha} = \frac{\beta_i^{\alpha} - \alpha_i^{\alpha}}{\sum_{type} M_i^{type} \times \omega_{\alpha}^{type}} \quad (2)$$

Among them, i is the experiment number, η_i^{α} is the conversion efficiency of element α, α and β are the content of elements in the molten steel before and after the converter end point, M_i^{type} represents the type of raw material and ω_{α}^{type} represents the content of element α in the raw material.

At the same time, in the analysis of the remaining experimental results after data cleaning, it is also found that in some experiments, due to the lack of experience of processing workers, the raw material input is not enough to meet the needs of steel-making, resulting in the generation of defective products. Therefore, it is necessary to further process the experimental data, that is, to make certain restrictions on the input of raw materials in the experimental data. According to the data used in this paper, firstly, standardize the absorption of C and Mn elements, take the values distributed in (μ - σ, μ + σ), and finally get 982 experimental data, and calculate their average historical yield (Table 2) [7].

Table 2 Historical average yield of C and Mn after data cleaning

Historical yield of C	Historical yield of Mn
92.34%	89.88%

4. GREY PREDICTION ANALYSIS OF ELEMENT YIELD

After calculating the historical yield of C and Mn, due to the large number and miscellaneous types of factors affecting the yield, it is decided to look for the main factors affecting the yield in the data by grey correlation analysis after consulting the relevant data [8].

According to the requirements of grey correlation analysis, the absorption rate of elements is regarded as the parent sequence

$$Y = Y(k)\,|k = 1,2..n \quad (3)$$

Other influencing factors as subsequences

$$X_i = X_i(k)\,|k = 1,2..n, i = 1,2..m; \quad (4)$$

Normalize the data of element absorption rate and otherinfluencing factors:

$$\begin{cases} X_i(k) = \frac{X_i(k) - Min\{X_i(1), X_i(2) .. X_i(k)\}}{Max\{X_i(1), X_i(2) .. X_i(k)\} - Min\{X_i(1), X_i(2) .. X_i(k)\}} \\ Y(k) = \frac{Y(k) - Min\{Y(1), Y(2) .. Y(k)\}}{Max\{Y(1), Y(2) .. Y(k)\} - Min\{Y(1), Y(2) .. Y(k)\}} \end{cases}$$

when $\Delta_i(k) = |Y(k) - x_i(k)|$ (5)

Calculate the correlation coefficient:

$$\xi_i(k) = \frac{min_i\, min_k \Delta_i(k) + \rho max_i\, max_k \Delta_i(k)}{\Delta_i(k) + \rho max_i\, max_k \Delta_i(k)} \quad (6)$$

Where $\rho \in (0, \infty)$, known as the resolution coefficient, usually $\rho = 0.5$

The correlation degree of each influencing factor is as follows:

$$r_i = \frac{1}{n} \sum_{k=1}^{n} \xi_i(k), k = 1,2,..,n \quad (7)$$

Through the calculation of the above formula, the correlation degree of the influencing factors of the historical yield of C from the grey prediction model is shown in the table below (Table 3):

Table 3Correlation degree of influencing factors of C historical yield rate

Influence factor	correlation degree	influence factor	correlation degree
Molten steel net weight	0.710	end temperature	0.700
Petroleum coke carburizer	0.691	manganese silicon	0.677
end point of C	0.673	Calcium aluminosilicate	0.667
Vanadium iron	0.659	Nitridedferro vanadium	0.617
Silicon carbide 55	0.597	silicon aluminum alloy	0.577
Vanadium nitrogen alloy	0.569	ferrosilicon	0.559
Silicon aluminum manganese alloy ball	0.554	low aluminum ferrosilicon	0.554
Silicon calcium carbon deoxidizer	0.545		

According to the data, the greater the correlation of the influencing factors, the greater the impact on the historical yield of C. Therefore, it can be seen from table 3 that the net weight of molten steel, converter end-point temperature, petroleum coke carburizer and manganese silicon alloy have the largest correlation, so the main factors affecting the historical yield of C are the net weight of molten steel, converter end-point

temperature, petroleum coke carburizer and manganese silicon alloy.

According to the table, it can also be seen that the main factors affecting the historical recovery rate of Mn are the net weight of molten steel, the end-point temperature of converter, the carburizing agent of petroleum coke and manganese silicon alloy (Table 4).

Table 4Correlation degree of influencing factors of Mn historical recovery rate

Influence factor	correlation degree	influence factor	correlation degree
Molten steel net weight	0.786	end temperature	0.754
Petroleum coke carburizer	0.737	manganese silicon	0.706
end point of Mn	0.704	Vanadium iron	0.688
Calcium aluminosilicate	0.653	Silicon carbide 55	0.614
Nitridedferro vanadium	0.590	silicon aluminum alloy	0.548
Vanadium nitrogen alloy	0.533	ferrosilicon	0.523
Silicon aluminum manganese alloy ball	0.510	low aluminum ferrosilicon	0.510
Silicon calcium carbon deoxidizer	0.510		

5. CONCLUSION

In this paper, through the analysis of the data in the actual production and life, the experimental data are cleaned and analyzed by using the "Pau tacriterion" and the grey correlation analysis, and the following conclusions are drawn:

From the grey correlation prediction analysis, we can get that the transformation efficiency of C and Mn elements is most related to the net weight of molten steel. The greater the quality of molten steel, the higher the transformation efficiency of the two elements, which also reflects the advantages of large-scale production to a certain extent.

In addition to the net weight of molten steel, the converter end temperature, petroleum coke carburizer and manganese silicon alloy all have a great impact on the conversion efficiency of the two elements, which also tells us that in the industrial production, more elements are put into the reaction, which can greatly improve the efficiency of the reaction.

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Discussion on Badminton Teaching Thoughts in Colleges and Universities under the Background of National Fitness Strategy

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Abstract: In order to enhance people's physical quality, the national fitness strategy is put forward that aims at making people to improve their personal physical quality through fitness and enhancing the comprehensive national strength. On this basis, college badminton teaching is rather important. Badminton teaching in colleges and universities is not only an important way to improve college students' physical quality, but also an effective way to carry forward the tradition of badminton teaching in China. Based on the era, colleges and universities can improve teaching method and content to lay a foundation for badminton teaching in colleges and universities of China.
Keywords: national fitness strategy of badminton; colleges and universities; badminton teaching.

1. THE CURRENT SITUATION OF BADMINTON TEACHING IN COLLEGES AND UNIVERSITIES

The teaching thought is the general framework which carries on the classroom teaching, and is made up of parts that connected with teaching activity. Therefore, the teaching thought means a lot to badminton teaching in colleges and universities. However, according to the current situation, badminton teaching in colleges and universities still have some problems, for it is hard to increase students' interests of badminton or make them love this sports. Thus, we should improve teaching methods and contents of badminton to lay a foundation for badminton development in colleges and universities and make the national fitness strategy come true [1].

1.1. Teaching Materialistic Phenomenon is Serious

Currently, most colleges and universities still use physical examinations to test students' classroom learning. Under such circumstances, the teaching content will close to test standards, which limits teaching content. Students then become materialistic and just focus their attention on tests. They just take exercises on those will be tested. It is hard to make students love badminton and will not be good for badminton teaching and the implementation of national fitness in this way [2].

1.2. Obsolete Teaching Facilities with Single Method

Limited to money and facility, colleges and universities still use obsolete teaching facilities currently, and their teaching content and method also are quite single. For example, most teachers explain first and then ask students to exercise in two people during the teaching process. It is difficult to make students to learn the spirit of competition and the cooperation consciousness of badminton with this teaching method, and it's not easy to inspire students' interests for badminton [3].

1.3. Shortage of Teachers and Lack of Teaching Power

With the national fitness strategy putting forward, people pay more and more attention to physical education in colleges and universities. However, during the period of primary and secondary schools, we attach much importance to examination results and pay little attention to physical education, so the physical quality of the current college students are very poor. Besides, teacher of physical education is considered a multifunctional position in some colleges and universities. Colleges and universities don't have a highly standard to apply for teachers of physical education, who always be arranged to do other works rather then physical education teaching. Mostly, the shortage of teachers and lack of teaching power in colleges and universities are unfavorable to students' survival and development in the future.

2. VALUE ANALYSIS OF BADMINTON TEACHING REFORM IN COLLEGES AND UNIVERSITIES UNDER THE BACKGROUND OF NATIONAL FITNESS

Due to the lack of attention to physical education teaching in primary and middle schools, the physical quality of college students is generally poor, and gradually getting worse. Under this background, our country strongly advocates national fitness, which conforms to the trend of the times and benefits the development of our country and people. At the current times, more and more colleges and universities begin to establish teaching concepts according to their own actual situations, and they are going to integrate the national fitness concept into the physical education in colleges and universities. Under the background of national fitness, badminton teaching reform in colleges and universities will improve students' physical quality and strengthen their coordination and sensitivity, and which can foster the cooperation spirit and competition consciousness of students and be good for students' future development.

Firstly, badminton is different from running, long jump and other sports that require a lot of

perseverance, it's a very ornamental sport. If teachers can improve their teaching method that can be in line with the trend of times according to actual situation, then students will take exercise through badminton and grasp the spirit of badminton. Secondly, there are many ways to play badminton. Teachers can organize students to play singles or doubles to promote communication among students and make students experience the happiness of friendship by playing badminton. We ought to be clear: college students are the future of our country and the hope of our nation. Therefore, teachers should improve badminton teaching method of colleges and universities according to actual situation, provide more appropriate badminton teaching for students, that will let students get the importance of fitness and make the national fitness strategy really come true.

3. EFFECTIVE TEACHING IDEAS OF BADMINTON TEACHING IN COLLEGES AND UNIVERSITIES UNDER THE BACKGROUND OF NATIONAL FITNESS

3.1. Rational Guidance, Inspire Students' Interest of Learning

We need to be clear: interest is the best teacher. If students can be interested in badminton, then they will be more likely to learn and study on their own initiative, which is helpful to the development of classroom. Thus, teachers should inspire students' interests of badminton learning through appropriate guidance based on actual situation to lay a firm foundation for students' future development.

For instance, teachers can tell students the origin and history of badminton in the first class, so that students will have a general grasp of badminton. After that, teachers can give students more encouragement and support during the teaching to increase their confidence and make them more willing to do this sport. At last, teachers should make it clear to students: everyone can do this sport well, and the key point is whether you're willing to do or practise. In this way, it can improve students' confidence to some extend and lay a firm foundation for students' future development.

3.2. Based on the Actual, Specification of Students' Basic Technical Movements

Basic technical movements are the fundamental content. Teachers should specify students' basic technical movements based on the actual during the teaching, which can lay a firm foundation for students' future learning and development.

3.2.1. Carrying Out Differentiated Teaching

It is hard to measure students with the unified standard, for they are not in the same level. Thus, teachers can carry out differentiated teaching according to different students, which can improve teaching efficiency and quality to lay a good foundation of nice physical quality for the future study and development of students.

For example: teachers can arrange technical tests of badminton at the first class, and divide students into three groups according to their scores. One group is good-based students, the second group is general students, and the third group is poor-based students. Then, teachers can give different practise tasks to each group based on their real condition. For instance, the basic techniques of badminton can be divided into four parts: grip, service, shuttle and footwork. After telling the basic techniques of badminton, teachers can require the first group to practise the first three parts of badminton's basic techniques in a fixed time, the second group to practise the first two parts in a fixed time, and the third group to practise the first part in a fixed time. In this way, it can help to improve teaching efficiency and make students learn more knowledge in limited time.

3.2.2. Carrying Out Teaching with Emphasis

Teachers should pay more attention to details and carry out teaching with emphasis during the teaching course. Because it can not only help to reduce students' learning resistance in the very great degree, but also improve students' academic performance.

For example, when teachers teach students the basic technical skills of badminton, as standing of badminton, students can study together. However, when leading students to learn how to hold the racket, serve or hit the shuttle, teachers should explain carefully and let them practise in groups. In this way, not only can the whole point demonstration be combined with the sub-point demonstration, but also can highlight the key points and improve teaching efficiency, which will be helpful to students' development in the future.

3.3. Looking at the Frontier and Innovating Teaching Mode and Method

With the development of social, education should keep up with the times. To provide a nice teaching experience for students, to make students get into the habit of national fitness, to lay a good foundation of habit and physical quality for students' future development, teachers should look at the frontier and innovate teaching mode and method.

3.3.1. The Application of Multimedia to Teaching

We all know that badminton involves different kinds of sports postures. This posture, if only dictated by the teacher, then it is hard to get the connotation of badminton for those students with weak basis in badminton. Therefore, teachers can display and guide postures by the application of multimedia to teaching to improve teaching efficiency.

For instance, with the introduce of multimedia to teaching, firstly, teachers should ask students to watch the demonstration action with the normal speed before learning new postures, so that students can have a more comprehensive understanding of the movement direction and the lines of action; Secondly, watching the demonstration action in a slow speed to make students know the action image, structure and details for deepening impression in mind of students.

Lastly, teachers can build a network platform, then students can study by themselves after class, taking a further study to achieve the result of improving teaching efficiency and the physical quality of students.

3.3.2. The Application of Single and Combination Teaching Method to Carry Out Teaching

The so called "single and combination teaching method" is: during the teaching, teachers explain the postures of badminton one by one to students. After having finished the single actions, teachers then ask students to do exercise in combination to form a complete action system finally. This teaching method of step by step approach is an excellent way to improve students' badminton level.

For example: when leading students to learn footwork, teachers should make it clear of the key contents of footwork. Then teachers can lead students to study one by one. Teachers ought to grasp the basic footwork of parallel step, cross step, pedal step and stepping to carry out repeated practise. They can take practise in combination after mastering these footwork. This method is quite useful in the course of learning basic skills and is worth using by teachers.

3.3.3. The Application of Multi-ball Training to Carry Out Teaching

Multi- ball training refers to a technical training method of using multi-ball in ball sports. Multi-ball training applies to students of different levels, which is suitable for those with weak foundation of badminton when entering the physical education. Muiti -ball training method can not only practise students' speed of reaction,but also improve students' sensitivity of limbs. It can practise students' patience, strengthen their physical quality, can be helpful to students' development in the future.

For example: teachers can put students in pairs and give each of them three to four balls when teaching. Teachers do a demonstration for students, then ask them to practise in groups. One serve, the other receive. Teachers time and count beside, and provide skilled guidance for students according to their actual situation. So it can practise students' physical quality, improve their skill, cultivate their capacity of cooperation which will be helpful to students' development in the future.

4. CONCLUSION

In summary, badminton teaching in colleges and universities is rather important under the background of national fitness. Therefore,during the course of teaching, teachers can inspire students' interests of learning through coordinate guidance, teachers can specify students' basic technical action on the actual basis, teachers can look at the frontier and innovate teaching mode and method to improve badminton teaching mode in colleges and universities, to optimize teaching content, to provide a nice teaching experience for students , to make the national fitness strategy really come true.

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Exploration of Teaching Reform of *Software Testing* Course Based on OBE

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Abstract: The teaching of *Software Testing* course should constantly adapt to the changes of social needs and meet the dynamic needs of IT enterprises. This paper explores teaching reform of *Software Testing* course based on OBE. It first analyzes the expected learning outcomes of the course. And then it discusses the reverse design of class teaching contents based on learning outcomes. Multiple teaching methods driven by learning outcomes are proposed, and the evaluation method of achievement degree of learning outcomes are also introduced which provides a reference for teachers and universities to improve *Software Testing* course teaching.
Keywords: OBE; Software Testing; Course Reform

1. INTRODUCTION

OBE (Outcome-Based Education) is an educational model which organizes, implements and evaluates education based on outcomes. The OBE model adapts to the needs of the society, especially the business community for talents, that is, students' skills and abilities are presented in observable, measurable and applicable forms [1]. In order to promote the reform of engineering education and improve the quality of engineering personnel training, OBE concept has become the focus of wide attention in local engineering colleges [2].

Different from the traditional teaching mode, in the idea of OBE, teachers should pay more attention to the learning outcomes of students. In OBE, all the educational activities, processes and all the design of teaching lessons should focus on the realization of expected learning outcomes [3]. OBE focuses on the following issues:

1) What do students need to learn and master? In order to solve this problem, we should make clear the teaching knowledge system and break down the objectives of the teaching process.
2) Why are students required to learn these? The ultimate goal of teaching is to enable students to achieve certain ability requirements, which requires the interpenetration of multi-objective teaching concepts, and ultimately achieve the overall goal of the requirements and expectations of students, the society and the state.
3) How to help students achieve these outcomes? This requires effective organization and control of the teaching process with learning objectives and outcomes as the guidance.
4) How to effectively guide students to achieve these learning outcomes? This requires the establishment of a sophisticated and scientific assessment and appraisal system to evaluate teaching results.

OBE focuses on students' understanding, mastery and application of learning knowledge, and no longer emphasizes what teachers teach. OBE education mode has realized the transformation of education paradigm from "content oriented" to "outcome oriented". Teaching objectives (students' expected outcomes) exist before teaching contents. Curriculum, teaching methods, student management and so on should be carried out around the expected results [4]. OBE does not put forward requirements for specific teaching methods, only for the final learning outcomes of students.

2. LEARNING OUTCOMES OF SOFTWARE TESTING COURSE

Engineering Education Accreditation emphasizes that training objectives are the goals of learning outcomes for all qualified graduates, not the expectation and slogan for excellent students, but the ruler of teaching work. According to CDIO, there are four types of stakeholders in applied engineering education: students and parents, enterprises, teachers and society. The determination of professional training objectives and graduation requirements depends on a comprehensive investigation and analysis of the needs of all stakeholders [5].

After making a thorough exploration of the 12 requirements for graduates in the general standard of *China Engineering Education Accreditation*, investigating students and their parents, teachers, alumni, IT enterprises and other stakeholders, understanding the application of new technology and development platform, and the impact of regional economic or industrial restructuring on the needs of graduates in the next few years, as well as combining with the positioning of our university, we derive the training objectives (i.e. learning outcomes) of software testing direction in software engineering specialty [6]. The defined learning outcomes can be presented in three different levels of abstraction.

First of all, according to the general standard of *China Engineering Education Accreditation*, the top level learning outcomes of software testing direction are specified as follows.

O1: Ability to apply mathematics, computer science, software engineering fundamentals and software testing expertise to solve complex engineering

problems.

O2: Be able to apply the basic principles of software testing, identify, express and analyze complex engineering problems through literature research to obtain effective conclusions.

O3: Ability to plan and design software testing processes and methods to meet specific project requirements.

O4: Ability to design and implement testing work as well as analyze and interpret the results.

O5: Be able to develop, select and use appropriate technologies, resources and tools for complex project testing problems.

O6: Be able to analyze and evaluate the impact of professional engineering practices and problem-solving solutions on society, health, safety, legal system and culture, as well as the impact of these constraints on project implementation.

O7: Be able to understand and abide by the professional ethics and norms of software testing engineers in practice and perform their duties.

O8: Be able to play the role of individual, team member and manager in the project test team.

O9: Ability to communicate effectively.

Table 1 Matching matrix of some course contents and top level learning outcomes

Course Contents	**Top Level Learning Outcomes**										
	O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11
Concepts and ideas of software testing	√	√	√			√	√	√	√		√
Static testing	√	√	√	√	√	√		√	√		
Unit testing – Boundary value testing	√	√	√	√	√			√	√		
Unit testing – Equivalence class testing	√	√	√	√	√			√	√		
Unit testing – Decision table-based testing	√	√	√	√	√			√	√		
Unit testing – Control flow testing	√	√	√	√	√			√	√		
Unit testing – Data flow testing	√	√	√	√	√			√	√		
Integration testing	√	√	√	√	√			√	√		
System testing	√	√	√	√	√	√		√	√		
Test management	√	√	√		√	√	√	√	√	√	

4. IMPLEMENTATION OF SOFTWARE TESTING COURSE TEACHING DRIVEN BY LEARNING OUTCOMES

According to the OBE reverse driving method, teachers put the judgmental indicator points of expected learning outcomes into teaching activities, and design the teaching according to the expected results of the course. Different learning outcomes should be cultivated with appropriate teaching contents and strategies in order to achieve better results [7]. Specifically,

1) For O1, it is mainly cultivated through the lecturing of professional knowledge of software testing course.
2) For O2, it is mainly trained through the lecturing of professional knowledge of software testing course. In teaching, the methodology of "problem analysis" is emphasized to cultivate students' ability for scientific thinking.
3) For O3, it is mainly cultivated through experimental classes and project-driven practical teaching sections.
4) For O4, it is cultivated by software testing theory lectures, experiment class, practice sections and various research activities inside and outside the class.
5) For O5, it is mainly cultivated through software testing theory lectures, experiment lessons and project-driven practice section.
6) For O6, it is mainly cultivated through project driven practice section, self-studying and team discussions.
7) For O7, it is mainly trained through course lecturing and practical teaching sections. The cultivation of professional ethics of software testing engineers should be implemented into the training of students' basic qualities, such as honesty and justice (true reflection of learning outcomes, no concealment of problems, no

O10: Be able to understand and master the principles and methods of software test management.

O11: Have the consciousness of self-study and lifelong study, as well as the ability of continuous studying and adaptive development.

Then, the top level learning outcomes are concreted. And the second level learning outcomes of software testing direction are determined. Finally, the second level learning outcomes are analyzed in detail to get the third level learning outcomes. Around the expected graduation abilities, the teaching contents of software testing course are designed in reverse. The conceptual expression of learning outcomes has been transformed into a series of practical and measurable indicator points.

3. DESIGN SOFTWARE TESTING COURSE CONTENTS BASED ON LEARNING OUTCOMES

According to the defined learning outcomes, combined with the software testing knowledge domain, the teaching contents of software testing course are designed in reverse. And a matching matrix between the course contents and learning outcomes is obtained. Table 1 shows part of the matrix of some course contents and top level learning outcomes.

exaggeration or fabrication of results, etc.), as well as integrity and abiding by rules (punctuality, no cheating, respect for intellectual property rights, etc.).

8) For O8, it is mainly cultivated through various teaching activities in and out of class, project team tasks, discussions and other cooperative learning activities.
9) For O9, it is mainly cultivated through relevant theoretical and practical lessons, project team tasks, special seminar activities, etc.
10) For O10, it is mainly cultivated through the lecturing of software testing theoretical lessons and project-driven practical teaching sections.
11) For O11, it is mainly cultivated through enlightening and guiding course teaching strategies, as well as the practical sections inside and outside the class.

A variety of teaching methods and strategies are adopted integrating with teaching resources such as teachers and teaching equipments, in order to ensure the achievement of learning outcomes and guide students to carry out inquiry learning and active learning. According to the idea of OBE, the teacher accurately grasps the learning track of each student in the teaching process, and learns the goal and process of each person in time. Thus it realizes the teaching work playing an effective role in all students that Engineering Education Accreditation advocates. And it is proved that it has produced the expected effects on all students

5. ASSESSMENT OF LEARNING OUTCOMES

In OBE, teaching evaluation focuses on learning outcomes. And through a clear understanding of students' learning status it provides reference for schools and teachers to improve teaching.

The evaluation of learning outcomes of software testing course can be done in detail. The assessing items are refined to correspond to the indicator points of expected learning outcomes. According to the results of assessment, the reaching degrees of learning outcome indicator points are calculated. And then the achievement degrees of learning outcomes can be calculated based on the reaching degree of indicator points. Through this method, we can not only compare the achievement of different indicator points of software testing course in the same year, but also compare the achievement of learning outcomes between different academic years of this course. By comparison, we can find out the weak points of learning achievement, so as to find out the direction of rectification, adjust teaching strategies, gradually improve teaching approaches, reduce and avoid knowledge gaps and omissions, and make students' learning outcomes develop more balanced. This is not only conducive to the balanced development of curriculum learning, but also can determine which course objectives are unreasonable, so as to adjust the syllabus, modify the training program, and gradually improve the quality of teaching.

6. CONCLUSIONS

OBE education mode can effectively improve the quality of teaching by clarifying the learning outcomes, straightening out the relationship between teaching contents and students' abilities. This paper analyzes the expected learning outcomes of software testing course, discusses the reverse design of classroom teaching contents based on learning outcomes, and multiple teaching methods driven by learning outcomes, and introduces the evaluation method of reaching degree of learning outcomes. It provides a reference for universities and teachers to improve their teaching effects of software testing course.

In the future, we will further optimize the relationship among learning outcomes, teaching contents and strategies according to the evaluation feedback, and seek to adopt a more effective and comprehensive assessment method

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Intelligent Teen Vision Correction System Design

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Abstract: China has become the country with the highest incidence of myopia in the world, and the problem of myopia in adolescents has received more and more attention. Based on this, this paper designed a smart vision correction system designed to supervise the correct use of eyes by teenagers. The system uses the single-chip microcomputer as the controller, which can effectively correct the writing and reading posture of teenagers, avoid long-term bad sitting posture habits to a certain extent, avoid eye myopia, affect learning and vision, and at the same time have low cost, intelligent operation control and humanization. , practicality and other advantages.
Keywords: Vision protection; Sensor; Single chip microcomputer; Voice alarm

1. INTRODUCTION

With the continuous advancement and development of modern technology, electronic products such as mobile phones, tablets, and game consoles are becoming more and more popular. While bringing convenience to people's life, study, work, entertainment, etc., the number of young people suffering from myopia is increasing year by year. There are many products that protect eyesight on the market, such as eye massagers, sitting posture correction clothes, etc. Eye protectors are used to protect the eyes, but are not recommended for long-term use， the sitting posture correcting clothes force the posture correction through the force, which causes the students' spine and muscles to be greatly damaged. In this regard, this paper proposes a design of intelligent teenage vision correction system. The program, this smart vision protector can remind young people at any time, sit upright, straighten the back, develop good reading and writing habits, effectively prevent hunchback, spine bending and myopia and other physical diseases.

2. SYSTEM STRUCTURE DESIGN AND WORKING PRINCIPLE

This design is based on the new members of the smart home, does not pick the desktop aligner [1], for most tables of different shapes and thicknesses, such as work tables, study tables, dining tables, conference tables, etc., to protect young people's vision Intelligent system. As shown in Figure 1, the system uses a single-chip microcomputer as the controller, which mainly includes a button module, a display module, a voice alarm module, a sensor module, etc. The design also incorporates the design of the mobile APP control and display function, and uses the Bluetooth module for hardware. And mobile APP data transmission, control system switch, display the time and number of electronic devices used by the system and the parameters of the viewing environment.

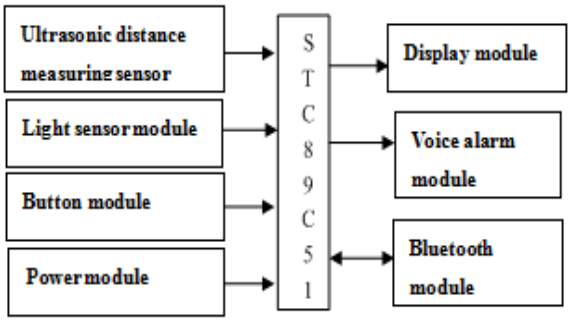

Figure 1 system block diagram and working principle

3. SYSTEM HARDWARE COMPONENTS

3.1. Ultrasonic ranging sensor module

Ultrasonic is a kind of high-frequency sound, which has the advantages of strong directivity[2], slow energy consumption and long distance of propagation. It is often used for distance measurement. This system uses HC-SR04 ultrasonic sensor to measure distance and can provide 2cm-400cm. Non-contact distance sensing function, ranging accuracy up to 3mm, fully meet the needs of this design, ultrasonic ranging sensor module includes ultrasonic transmitter, receiver and control circuit, which uses ultrasonic pulse echo emission receiving time method Realized, working principle: set the time that the ultrasonic pulse is emitted from the sensor to the receiving, and the ultrasonic wave propagation speed in the air is c, then the distance L from the sensor to the target object can be obtained by the following formula: L=ct/ 2.

3.2. Light sensor module

The optical sensor module uses the BH1750 chip. The BH1750 ambient light sensor has a 16-bit analog-to-digital converter that can directly output a digital signal without the need for complicated calculations. This is a more sophisticated and easy-to-use version of a simple resistor that calculates the voltage to get valid data. This ambient light sensor can be measured directly from a photometer.

3.3. Display module

The display interface is displayed by LCD1602 liquid crystal. LCD1602 liquid crystal display has stable performance, low power consumption, small size, ultra-thin, light weight, rich and clear display content, large amount of information and convenient use. It is widely used in low-power circuits.

3.4. Voice module

The voice module uses ISD4004 chip, ISD4004 working voltage is 3V, single-chip recording and playback time is 8~16min, sound quality is good, suitable for mobile phones and other portable electronic products.

3.5. Bluetooth module

The Bluetooth module HC-05 module can be directly connected to a 5V single-chip microcomputer, and the effective communication distance reaches 10 meters. It can be paired with an Android mobile phone to power on the module, and can be connected with the mobile phone with Bluetooth.

4. ULTRASONIC RANGING PRINCIPLE

As shown in the schematic diagram of the ultrasonic ranging as shown in Figure 2.

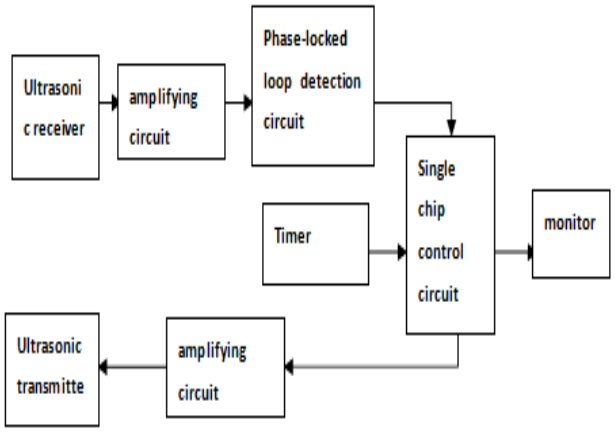

Figure 2 Ultrasonic ranging schematic

The design uses the AT89C51 single-chip microcomputer as the controller, and realizes the digital display of the LCD by the dynamic scanning method, and uses the timer of the single-chip microcomputer as the ultrasonic driving signal. The single chip sends a signal, which is amplified and output through the ultrasonic transmitter; the ultrasonic receiver amplifies the received ultrasonic signal through the amplifier, and after using the phase-locked loop circuit for detection processing, starts the single-chip interrupt program, and the measured time is t, and then the software Determine and calculate, get the distance and send LED display.

5. SYSTEM PROGRAMMING

The system program mainly includes a main program, an ultrasonic sensor detection subroutine, a light intensity detection subroutine, a display data subroutine, a voice alarm subroutine, and a button subroutine. The specific flow chart of the main program is shown in Figure 3.

When the system is running, initialize, start the timer, when the learning time exceeds the set time (1 hour), the voice reminder rests [3]; at the same time, the ultrasonic ranging module starts collecting data, detecting the distance of the head from the desktop, and will The distance signal is converted into an electrical signal and fed back to the single-chip microcomputer. When the detected distance signal is less than the set height value, the voice alarm prompts; at the same time, the light module collects ambient light intensity information, when the light intensity is greater than the set light intensity upper limit, the voice reminder Turn off the light, when the light intensity is less than the lower limit of the set light intensity, the voice reminder turns on the light.

The main function of the display data subroutine is to display the distance measured by the ultrasonic module on the LCD liquid crystal display through the distance processed by the single chip microcomputer. At the same time, the subroutine displays data such as date, learning time, current light intensity, upper and lower light intensity levels.

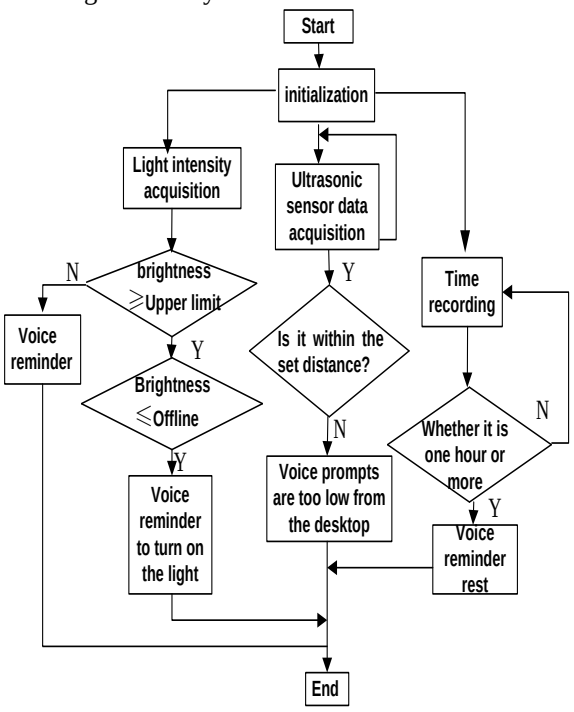

Figure 3 system structure block diagram

6. SUMMARY

This paper designs a youth vision corrector, which detects the distance between the human head and the desktop through the ultrasonic sensor, the light sensor detects the light intensity, the timer records the monitoring learning time, and has the voice alarm prompt function, which realizes the debugging of the software and hardware functions. To a certain extent, it has played a preventive and protective role for adolescents' vision and has broad application prospects.

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Exploration of Teaching Reform of Single Chip Microcomputer Application Technology Course Under the Cooperation of School and Enterprise

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Abstract: Under the new curriculum education system reform, school enterprise cooperation, as a modern education and teaching mode, has played an important role in improving the teaching quality and teaching efficiency. As a required professional course of electronic information engineering and mechatronics, how to improve the teaching efficiency under the school enterprise cooperation mode has become the core education reform of educators at this stage. For this reason, this paper mainly aims at the problems existing in the traditional single-chip teaching, and puts forward the corresponding optimization and reform strategies, so as to lay a good foundation for the realization of students' all-round development of teaching objectives.
Keywords: School Enterprise Cooperation; Single Camera; Teaching Significance; Reform Strategy

1. INTRODUCTION

Single chip microcomputer is a professional basic course with relatively strong theoretical and practical features. In the current information industry era, its teaching quality and efficiency have also been highly concerned by all sectors of society in recent years. However, due to the deep-rooted influence of traditional learning concepts and learning concepts, students generally pay attention to mastering theoretical knowledge in the course of learning. Neglecting the improvement of their own practical operation ability has a negative impact on their growth and development. At the same time, students have formed a kind of qualitative cognition in the learning process of single chip microcomputer. They generally think that single chip microcomputer is to learn the internal structure knowledge, interrupt system, assembly instructions and other theoretical knowledge of 8051 series single chip microcomputer, so they can not mobilize the learning interest of the course. Interest and subjective initiative have a negative impact on the growth and development of students.

As the organizer and practicer of curriculum teaching, the level of teaching ability and comprehensive quality of educators has an important influence on students' learning and development to a large extent. However, it is undeniable that some educators still adopt "indoctrination" and "filling" in the teaching process of single-chip microcomputer because of the deep-rooted influence of traditional teaching idea of exam oriented education. Duck style teaching mode, which leads to the students' interest in learning courses is decreasing, and even easily leads to their resistance and fear of difficulties, which has a very negative impact on the growth and development of students. At the same time, in order to facilitate the course teaching, in the process of classroom practice teaching, educators often adopt the teaching mode of "theory and practice separated". No matter in theory teaching or practice training, there is always a gap between the course teaching quality and the expected teaching objectives. In the long run, after the end of the whole semester, students still can not understand the single-chip microcomputer. What is the base and how to use it.

2. CURRICULUM TEACHING REROEM

2.1. The necessity of strengthening school enterprise cooperation

According to the analysis of a large number of survey data, there are four modes of school enterprise cooperation, namely, the mode of school enterprise introduction, the combination of labor and teaching, the interaction between school and enterprise, and the "order form" cooperation. The specific content and teaching scheme of different modes of school enterprise cooperation are also different. Specifically, the so-called "school enterprise introduction mode" refers to that enterprises put some production lines into operation. In schools, educators can start teaching according to the actual production operation of enterprises. The combination of labor and teaching means that students learn in school or in enterprises in term or quarter, and "school enterprise interaction" refers to providing practice bases for enterprises, and participating in the formulation of teaching plans to ensure the progressiveness of teaching programs. The University cooperates with enterprises to ensure the simultaneous operation of teaching and production. On the basis of the goal of "entering school with work, graduation is employment", the University reduces the pressure of national employment and lays a good foundation for the realization of the goal of social sustainable development. At present, the common

mode of school enterprise cooperation is mainly the combination of labor and teaching. The main reason is that the application of this mode can not only ensure the scientificity, rationality and effectiveness of teaching for educators to a large extent, but also provide the practice site and equipment for learning, which can not only effectively stimulate students' interest in learning, but also stimulate students' interest in learning. The cultivation of the ability of practical exercises also laid a good foundation.

2.2. Innovation of educational teaching concept and means

In a way, in order to obtain the expected teaching quality and efficiency fundamentally, after the integration of the curriculum knowledge system, the curriculum education and teaching mode also needs to be innovated and improved. Specifically, educators need to abandon the traditional "indoctrination" and "cramming" education and teaching mode, and let the innovative teaching method run through the classroom all the time. The acquisition of ideal teaching objectives lays a good foundation, while in the current teaching mode, the common teaching methods used by educators are as follows:

First, case teaching. In the process of case-based teaching, in order to effectively improve the quality and efficiency of education and teaching, educators need to pay more attention to the case selection to ensure that the selected case can not only express its realization effect directly, but also include the knowledge points to be learned, so as to deepen the memory and understanding of the course content;

Second, guided teaching. In the current era of quality education, in order to fundamentally and effectively improve the quality and efficiency of curriculum teaching, educators can adopt a guided teaching mode, that is, to inspire students to think, explore and practice in a planned way in teaching, so as to deepen the memory and understanding of the curriculum on the basis of stimulating students' enthusiasm for learning through repeated practice.

3. CONCLUSION

All in all, under the reform of the new curriculum education system, as a required course of electronic information engineering and mechatronics, the teaching quality and efficiency of single-chip microcomputer have been highly concerned by all walks of life in recent years. However, throughout the current teaching practice in the classroom, due to the existence of various uncontrollable problems, the teaching quality of single-chip microcomputer and the expected teaching objectives begin. Finally, there is a certain gap. Therefore, according to the talent needs of enterprises, it is the core education development direction for educators to make correct talent training programs.

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On Voice in the Systemic Functional Linguistics

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Abstract: Different from the voice of traditional grammar, the voice in Systemic Functional Linguistics is based on the experiential function, which belongs to ideational function, and is reflected on both semantic level and lexicogrammatical level. Furthermore, interpersonal and textual functions have a profound impact on the choice of English voice.
Keywords: Voice; Systemic functional grammar; Passive voice; Metafunction

1. INTRODUCTION

Voice as a very important concept in English grammar has been studied by many linguists of various linguistic schools. In traditional English grammar, English voice can be divided into active voice and passive voice. At the clausal level, if the agent is the subject in a sentence, it is active voice, or it is passive voice. At the lexical level, the predicate form in passive sentences is *be+v-ed*.

In traditional English teaching, teachers whose understanding of voice is based on predicate form ask students to do lots of practices on form transformation between the active and the passive sentences, thinking that students can grab the essence of voice through this way. But that's not the truth. Look at the following two sentences:

a. The car needs repairing.

b. The flower smells sweet.

In example 3, the subject "car" isn't the agent of the action "repair" but its patient. The voice of the sentence is passive in terms of meaning, however, the predicate "needs" is active form. Similarly, example 3 has the passive meaning but the active form. It's apparent that these conditions cannot be clearly explained by the voice of traditional grammar.

With the in-depth study of English voice, linguists from different linguistic schools have put forward their own views on voice from various perspectives among which the voice of Systemic Functional Grammar (SFG) represented by Halliday has caused immense influence. The author will introduce the voice of SFG and discuss the relationship among the three metafunctions in SFG and the instantiation of voice in English.

2. VOICE OF SFG

SFG proposed by the English linguist Halliday has become one of the most influential linguistic schools. The great significance of SFG lies in its groundbreaking proposition that language has three basic metafunctions: ideational function, textual functionalities and interpersonal function which are respectively related to the transitivity system, the mood system and the thematic system. Furthermore, language is organized into four strata—semantics, lexicogrammar, phonology, and phonetics.

The voice view in SFG starts from the experiential function which belong to ideational function and is closely linked with interpersonal function and textual function. Halliday divided voice according to whether a clause has the attribute of agency. According to Halliday & Matthiessen (2010), "A clause with no feature of "agency" is neither active nor passive but middle. One with agency is non-middle, or effective, in agency." Special attention should be paid to distinguishing between the feature "agency" and the structural function "Agent". Just as Halliday said: "Strictly speaking an effective clause has the feature "agency" rather than the structural function Agent, because this may be left implicit, as in *the glass was broken*". [1] The difference between "The glass was broken" and "The glass broke" is that the former has the feature of agency and people tend to ask "by whom", while the latter only involves one participant and the "broke" of the "glass" is spontaneous. Therefore, the former belongs to the non-middle voice while the latter the middle voice. We can say that if a process in a sentence is only associated with one participant, then the clause is the middle voice.

If a process in a sentence is related to two or more than two participants, the clause is the non-middle voice. The non-middle voice can be either operative or receptive. "In an operative clause, the subject is the agent and the process is realized by an active verbal group; in a receptive the subject is the medium and the process is realized by a passive verbal group" [1].

In addition, the voice of SFG is also reflected at semantic level. Look at this example and distinguish its voice:

Hamlet is Mr. Gamick.

In traditional grammar, it's unacceptable to refer to this sentence as passive voice because the verb "be" doesn't have passive form. The sentence "Hamlet is been by Mr. Gamick" is unreasonable. However, in SFG this sentence can be regarded as passive voice on semantic level. "Mr. Gamick is Hamlet" which corresponds to "Mr. Gamick plays Hamlet" is active voice, while "Hamlet is Mr. Gamick" which corresponds to "Hamlet is played by Mr. Gamick" is passive voice.

From what has been discussed above, we may draw a

conclusion that the voice of SFG is not only reflected in the lexicogrammatical layer, but also in the semantic layer.

3. THE RELATIONSHIP BETWEEN VOICE AND METAFUNCTION

The choice of active and passive voice in language is not random but linked with the interpersonal and textual functions. In Halliday's view, the application of voice is actually speakers' choice for the meaning potential of voice system in specific context under the guidance of language function, in other words, this is a process from "what can be said" to "what is actually said".

3.1 The Relationship between Voice and Interpersonal Function

According to Halliday, the interpersonal function is 'language as action'. Interpersonal function of language is enacting one's personal and social relationship with others. In other words, the interpersonal meaning mirrors the interactive relationship between the addresser and addressee as well as the addresser's intentions and attitudes.

Next analysis of the interpersonal meaning of the passive voice will be made. The reason why the passive voice is selected is that it's the marked form in the voice system. In addition, the passive voice and interpersonal meaning are closely connected. Under following conditions, passive voice is selected.

(1) to arouse the readers' attention

In the structure of "goal + process + by + agent", the goal is put before the agent because the speaker anticipates the listener to attach importance to the goal. For example:

The answer is complicated by the oddity of Britain's media market.

The goal "answer" in the sentence is new information and is directly connected with the former sentence, thus it's selected as the subject to arouse readers' interest and attention as well as lead to the following sentences.

(2) To weaken responsibilities

In some passive sentences, agent is deliberately omitted in order not to assume the responsibility of one propoal. Look at this example:

Above all, women's tennis is criticized for being one-dimensional and dull to watch.

This sentence enables readers to know the dissatisfactory state of women's tennis. "Women's tennis" is selected as the subject, and the agent is deliberately omitted in order to get rid of responsibility because the action "criticize" may make the speaker be attacked by the supporters of the women's tennis.

(3) to be objectiveness

In many science and technology articles and academic discourse, passive voice is widely applied for the sake of objectiveness. The author purposely guides people to regard what he says as the consensus by omitting the agent so as to influence readers' thoughts in an implicit way.

(4) to show politeness and respect to the listener or reader

Showing politeness is also one of the functions of passive voice. For example:

The box is too heavy to move and your help is urgently needed.

Your suggestion is sincerely anticipated.

The goals of the two sentences "your help" and "your suggestion" are the point of departure of the message, which shows the importance of the listener or reader. The fact that the agent "we" is not mentioned further highlights the importance of the goal. This can help the speaker achieve the interactive goal as well as show respect to others. [2]

4. THE RELATIONSHIP BETWEEN VOICE AND TEXTUAL FUNCTION

Textual function mainly refers to the use of language to organize information of texts. Textual function of language is of vital importance because both constructing experience (ideational function) and enacting interpersonal relations (interpersonal function) depend on building up the sequences of discourse, organizing the discursive flow, and creating cohesion and continuity. Textual function includes three subsystems: Theme-Rheme system (thematic structure), the information structure (Given+ New) and cohesion system. The Theme of a clause is the first group that has function in the experiential structure of the clause and the remainder of the clause is the Rheme [1]. Theme is the point of the departure of the message, and the choice of Theme influences the meaning of a clause. Information structure is to organize the language as information unit: the New and the Given. The Given refers to information which has already appeared before. The New refers to new information which hasn't appeared before. Generally speaking, the Theme usually corresponds to the Given information and the Rheme to New information. Cohesion indicates the relationship between two language components. The cohesion of a text is usually reflected in grammatical cohesion and lexical cohesion.

From the textual perspective, the passive clause and the active clause have different thematic structure, information structure and cohesion system. Changing from the active voice into the passive voice is to reorganize the components of a sentence. But English passive voice is not only a result of the reorganization of language components, but also gives components at different place some certain textual function. The textual function is shown in the following aspects:

(1) topic- setting

Topic -setting is the utilization of some grammatical means to determine a topic for a text. In the process of constructing a text, passive sentences can put someone or something at the beginning of one

sentence, and identify a topic for the text so that the whole text can revolve around this topic.

(2) topic-connecting

The information recombination of passive sentences facilitates the connection of topics and reduces the possibility that the text digresses from the topic.

(3) topic-shifting

Topic-shifting includes the shifting of sentence topic, paragraph topic and text topic. Passive voice, as a pragmatic means of information reorganization, adjusts word order to change the given information and new information of the sentence, thus completing the function of topic-shifting.

(4) focus-highlighting

Focus-highlighting refers to reorganizing the information in the discourse with the help of passive voice, placing the important information that the speaker wants to express at the end of the sentence to become the focus of the information.

(5) focus-contrasting

The focus-contrasting function of the passive sentence is realized by putting two or more passive sentences together to form the strong contrasting focus.

(6) textual cohesion and coherence

Passive sentences, as a pragmatic means of information reorganization, can make the text cohesive and coherent by adjusting the order of the given information and the new information.

5. CONCLUSION

The voice of SFG has been reflected in both lexicogrammatial layer and semantic layer. Also, the choice of voice has a close relationship with interpersonal function and textual function.

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On the Present Situation, Problems and Prospects of Fault Indicator in Distribution Line

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Abstract: With the rapid development of social economy, the demand for power distribution increases greatly. Nowadays, under the circumstance of rapid development, if the line fault can not be solved in time, it will cause a huge loss to the regional economy. In this regard, distribution line fault indicator arises, and with the development of society, its demand is increasing, the application value is increasing. Many deficiencies still exist in fault indicators. Restricted by the power distribution system automation level, it lacks of practical experience in practical applications. The type judgment, cause analysis, and location determination of faults such as phase-to-phase short circuit faults and ground faults are not fast and accurate. The rapid analysis and processing of fault information and the rapid positioning of faults need to be improved. This paper analyzes the current application status of fault indicators in distribution lines, summarizes the common problems and difficulties in fault indicators, and explores the future development direction of it.
Keywords: Fault indicator; Fault location technique; Problems and difficulties; The development direction

In the process of modernization, with the increasing prominence of distribution line faults problem, fault indicator gradually steps into a phase of rapid development, playing a vital role in practical application as well [1]. When a short-circuit fault or single-phase ground fault occurs in the power distribution line, the fault indicator can issue a corresponding warning, reminding the staff of repairing the fault quickly so as to restoring the power supply. Thus, it is clear to see that fault indicator contributes a lot to electricity-related industries.

1. THE APPLICATION VALUE OF FAULT INDICATOR

(1) The electric power distribution system: Distribution network technology is an important part of power system, the core of which is the distribution automation system. The power supply lines are exposed all year round, circuit faults occur from time to time, which is particularly obvious in summer and winter during which the electricity consumption reaches the peak. And this requires a device that can perceive the electricity state, analyze the type of fault and locate it apace，which is convenient for staff to find out reasons timely, locate and repair the fault. In the process of supervising the state of the electric power distribution system, it is able to monitor different types of communication. During the operation of the power distribution system, the main station and sub-stations can be organically coordinated to manage the power distribution system scientifically and normatively [2].

(2) Practical application: During recent years, the construction of a strong smart grid with UHV AC and DC power grids as the backbone grid has developed rapidly. The reason why the fault location technology based on distribution network automation can be valued at this stage is that it is determined by user needs and development trends. The application of distribution network automation fault location technology is an inevitable choice after the development of society and the times [3]. The significance of the fault indicator is mainly to ensure the stability of power supply, improve the efficiency of troubleshooting of those increasingly complex power distribution lines, and reduce the negative impact of faults in the distribution network on power consumption.

(3) The development of technology: Distribution network automation fault location technology is one of the important technologies of power distribution automation, which has made an important contribution to ensuring the stability of power supply, and has gradually attracted the attention of more and more engineers. The most cost-effective tool in distribution network fault location technology is the fault indicator, which is also the most basic technology in current fault location technology [4]. At present, the related technology of fault indicator is not mature enough, thus it is a common concern for those engineers to strive so as to make great progress in technology.

2. THE APPLICATION STATE OF FAULT INDICATOR

2.1 The Classification of Fault Indicator

At present, fault indicators are generally divided into three types: applied signal type, transient characteristic type and transient filtering type [5].

2.1.1 External signal type fault indicator

The working principle of the externally applied signal type fault indicator can be simply understood as: when a fault occurs, the signal injection device is used to amplify the fault information, artificially increase the ground current, and generate a characteristic signal sequence, thereby improving the judgment ability of

the fault indicator.

Disadvantages: Due to the artificial increase of the ground current, the safety hazards of the system increase. As a result, such fault indicators are rarely used in practical applications.

2.1.2 Transient characteristic fault indicator

The transient characteristic fault indicator uses a catastrophe method to detect short-circuit faults. During the fault process, the power distribution line has a significant amount of fault characteristics. For a single-phase ground fault, the voltage of the faulty phase will suddenly decrease, the voltage of the non-faulty phase will suddenly increase, and the distributed capacitance of the line will begin to charge [6]. The actual fault indicator algorithm is mainly the transient comprehensive criterion method. The algorithm is used to detect a variety of fault characteristic quantities, and to judge the short circuit and ground fault of the line by comparing the characteristic quantities with normal quantities.

Disadvantages: This type of fault indicator requires fast and accurate capture of transients. Although there are currently many transient algorithms that can theoretically achieve accurate capture of transient quantities, they actually have high requirements for the processing capabilities of terminal equipment. Limited by the processing capacity of the terminal, the accuracy of single-phase ground fault judgment using transient algorithms still remains low.

2.1.3 Transient Recording Fault Indicator

The transient recorder-type fault indicator is composed of an acquisition unit, a collection unit, and a master station system. The collection unit collects fault characteristic data information and transmits the collected information to the collection unit; the collection unit analyzes and processes the data information uploaded by the collection unit and transmits it to the master station system [7]. When the line status changes abnormally, the indicator triggers the recording and uploads it to the master station. The master station locates the fault zone by analyzing the recorded data.

Disadvantages: Due to different regions, each fault indicator may have a certain personality difference. Therefore, for specific equipment, the threshold needs to be customized to improve the accuracy and stability of the equipment, and the actual operation is more complicated.

2.2 Distinguishing the fault

2.2.1 Line faults in distribution networks are mainly divided into transient faults and permanent faults

(1) Transient faults: Transient faults refer to faults, that can be eliminated by a single reclosing, such as trips. Such faults usually have a small overview in real life [8].

(2) Permanent fault: Permanent faults refer to a fault that cannot be eliminated by a single reclosing, and must be repaired on site by the relevant staff. When such a fault occurs, the fault section needs to be quickly and accurately located so that the staff can timely find the fault and repair it, which is exactly the application value of the fault indicator.

2.2.2 Fault indicator's basic function in distinguishing

The basic functions of fault indicators are as follow: Short-circuit fault identification, ground fault identification, reclosing fault identification, adaptive load current, and anti-fault function etc.

3. PROBLEMS AND DIFFICULTIES OF THE FAULT INDICATOR

3.1 Problems in the Fault Indicator

3.1.1 Locating the fault

(1) Uneven distribution of the line load. Because of the unreasonable urban-rural planning, the load of power line varies widely [9].

(2) The radius of the line power supply is large, and the line loss is serious. Nowadays, the scale of urban and rural areas continues to expand. Even with line optimization, the problem of increasing radius of line power becomes more serious.

(3) The cross section of the wire is relatively small, which hides a safety hazard.

(4) The fault detection of distribution line is random.

(5) The measurement accuracy and sensitivity are poor. The accuracy of the indication in frequent ground faults in the distribution network is low. The phenomenon of refusal and false alarms frequently occurred, and the application is limited [10].

3.1.2 Practical application.

(1) Lack of practical engineering support [11].

(2) Practical application is less, comparing with the research and exploration on fault indicators [12].

(3) The practical operation is sophisticated [13].

3.2 Difficulties in the Development of Fault Indicators

(1) Fault location of ring network power supply [4]. For feeder automation, structural operation and ring network open loop are its primary conditions. The distribution switch monitoring terminal (FTU) collect information before and after failure, and sends the fault information to the control center. The computer equipment of the control center analyzes the area where the fault occurs and locates the fault.

(2) Fault location with DG (distributed power) access to the distribution network [5]. The distributed power has fluctuation and randomness, which makes the protection devices in the line unable to be set. After a fault occurs, the direction of the fault current is also uncertain. Therefore, the distribution network containing DG is difficult to achieve rapid fault location and removal.

4. FUTURE DEVELOPMENT OF FAULT INDICATORS

With the continuous development of society and economy and the continuous progress of science and technology, the development prospect of fault indicators is relatively good, and the development trend is also considerable, mainly in the following aspects:

(1) Automated processing is more accurate and faster,

information technology is strengthened, and intelligent fault indicators with new integrating technologies are the direction of the future development of fault indicator technology [1].

(2) Gradually adopting wireless private network for fault information transmission. For remote areas, the signal is unstable, so researches on wireless private networks can be strengthened to promote the development of fault indicators [5].

(3) Nowadays, due to the low level of distribution automation in China, the fault indicator system cannot yet be integrated into the substation integrated automation system. Therefore, combining the fault indicator system with the distribution automation system in a suitable way is a future direction.

(4) Continuously improving the analysis capabilities of power grids and the accuracy of load calculations, strengthening risk control, and optimizing operation through establishing support systems, related power supply guarantee systems, and emergency mechanisms to ensure the safety and reliability of distribution systems [14].

In order to meet the important need of using distribution automation technology to solve faults at present, the research on the rationality and safety of fault indicators based on distribution fault automation technology is of paramount importance. This can not only push the development of distribution network power supply into a stable direction, deal with emergent failures in a timely manner, but also achieve both economic and social benefits in power-related industries.

Summary

The application of fault indicators in power distribution lines is currently underdeveloped. There are many problems and development difficulties in fault location and practical application. But the future prospects are very broad Integrate new technologies, research and development on wireless

networks, effective integration with distribution automation systems and the establishment of support systems are considerable directions.

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Research on Deep Integration of Environment Design Speciality Based on Virtual Reality Technology

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Abstract: Under the new situation, it is a new exploration to construct a network of industry, specialty and entrepreneurship, which is deeply intersected and multi-dimensional integrated. This paper studies the feasibility and necessity of virtual reality environment design, talent training model construction and application practice.
Keywords: Professional integration; Virtual reality; Applied university; Transformation

1. INTRODUCTION

In the 21st century, driven by the new generation of information technology, social productivity and human civilization have reached an unprecedented new height, and the world has entered the information age. At present, the scientific and technological revolution and industrial change promote the vigorous development of the new generation of information technology, and the continuous deep integration with the real economy in the fields of industrial manufacturing, smart city construction, transportation, health care and so on, bringing unprecedented profound changes. With the rapid development of the new generation of information technology represented by artificial intelligence, Internet of things, big data, virtual reality technology, etc., digital economy has become a new engine of China's economic development. Facing the fierce competition of global technological innovation commanding point, the new generation of information technology in China is lack of compound and applied talents, lack of reserve team and weak international competitiveness [1].

2. FEASIBILITY AND NECESSITY ANALYSIS

In 2018, the Ministry of education of the people's Republic of China explicitly listed virtual reality technology in the annual key work tasks of educational informatization, explicitly required national universities, primary and secondary schools, vocational education, etc. to further promote the deep integration of information technology and higher education teaching, and promote the in-depth application of big data, virtual reality, artificial intelligence and other new technologies in education and teaching [2].

The analysis of landscape visual space involves different green space types and different scales of urban and rural space, which is practical

Difficult operation, involving high-risk and extreme environment, high risk and high consumption. These characteristics determine that in the real system

The risk, limitation and impossibility of landscape design personnel training in the unified operation environment make

The construction and application of simulation operation environment has become an inevitable means of personnel training. Through the application of the new generation of information technology in the environmental design specialty, it can speed up the professional reform and curriculum construction, improve the teaching quality, and cultivate professional talents who meet the needs of environmental design in the era of 3D information interaction based on VR. Form the demonstration teaching of the combination of education and industry, and improve the level of information practice teaching in Colleges and universities [3].

Construction of talent training model

3.1 School Enterprise Cooperation to Jointly Formulate Talent Training Plan

Because the relevant enterprises have professional and technical personnel with industry background, rich practical resources and on-site teaching case resources, familiar with the new technical specifications, new processes, new standards and professional post group business processes, and accumulated a large number of technical data and examples. Therefore, at the beginning of this period, we can build a long-term mechanism of school enterprise collaborative education, which is closely connected and seamless, and provides a guarantee for school enterprise collaborative education [4].

The application-oriented colleges and universities can clearly put forward according to the guiding ideology of their respective undergraduate professional talent training programs, take the national standard as the basis, take the application-oriented talent training as the main line together with cooperative education enterprises, take the integration of production and education, collaborative education as the support, take the quality-oriented Teaching system, basic teaching system and practical teaching system as the support, explore and improve the combination of school education and enterprise education The application-oriented personnel training system, which combines classroom teaching with practical teaching, curriculum setting with professional standards, and

learning with work, cultivates high-level application-oriented personnel with social responsibility, strong learning ability, practical ability and innovation and entrepreneurship ability. The experts of Korn ferry city (Chongqing) science and Technology Co., Ltd. and we jointly design training objectives, jointly formulate training programs, jointly implement the training process, jointly evaluate the training results, and change the in school training into open cooperative training, which can realize the seamless connection between talent training and local economic and social development needs [5].

3.2 Curriculum Setting

(1) Orientation of training objectives

The basic task is to cultivate high-level applied talents with a sense of social responsibility, strong learning ability, practical ability and innovation and entrepreneurship ability.

(2) Main subjects and Curriculum

The curriculum system consists of five modules: general education curriculum, subject education curriculum, professional education curriculum, independent development curriculum and practical education curriculum. Among them, the main subjects, core courses and main practical teaching courses are as follows [6-8]:

Main subjects: Art and design

Core courses: Interior design, Architectural design, Exhibition design, Studio, Landscape planning and design, Tourism planning and design, Digital landscape

Main practical teaching: Military training, Labor practice, Reading activities, Computer application technology foundation (practice), Residential building and environmental mapping, Comprehensive cognition, Urban hiking, Professional observation, Graduation practice, Graduation design (Thesis), Innovation and entrepreneurship education, The second classroom practice

In order to further promote the deep integration of virtual reality technology environment design, in the implementation of the project of production education integration and collaborative education, a teacher team can be formed with the participation of professional teachers of environment design, architecture, computer science, etc. to carry out scientific research and teaching research activities. Driven by the actual projects of the enterprise, the enterprise engineers participate in the whole process, train and guide the students of many colleges to form cross integration groups, complete the project tasks and provide corresponding services for the society. In the course setting, we need to use the existing subject system to form the subject system of virtual reality, and the urgent task is to establish the "course group" of virtual reality. At the same time, it points out that the training of talents must conform to the educational policy and clear the training goal. For example, courses such as information technology foundation, digital construction technology and application, virtual reality art design can be set up as required.

4. THE APPLICATION OF VIRTUAL REALITY TECHNOLOGY IN ENVIRONMENTAL DESIGN SPECIALTY

4.1 Purpose of the Experiment

Recognize various types and scales of landscape visual space, including: space type, space interface, building space interface, landscape visual space interface, landscape visual space form attribute, etc. To master the composition of static line of sight: viewpoint, sight distance and horizon; to master the method of landscape static line of sight analysis through viewpoint analysis, sight distance analysis and horizon analysis. Grasp the composition of dynamic line of sight: station, landscape and path; grasp the analysis method of dynamic line of sight through path spacing analysis and path permeability analysis. Master the quantitative evaluation method of visual impact in landscape visual space. According to the visual design simulation of landscape space and the visual order simulation of landscape space, the design practice and application of visual space in landscape are continuously strengthened

4.2 Experiment Principle

The experimental principle includes: inter design scale control theory (topological isomorphism, spatial syntax), landscape visual spatial cognitive simulation experiment principle, landscape visual spatial analysis simulation experiment principle.

4.3 Experimental Equipment, Materials and Teaching Methods

(1) Experimental equipment (device or software, etc.)

Software: landscape visual space analysis virtual simulation software (VR software platform).

Experimental equipment: two classrooms in the computer center of the school of art and design can accommodate 100 people for classes, all of which are new computers, and the configuration meets the requirements of relevant software.

(2) Experimental materials

Students use special measuring equipment to measure any space in groups. After the measurement is completed, they process the data respectively, conduct rapid modeling and other work. After the data is completed, they are unified and integrated, and then they can carry out space design and virtual display.

(3) Experimental teaching method

On the basis of traditional design method teaching, teachers upgrade the teaching method of two-dimensional plane media to immersive three-dimensional experiential teaching based on virtual reality technology. In the form of digital courseware, students can enter the virtual simulation space through interactive devices such as PC, VR helmet, etc. they can learn and discuss excellent regional environment design works or self-designed works online, Through the experience of architecture

and environment in virtual space, we can understand the theoretical knowledge of design and master the design language method.

4.4 Test Method and Procedure Requirements

(1)Site investigation

- Submit Research Report
- Background Evaluation Research Report
- Click to play the design experiment teaching video of concept stage
- Submit account usage requirements to the administrator

(2) Design preparation

- Fill in the computer configuration information according to the prompts
- Pop up the software download and installation interface and install according to the prompts
- Click "original site. MPX" to download and import via Mars
- Open Mars and click the edit interface - model Edit - Geometry
- Edit the block size scaling through the computer-side coordinate axis, and consider the spatial relationship
- Click VR to enter the virtual reality site (prepare helmets and other hardware devices in advance)
- Enter the virtual scene and observe the relationship between the main building and the site from the perspective of human and bird's-eye.
- After determining the appropriate site relationship, click to export the panorama of each node
- Open Venus to make panoramic QR code
- Fill in concept stage evaluation form and upload it together with panoramic QR code

5. CONCLUSION

In recent years, with the rapid development of virtual reality, augmented reality and other related digital technologies, virtual reality environment design (landscape design, interior design, architectural design) based on these digital technologies has impacted and challenged the theory and practice of traditional environmental art design. Through the intervention of virtual reality technology, the level and depth of traditional teaching has been improved. On the one hand, the platform of multi-channel verification theory has been realized. On the other hand, it has opened a window of multiple perspectives for practical teaching, laying a solid theoretical and practical foundation for students to enter the senior year for curriculum design. Virtual environment design brings new construction thinking and practice means for the application of digital city, the construction of urban context, the development and utilization of relics and interior space design. It provides an important research source for thinking about the relationship between humanity and science, material and virtual, history and contemporary.

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Research on Enterprise Management Information System Based on Big Data

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Abstract: In recent years, business management and operations have paid more and more attention to the development of information technology. However, in the context of the big data era, traditional information management is still at the level of business operations, ignoring the effective use of large amounts of data in the production process, and it is difficult to meet the actual management needs of enterprises. Based on this, this article expounds the big data technology and information management system from a theoretical perspective, analyzes the actual needs of the enterprise, and builds an enterprise management information system based on big data.
Keywords: Big data; Management information system; Demand analysis; System design; Research

Since the computer and information technology revolution, the information technology industry has undergone considerable development, prompting socio-economic development and huge changes in various fields. Information technology also plays a very important role in corporate strategic planning and management. Through the management information system, enterprises can carry out intelligent management and humanized management, which greatly improves the efficiency of the enterprise. On the one hand, the application of management information systems can improve the efficiency and value of big data utilization by enterprises, help enterprises achieve innovative development and sustainable development, and then bring greater social and economic benefits to enterprises. On the other hand, in the actual management process of an enterprise, the use of management information systems can collect and accumulate a large amount of raw data for the enterprise. In addition, it provides data support for enterprises in terms of market product positioning, corporate development strategic planning, and management decisions. However, in the context of big data, traditional enterprise management information systems are difficult to achieve information communication between enterprises, and data islands often occur. At the same time, when using traditional management information systems, enterprises are more inclined to structured data management and pay less attention to the application value of unstructured data. Therefore, based on the background of big data, it is of great practical significance to deeply discuss the construction of enterprise management information system.

1. THEORETICAL OVERVIEW

1.1 Big Data Technology

With the advent of the era of big data, data information has grown exponentially, and unstructured, semi-structured, ultra-large volumes of data have emerged. In this context, traditional database management capabilities have been difficult to meet the practical requirements of big data management. Big data technology, as a new type of data management technology, can help people extract more valuable data from complex and large data, and can also help people better store and manage data. In essence, big data is also a type of data. Therefore, some key technologies of traditional data are also applicable to big data. These key technologies mainly include two aspects, one is the use and retrieval of data, and the other is the management and storage of data. At present, new big data technologies such as data analysis and processing, data storage, and data mining continue to emerge, making people more efficient and cheaper in processing large amounts of data. In business management, these new technologies also have high application value [1].

In the context of big data, business models and architectures have also changed dramatically. Traditional business intelligence technologies can only process and analyze relatively small amounts of data, and their data mining models and data warehouse designs are more complex. With the derivation and popularization of big data technologies such as cloud databases and cloud computing, the processing of big data has become simpler. Users can realize the prediction, analysis and statistics of business data through a low-cost PC or server. In other words, the application of big data technology has changed the traditional business intelligence. In the new market environment, big data technology has become a powerful support for new business intelligence platforms, enabling rapid construction and deployment of business models [2].

1.2 Management Information System

A management information system is a system composed of equipment, computer technology, people, and other information means, and applied to

information management. Management information system mainly includes six major components, which are data maintenance, information storage, information collection, data processing, information transmission and information use. In software engineering, the requirement analysis of management information system refers to the elaboration of system functions, purposes, and contents when upgrading or component systems. At this stage, there are three main stages in the analysis of requirements for management information systems. First, the interview phase. This stage is mainly to communicate with people at different levels, to be familiar with the current situation of the user, and then to obtain the specific application needs of the user. Second, the boot phase. This stage mainly uses some hardware and technology to build the primary system. Then analyze the customer needs in the system demonstration, and further modify and sort out the interface, data flow and business flow. Third, the confirmation phase. This stage is mainly to confirm the final data report form and business process flow. This stage is the stage of finalizing the system design. Generally speaking, there are two main types of management information system analysis tools commonly used. One is a data flow diagram, which is used to comprehensively describe the logic of an information system. The other is a business flowchart, which describes the management information flow and business processes [3].

2. ENTERPRISE MANAGEMENT INFORMATION SYSTEM REQUIREMENTS ANALYSIS

By comprehensively analyzing the foot bones of all levels of the enterprise and combining big data information technology, the enterprise information management system is redesigned. In terms of functional design, this system will focus on factors such as the measurement system, scheduling management, and energy efficiency assessment. In terms of technical design, this system will focus on management practices such as on-site reconstruction, improved management, and diagnostic analysis. Therefore, the actual architecture of the system mainly includes four major functional modules: accident emergency management, data information management, production monitoring management, and system management [4,5].

The main tasks of the system management module include setting system roles and permissions, log management, and system data backup. The setting of system roles and permissions refers to the assignment of roles and permissions according to the actual use of the system by the user. Log management means that every user's operation in the system will be recorded and saved in the system log, which is convenient for system administrators to check. Data backup refers to the storage and backup of data in the system database. The backup data is mainly predictive analysis data.

The accident emergency management module mainly refers to the preset value of the system, scans and compares the change rate of the analog quantity, the average output value, etc., and then determines whether the system is abnormal. In this module, alarm signals are divided according to the urgency of the accident. In this design, alarms will be made in the form of flashing screens and voice announcements, and corresponding measures will be provided. In addition, the display forms of the fault information mainly include a table form, a pop-up window form, and a monitor screen color change form. When the fault level reaches a certain level, the printer will print in real time.

The data information management module contains four sub-modules, namely the production report management module, the measurement parameter management module, the equipment control management module and the production plan management module. The main work of the production plan management module is to query, modify and delete the production plan information according to the product type, production unit, and equipment energy consumption. The production report management module mainly provides users with report modification and new functions to meet the actual needs of users. This module mainly reads report data from different data sources and processes the data. Finally, through appropriate output forms, report output and print functions are implemented. The main function of the measurement parameter management module is to query, modify, delete, and add some basic measurement parameters, such as remark information, affiliated units, and parameter names. The main function of the equipment control management module is to establish the corresponding relationship of the measuring equipment and manage the basic information of the equipment. For example, querying, modifying, deleting, adding, etc. using information such as unit, equipment name, and operator.

The main function of the production monitoring and management module is to monitor production factors and set remote sub-stations and data collection stations at the signal gathering place of the main production equipment, thereby real-time data collection and return.

3. DESIGN OF ENTERPRISE MANAGEMENT INFORMATION SYSTEM BASED ON BIG DATA

3.1 System Function Design

It is necessary to centrally monitor the operating status of all levels of the enterprise. Therefore, in the system design process, all user needs need to be integrated for overall planning and design. Then, design step by step according to the actual operation management goals and requirements of the enterprise. This can ensure the scalability, advancedness and internal consistency of the enterprise management information system. Based on this, this article will

give a general overview of the system design from three parts: geographical location division, process subsystem division and system function level division. As far as system function level division is concerned, this paper adopts a pyramid-like architecture. The subsystems from bottom to top are the subsystem monitoring layer, the system centralized monitoring layer, and the information management layer. For system monitoring and information management, the subsystem monitoring layer is the basic layer, which is mainly composed of multiple independent subsystems. In the system design, the division of these subsystems is based on processing technology or geographical location, and the specific function is to execute control commands and complete data collection. The main work of these subsystems is to transfer basic data to the centralized monitoring layer and execute the instructions issued by the centralized monitoring layer. For the system centralized monitoring layer, this level is the middle layer between the management system and the subsystem. The system's centralized monitoring layer can monitor the energy consumption and usage of production equipment in real time, and process and analyze the collected equipment data. At the same time, this level will combine the instructions issued by the operator, issue operating commands to the subsystem, and transmit various data information to the next level. Therefore, the main work of the system's centralized control layer is to monitor the tasks and data of the system and complete the issuance of the next-level system instructions. For information management, it is the highest level of the entire management information system. This level receives various production data from the centralized control layer, performs forecasting, analysis and statistics on the data, and provides decision-making data support and information query functions for enterprise management. In addition, the information management layer will provide optimized data for reference to the centralized monitoring layer.

In terms of the division of process subsystems, the system design is divided into thermal energy monitoring subsystem, compressed air monitoring subsystem, water supply monitoring subsystem, and power distribution monitoring subsystem according to the different production processes in each link. Under normal circumstances, air compressors, air conditioners, etc. are equipped with automatic control systems. Therefore, the information management system can be connected with the monitoring system, and the relevant data can be directly read, thereby achieving coordinated and optimized control of multiple devices. In terms of geographical location division, in the system design process, the geographical location of the production equipment needs to be considered, and each production link is divided according to geographical location.

3.2 Database Design based on Big Data

The database is the basis of comprehensive statistics and centralized storage of data to assist management information systems. The database designed based on big data in this paper can implement decision support and statistical analysis. In database design, there are mainly three filters: information center, database and data collection. In order to improve the efficiency of database access, this paper makes full use of data partitioning technology. The main work of the data extraction integration module is to integrate external data into the subject data table. The main work of the OLAP module is to build data cubes according to the schema definition, and then to query and analyze multidimensional data.

Between the database and the application layer, a non-document database is introduced to aggregate and preprocess the data in the database that falls within the deadline. At the same time, develop the system data call interface, connect the non-document data with the database, and complete the batch loading and updating of the data. In the process of data construction, the idea of big data was incorporated to maximize the advantages of database and cache-like technologies, and realized the transformation of deep data.

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Research Progress on the Effect of Zn-Fe Transporter on Cd Absorption and Transport in Rice

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Abstract: In this paper, the structural characteristics of Zn-Fe transporter in rice, its relationship with Cd absorption, transport and accumulation in rice and the research progress of response to Cd stress in rice were reviewed, which laid a foundation for the systematic understanding of the mechanism of Cd absorption and transport in rice.
Keywords: Rice; Cd; zinc iron transporter; absorption transporter; function

Cd is a major heavy metal element that has a serious impact on rice pollution, and it is highly toxic, so it migrates actively in the environment. Cadmium is easily absorbed and transported by rice root system, and has the characteristics of long-term, difficult decomposition and irreversibility.Zn and Fe are essential metal elements for rice growth. Zn not only participates in various metabolism in rice, but also plays an important role in biological functions such as biofilm stability and gene expression regulation [1]. Zn deficiency can cause dwarfism, rice rigification, and destruction of chlorophyll and lipids. Zn, Fe and Cd have similar competition and inhibition relationship in plants, and the increase of Cd concentration will affect the acceptability of Zn and Fe in rice. Zinc and iron transporters (ZRT) and Fe transporters (IRT) are known as zinc and iron transporters (ZIP). In recent years, it has been found that they are widely present in rice and can transport various metal ions, including Cd2+. The research on this protein in rice is also in-depth. This paper mainly studied the relationship between Zn and Fe transporters in rice and the response of rice to Cd stress, and understood the relationship between Zn, Fe and other metal ion transporters and Cd absorption, transport and accumulation in rice.

1. THE ABSORPTION, ACCUMULATION AND TRANSPORT OF CD, ZN AND FE IN RICE

1.1 Cd and Zn absorption, transport and accumulation in rice

Cd is an essential element for rice growth, while Zn is an essential trace element for rice growth. Cd and Zn share the same outer nuclear electron configuration and similar chemical properties. Although they have opposite effects on rice, they have complex interactions [2]. A large number of experimental studies have shown that Zn application to soil can inhibit the absorption of Cd by rice, and significantly prevent the transport of Cd from xylem of root system to stem and leaf. Zn application can enhance the stability of the plasma membrane of rice, POD activity, and reduce the proline content in rice, so as to make rice resist and antagonize Cd accumulation and reduce the accumulation of Cd in rice. Meanwhile, other studies have shown that Zn has a synergistic effect on Cd. On the contrary, Zn application can promote the absorption and accumulation of Cd in rice and reduce the activity of various antioxidant enzymes. Cadmium and zinc have complex interactions because of their similar chemical properties and are usually associated. Cd-Zn interactions are mainly antagonistic and synergistic. Therefore, there is an interactive relationship between Cd and Zn, which has a very complex influence on rice.

1.2 Cd and Fe Absorption, Transport and Accumulation in Rice

As an essential nutrient element for rice growth, Fe has a complex relationship with the absorption, transport and accumulation of Cd in rice. Many studies have found that the nutrient supply of Fe is closely related to its absorption system IRT1, and IRT1 is one of the important ways for rice to absorb Cd ions. Increase of iron supply can alleviate the symptoms of cadmium stress in rice, and increase of iron supply can alleviate the toxicity of cadmium by reducing the expression level of IRT1, reducing the absorption and transport of cadmium by rice roots. The effects of increasing iron supply on the absorption of cadmium in rice under the stress of cadmium were studied by means of Fe-Cd interval and coexisting cyclic treatment. The results showed that increasing iron supply reduced the absorption and accumulation of cadmium in rice. Increasing external iron supply can also reduce the absorption of cadmium by plant roots by enhancing the competition between Fe and Cd absorption, so as to achieve the control effect. In addition, the supply of sufficient Fe for rice is of great help to the rice synthesis of large amounts of chlorophyll, which promotes the full development of photosynthesis, reduces the impact of cadmium on amino acid, protein synthesis and enzyme activity, and also plays a protective role in rice. On the contrary, cadmium pollution will induce the deficiency of iron nutrients in plants, and the iron oxide film formed on the root surface of waterlogging

plants can promote the absorption of cadmium by plants, aggravating the cadmium pollution of plants.

2. RELATIONSHIP BETWEEN ZN-FE TRANSPORTER AND RESPONSE TO CADMIUM STRESS IN RICE

2.1 Structure and functional characteristics of Zn-Fe transporter in rice

The Zn transporter family (ZRT) and Fe transporter family (IRT) are known as zinc iron transporter (ZIP). Current studies show that the rice ZIP gene family contains 16 members, 14 of which are zinc-regulated transporter genes and 2 of which are iron-regulated transporter genes. The ZIP protein is generally composed of 326~425 amino acid residues, and the difference in the number of amino acids is due to the different lengths of the "variable regions" in the third and fourth transmembrane segments of the protein. Most ZIP proteins contain 8 transmembrane domains. The variable region is a region that binds to metal ions and may be related to the transport of metal ions. Functional analysis shows that this gene family plays an important role in intracellular transport from the outside of the cell, and its transport objects include Zn2+, Fe2+ and even Cd2+.

2.2 The role of rice ZIP protein in response to Cd stress[2]

In rice, IRT is clearly studied in IRT1 and IRT2. OsIRT1 and OsIRT2 play key roles in Fe transport in rice. They participate in the transport of Fe2+ and Fe3+-PS chelates in rice. These two key genes have high compatibility with Cd2+, and overexpression can improve the transport rate of Cd2+ in rice. However, the ability of OsIRT1 to transport Cd is much greater than that of OsIRT2, because while promoting the absorption of Cd, OsIRT1 can also transport and distribute it. It can be seen that the two ZIP proteins OsIRT1 and OsIRT2 may be involved in the absorption and transport of Cd by rice roots, phloem and other tissues, and are important proteins in the transport of Cd in rice.OsZIP1, OsZIP2, OsZIP4, OsZIP5, OsZIP6, OsZIP7 and OsZIP8 play a key role in the transport of Zn. OsZIP1 gene is mainly induced and expressed in the absence of Zn and other metal elements, and the absorption of Zn decreases and the accumulation of Cd increases under the stress of Cd. OsZIP3 is related to the distribution of Zn, however, some scholars have found that the expression of OsZIP3 controlled by OsZIP2 promoter can effectively reduce the accumulation of Cd in rice. OsZIP4 gene is associated with the transfer and redistribution of zinc, Shimaru and others OsZIP4 genes identified under the condition of zinc deficiency, according to the results of gene chip and Northern analysis OsZIP4 gene expression in rice root of older or tender quantity highest, by in situ hybridization, found that zinc lack of rice, the OsZIP4 genes expressed in rice growing point and phloem, and explain its function may also involve zinc in rice in vivo transfer and redistribution process. Zn and Cd were transported by phloem specific mode, and it could be speculated that the transport of Cd might include short distance transport through the stem exosome pathway and the symplast pathway, and long distance transport via xylem and phloem. OsZIP8 has a similar expression pattern as OsZIP4, so it can be inferred that it also has similar transport and redistribution functions.

3. CONCLUSIONS AND PROSPECTS

In conclusion, Zn and Fe are essential trace elements for rice growth, but their absorption and transport by rice are closely related to the absorption and transport of other metal ions, especially heavy metal Cd, and they affect each other. At the same time, rice can respond to external Cd stress through complex regulation mechanism in vivo, so as to ensure its normal growth and development. ZIP gene family plays an important role in maintaining the balance of Zn and Fe in rice, but the expression patterns of different ZIP genes are all specific, so the mechanism of how rice coordinates many ZIP proteins in different parts of the body to coordinate the transport of cadmium ions is still unclear, and remains to be studied. Although many existing studies indicate that rice bivalent metal ion gene is involved in the absorption, transport and transfer of Zn, Fe and Cd, the specific gene sites and rules of its role need to be further studied. At the same time, only a few rice bivalent metals have been studied on their transport mechanism and their influence on Cd accumulation in rice, while many other members have not been studied thoroughly. Further studies in this field can provide theoretical basis for people to cultivate rice with low Cd accumulation.

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Study on the Construction Characteristics, Maintenance and Protection of Modern Catholic Churches in Guizhou--A Case Study of Meitan Catholic Church

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Abstract: Firstly, this paper analyzes the differences and reasons between modern Catholic churches in Guizhou and those in advanced coastal provinces. Then, this paper introduces the characteristics of the shape, construction technology and materials of modern Catholic churches in Guizhou. On this basis, the current situation of Meitan Catholic church is investigated in detail, and mapping and research are conducted from the aspects of architectural structure and structure, architectural decoration, damage and disease assessment. Finally, the maintenance and protection scheme is proposed.
Keywords: Modern Catholic church; Modeling features; Maintenance and protection; Meitan county; Guizhou province

1. INTRODUCE

In modern China, there are great differences in the shape, construction technology and construction materials of Catholic churches. The Catholic churches in developed cities on the east coast are mostly built in the form of western gothic churches. Its plane is in the shape of a Latin cross, and the front is a pair of high minarets sandwiched in the gable hall. The façade is divided vertically into three parts, each with a pointed arch door. The door frame is composed of regressive multi-layer column line and pointed arch rib. In the middle, there is a round rose window. The interior is a typical gothic beam column, supporting its skeleton coupons to support the roof. Some houses of worship even have flying buttresses to protect against side thrust, which are similar to Xujiahui church in Shanghai and Shengxin church in Guangzhou (Fig. 1). The Catholic church in Guizhou is quite different in design from the church in the advanced cities.

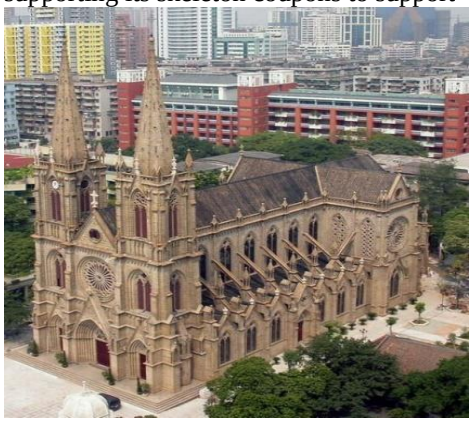

Fig. 1. Shengxin church in Guangzhou

2.CONSTRUCTION CHARACTERISTICS OF GUIZHOU CATHOLIC CHURCH

As a remote inland province, Guizhou cannot easily access western culture and thoughts as a coastal port city [1]. Before the first foreign missionary, Mgr Albrand, preached in Guizhou in 1847, Catholicism was weak in the province [2]. Local people had almost never seen the western architecture. If the church appeared in a westernized form again, the fear and resistance of the public towards something completely foreign would make it more difficult to preach. After Catholicism opened its “religious prohibition” in the late Qing dynasty, western missionaries, with their disadvantaged groups and heterogeneous cultural thoughts, entered a region where western culture was not yet understood, and where Chinese culture held a dominant position with deep-rooted traditional thoughts. The most direct and convenient way of preaching is to gradually import their own culture in a way close to the Chinese cultural form. Therefore, almost all churches built by missionaries during this period added many elements of traditional Chinese architecture to the church building, making the church form Chinese. Only under more familiar circumstances could missionaries attract local people to enter and slowly accept their doctrines.

2.1 Modeling Features Of Guizhou Catholic Church

Facade design of archway, with the front and back sides of the church as the archways, similar appearance to ancient Chinese archway, and a rectangular basilica church in the center. The Shiqian Catholic church, built in 1902, is a typical memorial archway [3], with tall and magnificent archways in front and behind. Church archway is presented as the hip roof hall belonging to four-poster style three ancient archway style, which is painted with landscape flowers and birds figures and various patterns of relief. The central bay and the secondary

bay of archway lead to the pointed arch gate with the gothic style of the church. The door has the exquisite relief instead of layers of back into the foot of the pointed arch rib. On the door, there are chromatic circle beautiful windows on each side. The central window is relatively large, and the windows of two sides are relatively small. among big. The chapel is flanked by eight pointed gothic stained-glass windows. (Fig. 2)

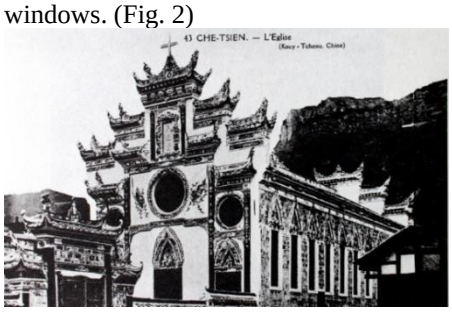

Fig. 2. Shiqian Catholic church (Guizhou in the eyes of two Frenchmen)

The existing Guiyang north Catholic church was built in 1875 [4]. On the front are the blue tiles of the four pillars, three rooms and seven floors. The roof brick archways are covered with landscape, flowers, birds, figures, colorful paintings and reliefs. There is a gate in the middle and the second of the archway. The door shape of the gate has obvious gothic vouchers, and each has a colored round window, which is small and small [5]. On both sides of the chapel, a clear water and empty brick wall is built as a retaining structure. Each brick wall has 12 Gothic vouchers with stained glass windows and an interior with a three-span gothic spire that is low in the middle and high on both sides. The middle hall adopts a stacked beam support spire, the side hall is supported by the Tongtian column, the pillar is a cylinder, and the stigma is a variant of Collins, with gold floral ornaments. On the west end of the chapel, there is a large altar, and a small altar on the left and right. Behind the altar stands a hexagonal altar, on which is a clock tower with a hexagonal four-fold blue cylinder tile roof. Each side of the clock tower has a "step by step brocade" mullion wooden window (Fig. 3).

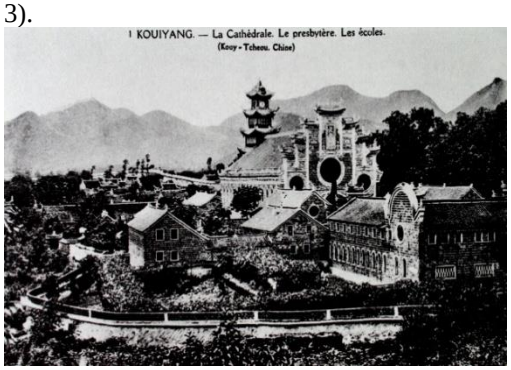

Fig. 3. Long shot of Northern Guiyang catholic church (Guizhou in the eyes of two Frenchmen)

Other shapes: The entrance façade of the Zhenning Tianzhai Temple in Zhenning, Guizhou (the construction time is unknown and has been dismantled) is a four-column and three-column style. The top of the façade ends in a three-segment arc shape with low sides and high sides, like three peaches. There is a treasure top and a cross at the top of each arc. The façade has only a large door, an inverted bell-shaped bell, and a glass window with three pointed continuous coupons on the door. The doors are not opened on both sides, and only the false windows of the three-pointed continuous coupons are symmetrically made. The entire facade is covered with landscape paintings and reliefs (Fig. 4).

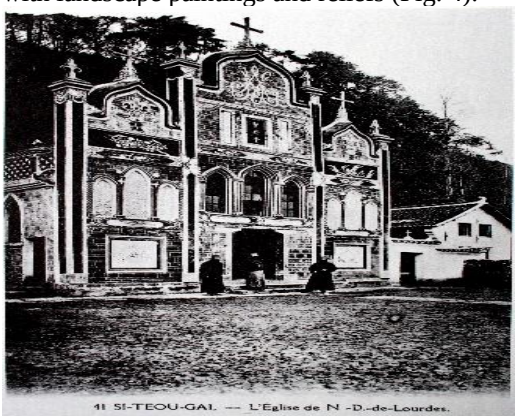

Fig. 4. Zhenning Shitouzhai Catholic church (Guizhou in the eyes of two Frenchmen)

From the examples or data analysis of the modern Catholic Church in Guizhou listed above, the style of the modern Catholic Church in Guizhou: the hall space is mostly Brazilian-style, three-span, high in the middle hall, low on both sides; the roof adopts Western-style skeleton coupons and China Traditional roofing combined with the construction method; the façade is a variant of a traditional archway or a variety of gables; the clock tower is replaced by a pavilion tower, or the clock tower is not used.

2.2 Construction Technology and Material Characteristics of Guizhou Catholic Church

The modern Catholic church in Guizhou is mainly composed of wood, brick and stone. The interior and side halls inside the church are like the construction of the ancient Chinese temple. The wooden structure is used to lift the beam or the bucket as the main force structure, creating a large space for the church. Stone is used for paving, foundation, brickwork and column foundation. The pillars of the load are made of traditional round wood columns instead of the beam columns of the Gothic church. The column base is made of various shapes and bas-relief stone columns. Bricks act as maintenance structures and do not bear gravity (Fig. 5). The top of the church is made of wooden panels to make a dome or vault. The dome and vault are located below the beams and rafts, similar to the ceilings of ancient buildings. The veneer's plate and plate are made of wooden ribs to form a skeleton coupon pattern, which meets the needs of force and shape. All the wood ribs are

handed over to the middle of the dome, and the bottom is a hanging flower. On the one hand, several ribs are embedded in the cylinder to fix, on the other

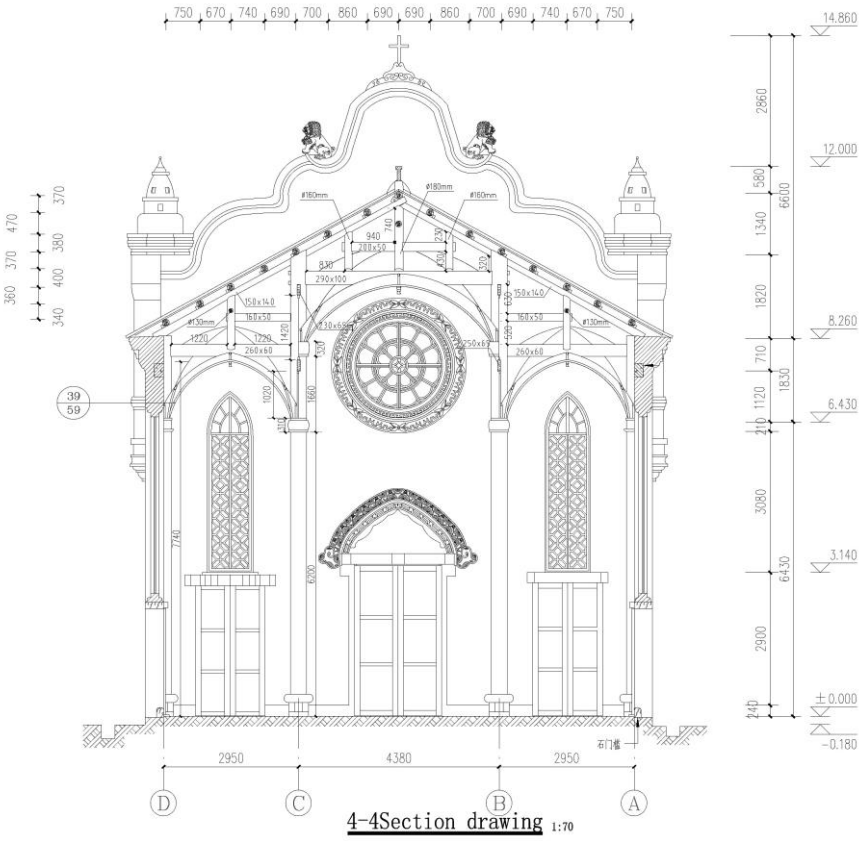

Fig. 5. Drawn by the author

hand, the short column for the decorative function serves to beautify the space. The roof is completely in accordance with the local practice in Guizhou, and the rafters are directly placed on the rafters to hang the small blue tiles.

3. MEITAN CATHOLIC CHURCH STATUS SURVEY

Meitan county Catholic church in Guizhou province (Fig. 6), located in the south road of Zhejiang university, Wenchang lane, Chacheng community, Meijiang town, Guizhou province, the south of the historical and cultural square of Zhejiang university's relocation to the west. It was built in 1884 and was announced as a state key cultural relic protection unit in June 2006. In October 2012, it was commissioned by Meitan county bureau of culture, sports, radio and television to compile a survey report on the current situation of the cultural relic and a design plan for the restoration project. With a more accurate understanding of the shape, construction materials and technology of modern Catholic churches in Guizhou, the protection and maintenance of the cultural relics are more characteristic, and the technical measures are more scientific. In addition to repairing the damaged part of the building, we also corrected the wrong changes of the church's shape and some structures and components in the past repair according to the old photos and interviews with the surviving clergy, so as to restore its original appearance to the maximum extent.

Fig. 6. Meitan Catholic church, photo by the author

3.1 Architectural Structure and Form

Meitan Catholic church is a brick and wood structure, with a width of 11.08 meters, a depth of 26.56 meters, a total height of 14.82 meters (including the bell tower), a width of 4.38 meters in the central hall of the church, and a width of 3.15 meters on both sides of the corridor. The rear of the building is a clock tower with four corners and a spire, which does not allow for the people to go upstairs. The foundation of the building is strip red rod stone, the lower part of the wall is 5 floors 240x150x75 mm brick, and the upper part is 240x150x35 mm empty bucket brick wall. The building is a two-slope tile roof. The building is a perforated wooden structure with zig-zag diagonal beam, which can bear the load and

is surrounded by external hollow brick walls. The four sides of the building are 16 wooden columns with a diameter of 350 mm (all of which were replaced by concrete columns during maintenance in the 1980s), which are connected by 16 shuttle iron pieces and four walls. There are 8 wooden columns with a diameter of 350mm in the middle, and all the 24 columns have exquisitely carved base bases (Fig. 7). The ceiling of the middle hall of the church is 5 octagonal vaults, and the front of the side corridor is 4 octagonal vaults, ending with a vault (Fig. 8).

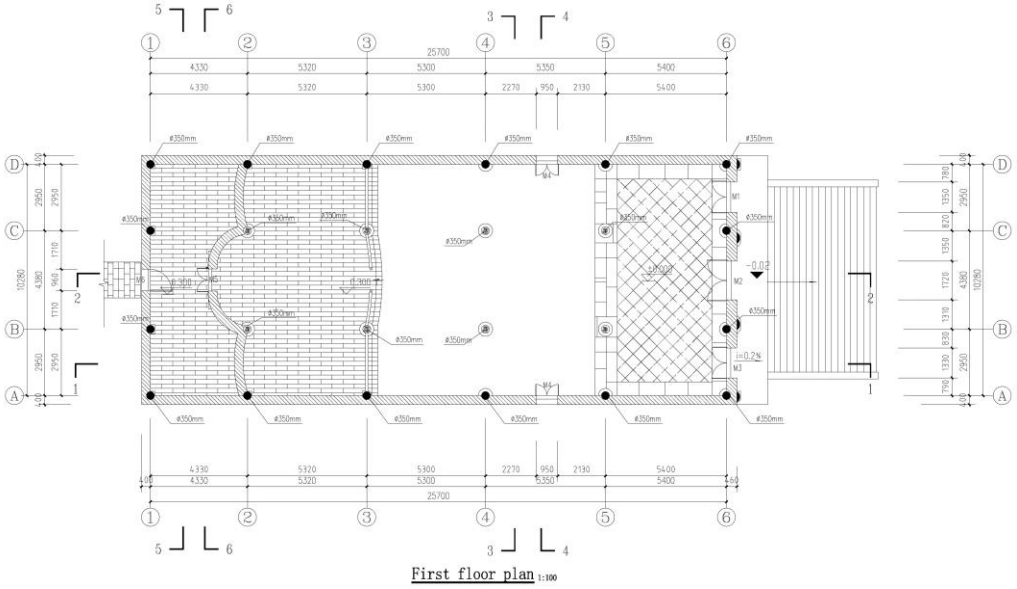

Fig. 7. Drawn by the author

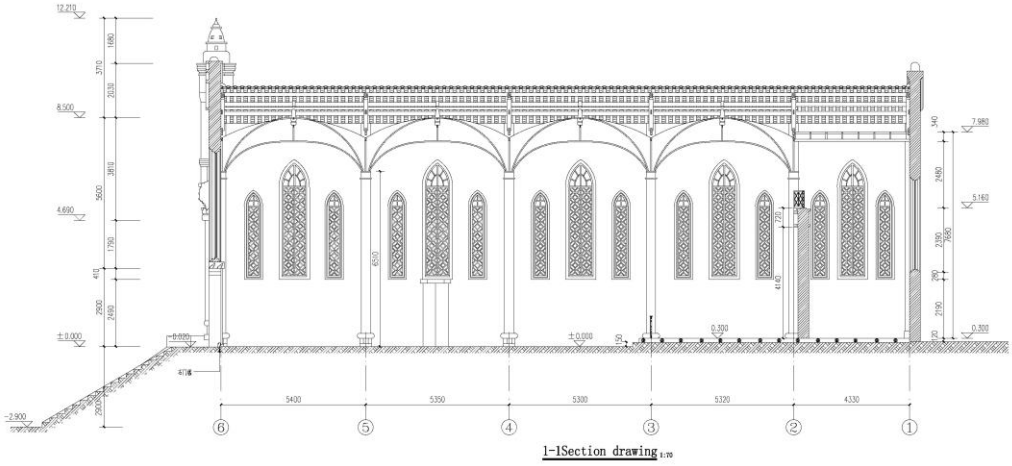

Fig. 8. Drawn by the author

3.2 Architecture Decoration

The dome in the middle hall, the dome in the front of the side porch were painted rust red, the vault was painted turquoise, and yellow stars were painted on the ceiling. The painting should have been painted during the maintenance in 1996.

The north and south walls are painted with mineral pigments on both sides of the Windows in large scale similar to the curtain pattern and under the Windows in a group flower pattern. The painting time should be similar to the completion time of the church in the 10th year of the reign of emperor guangxu of the Qing dynasty (1884). The pigment used in the curtain pattern is garcinia, and the pigment used in the group flower pattern is cobalt blue.

On the wall of the east wall, small patterns of flowers, insects, fish, animals, bats, landscapes and figures are painted on the brick wall with ink-brown mineral pigments. In addition, use ink and advertising pigment around the window frame to draw a floral pattern. The paintings were painted during maintenance in 1996.

On the western wall, four bats were surrounded by a cross painted under a rose window. The painting time should be similar to that of the church in the 10th year of the reign of emperor Guangxu of the Qing dynasty (1884).Other parts of the brick wall and window frames are decorated with flower trees, bats and flowers with ink and advertising pigments. The painting should have been painted in 1996 for repairs. The ceiling of the middle hall and side corridor is separated by a continuous wooden partition. Use advertising pigments to paint landscapes, figures and other activities. The painting was painted in 1996.

In the church facade, there are clay lions, elephants, a pair, as well as wheat ears, Portuguese tarts and other shallow relief.

3.3 Damage And Disease Assessment (Table 1)

Table 1. Table of the main components damaged

No.	Component parts	Texture	Damage properties	Cause of the damage	Damage assessment
1	Floor	Red stone; China fir	The original stone and wood floors were changed; The red stone ground was partially damaged	Outdoor stone steps were replaced with concrete steps, and indoor altars and ancillary rooms with original wood floors were replaced with cement floors. The stone floor of the side gallery of the hall was damaged and dented partially by the wind	Original stone material and wood floor practice were destroyed, uneven ground was caused, and the appearance of the ground was affected
2	Wall	Handmade clay brick	Partial brick walls were replaced by concrete bricks; The brick wall body showed no big damage, whereas the lime mortar on the wall was peeled off and stained	The bricks above the dome were replaced with concrete bricks, the front facade was changed from baroque style to cat back arch, and the lime mortar on the walls was naturally weathered	The safety was not affected; aesthetics was affected; the principle of authenticity of architectural heritage was destroyed
3	Column	China fir	Cracked, deteriorated, damaged by worms, paint was shed	Natural rain erosion without effective protection	There were worm-eaten holes, $\rho \approx 0.166 < 1/5 = 0.2$, which did not affect the safety of the structure
4	plinth	Bluestone	Slight weathered	Naturally weathered	The normal use was not affected
5	short column	China fir	Cracked, deteriorated, damaged by worms	Natural rain erosion without effective protection	There were worm-eaten holes, $\rho \approx 0.489 > 0.2$, which affected the safety of the structure; $\rho \approx 0.09 < 1/5 = 0.2$, which did not affect the safety of the structure
6	fornix	China fir	Rib and vault batten were deteriorated and shed	Natural rain erosion without effective protection	Constitute a damage point
7	Pendant on top of fornix, wooden ornament	China fir	Deteriorated	Natural rain erosion without effective protection	$\rho = 60x20/100x30 = 0.4 > 1/5 = 0.2$,which affected the safety of the structure; $\rho = 30x15/100x30 = 0.15 < 1/5 = 0.2$, which did not affect the safety of the structure
8	Arch	China fir	The bridle and the lath of vault were deteriorated	Natural rain erosion without effective protection	Constitute a damage point
9	Purline	China fir	Down-warped, cracked, small wood, which affected the safety of the structure	Natural rain erosion, and in the 1980s maintenance replacement material diameter is too small to withstand the roof load	$\omega 1 = 90 > 5520/120 = 46m$, which affected the safety; $\omega 1 = 30 < 5560/120 = 46mm$, which did not affect the safety
10	Fangzi	China fir	Deteriorated, damaged by worms, cracked microscopically	Natural rain erosion without effective protection	$\rho = 120x40/260x60 \approx 0.308 > 1/8 = 0.125$,which affected the safety of the structure; $\rho = 50x20/230x65 \approx 0.067 < 1/8 = 0.125$, which did not affect the safety of the structure
11	Rafter	China fir	Transformed,	Because of purlin's too	The maximum rafter span is

			deteriorated, broken	large around degree, resulting in deformation, natural rain erosion without effective protection	860mm, and the round degree of more than 60% is greater than 1/100 of rafter span, which causes obvious roof deformation, tile shedding and rain leakage, and affects the use of the house
12	Inclined beam	China fir	Cracked, deteriorated, damaged by worms	Natural rain erosion, and in the 1980s maintenance replacement material diameter is too small to withstand the roof load	ρ=90x80/130x120≈0.462> 1/8=0.125, which affected the safety of the structure
13	Grey coating		The shape did not match the old photo/damaged, the color was faded	In the 1980s, unscientific maintenance changed the original form; Naturally weathered	Destroy the principle of authenticity of architectural heritage; constitute a damage point
14	Door	China fir	Damaged, deteriorated, damaged by worms	Nature	Constitute a damage point
15	Window	China fir	Rose window/pointed arch window	Nature/during the 80's repair, the church was constructed in accordance with the principle of the installation of no glass construction, did not consider the installation of colored glass was not considered to be mounted on the church	Constitute a damage point
16	Different surbase	Brick, lime mortar	Broken or detached	Natural rain erosion without effective protection	Constitute a damage point
17	Tile	Chinese-style tile	Damaged	Natural rain erosion without effective protection	Cause the leakage of rain, affecting the use of the house
18	All components of the bell tower		Damaged and deteriorated	Natural rain erosion without effective protection	Constitute a damage point
19	entrance step	Cement	The original red stone steps were rebuilt into cement steps	The red stone steps were rebuilt into cement steps	Destroy the principle of authenticity of architectural heritage

These prove that ρ is the ratio of the area occupied by decay and aging deterioration (the total of the two) to the area of the whole section. If column's ρ >1/5, beam's and square-column's ρ >1/8, and some wood joints have deteriorated into soft joints or rotten joints, the component is severely damaged and deemed unsafe.

ω1 is the disturbance degree, the rafter disturbance degree is greater than 1/100 of rafter span, and has caused obvious roof deformation, which is considered the severe damage.

When purlin's $\omega_1 > L/90$ or $\omega_1 > 36mm$ (L denotes the calculated span) , or when its $L > 4.5m$, $\omega_1 > L/125$. Since most purlins' deflection is large($L \leq 4.5m$), which causes the leakage of rain, purlins, regardless of its size of ω_1 , are considered as damage points and unsafe components. Due to the large number of components in Meitan Catholic church, only one calculation data affecting safety and one calculation data not affecting safety are listed in the table to illustrate the basis for the assessment and identification of the degree of damage.

4. CONSERVATION AND MAINTENANCE FOR MEITAN CATHOLIC CHURCH

Based on the analysis of the characteristics of Guizhou Catholic church, it can be concluded that its structure is more inclined to the traditional Chinese wood structure and painted clay sculpture. Therefore, based on the full exploration of the damage and disease assessment of Meitan Catholic church, the

repair and protection process is following the revised version of the law of the People's Republic of China on the protection of cultural relics in 2007, Regulations for the implementation of the law of the People's Republic of China on the protection of cultural relics (2003), measures for the administration of projects for the protection of cultural relics (2003), and guidelines for the protection of cultural relics and historic sites (2000). Besides technically, more references were made to the technical code for the maintenance and reinforcement of wooden structures in ancient buildings.

4.1 Building Part

On the ground, the floor of the hall and the side gallery remains intact. For the altar and ancillary houses, the current cement floor will be demolished, the base layer will be compacted, and a 140 mm diameter raft with a pitch of 700 mm will be added. The upper bunk 200*700 thick 30 mm original fir floor is paved, and the base is restored to red ochre.

Wall. Demolition of the concrete brick wall that changed the original facade of the cultural relics during the maintenance in the 1980s. Rebuilt with lime mortar using custom hand-made clay bricks. The size and color of the custom hand-made bricks are basically the same as the original ones. In addition, the wall is re-grayed. Draw beautiful paintings according to traditional techniques and old photos. The top wall of the façade is restored according to the old photos. Since the lower part of the façade still maintains the original appearance, the dimensions of the wall, door, wall column and other components under the actual façade are scaled (1:1100) by segmenting the vertical direction of the old photograph. Derive the size of the wall to be restored in the upper part (Fig. 9). In the horizontal direction, the approximate size is derived by the grid method through the vanishing point (Fig. 10). Lime mortar and glutinous rice are used in the jointing of new and old walls to enhance the adhesion. Remove the lime mortar and peel off the stained surface. Use lime mortar to pour the surface. The painted area was redrawn with traditional techniques.

Fig. 9. Drawn by the author, old photo provided by local cultural relics department

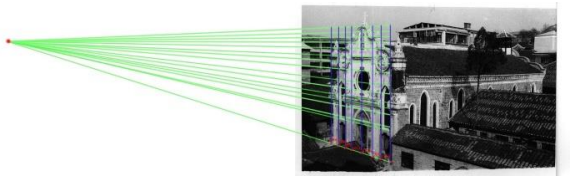

Fig. 10. Drawn by the author, old photo provided by local cultural relics department

The foundation of the column, the column and the foundation of the column remain intact. Considering the structural stability and the minimum disturbance to the wall painting, the 16 surrounding concrete columns are retained. The wooden frame is used to support the roof only on the first column and the last one of the four pillars against the wall to restore the original structure. Continue to use the 8 wood pillars in the middle for insecticidal, antiseptic, repair, and reinforcement treatment. The cracked part is inlaid with cracks with wooden strips, and is adhered with a water-resistant adhesive, and finally re-oiled. For parts that are too large, the parts are removed, and the new materials are replaced with iron hoops. (Because no destructive survey is taken this time. If the studs, columns, and hollows are not repairable during maintenance, the entire column should be replaced with the column with the same size of the material).

Melon column. Continue to use the melon column after insecticide, antiseptic, repair and reinforcement treatment. The insects, with the particularly serious damage, which has already threatened the safety of use, needs to be replaced by the same material with the same size.

Vault, arch. The arch ribs and rafts that can continue to be used are retained as much as possible. Replacement affects structural safety, grooved, detached ribs, slats, and vault slats. The entire dome and the arch were repaired to make the shape round and full. Then, use traditional paint craft oil. Vault is rust-colored, and arch is colored in sky blue, and both of which are painted with yellow stars.

Vault top hanging flower hanging piece. Try to repair the deteriorated part of the hanger and continue to use it. For the hangers that must be replaced, they should be made, engraved, and colored as they are.

Purlin, rafter. Most of the buildings and rafts were replaced during maintenance in the 1980s. The materials used were too small to bear the roof load, which caused the cockroaches to dislocate and the roof to sink and leak. Subsequent maintenance adds a lot of support components, and still can't solve the problem fundamentally. This design replaces the purlins that are too small and have too much under deflection. Replace the partially deteriorated, oversized rafter.

Scorpion. Continue to use the scorpion after insecticide, antiseptic, repair, and reinforcement treatment. For insects, the damage is particularly serious, and it has threatened to use safe, we chose to use the same size of the same material to replace the dice. For the replacement of concrete beams in the

1980s, this maintenance was retained in view of the minimum disturbance to the walls and paintings.

Oblique beam. The part of the diagonal beam of the building was replaced during maintenance in the 1980s. The material used was too small to bear the roof load. This design replaces the components that are too small and have too much undercut.

Tiles. Replace damaged tiles. The newly added tiles are fired according to the original size and traditional manual work, and the color is required to be consistent with the original tile, and the tile is laid by pressing the process of seven dews.

Gray coating. Repair the damaged gray plastic, and rectify the old photos according to the gray plastic changed in the previous maintenance.

Doors, windows, clock towers. It is necessary to replace components such as the deteriorated wooden material and the material damaged by worms. The windows are all repaired according to the design drawings. Replenished with stained glass. Replace the bell tower with broken, bad components.

Antiseptic and insect proof. For the key wood components with severe erosion such as beams, columns, rafts and rafts in the building, a secondary treatment method should be adopted. In the first treatment, the oil-soluble wood preservative is used, and the surface coating method and the spray method are used to inject the insect-infested wood into the insect-infested part by the injection method, so that the medicine naturally permeates and spreads. In order to achieve the drug intake, the site must be painted or sprayed more than three times. After each treatment, the components are wrapped and sealed with an agricultural plastic film to spread the medicament into the interior of the wood. After the oil-soluble preservative seal diffusion is completed, the film is wrapped. The second treatment is to perform a uniform spray treatment with a water-soluble agent after the first treatment is completed. Each wood member was sprayed three times carefully (3 times/time, 1 time/day). Complete a processing cycle in three days. Then, one processing cycle is repeated after 3-5 days.

For replacement of new wood, the wood components are immersed in a water-soluble medicament and used for drying the wood. For wood components that are susceptible to moisture, apply oil-soluble preservatives after the wood has dried. When handling doors and windows, the needle part is used to focus on the part of the skull. If necessary, the rest of the area can be treated by spraying.

4.2 Colored Painting

The principle of color painting restoration: follows the principle of “repairing the old as old” and “maintaining the original appearance”. According to the characteristics of color painting materials, we choose materials with stable chemical properties that can protect the color painting rather than change the color painting. At the same time, the material should be reversible or retreatable, so that it can be easily removed after aging, or do not affect the subsequent treatment. In addition, it is necessary to use the same material as the color painting material, and try to avoid new damage to the color painting during protection and repair.

Detailed records of the current status of color paintings, including text, drawings, photographs, etc., are required. Recording work is done in parallel with repairs, and each step is carefully recorded to preserve accurate and informative scientific data.

It is necessary to do a good job of strengthening and repairing the mantle layer. The mantle layer was reinforced by high to low with a 2% to 5% polyvinyl acetate solution. For the repair of the mantle layer shedding, the repair mortar is prepared according to the same material and ratio as the mantle. Remove the floating soil before repairing, fully wet the edges with distilled water, and then repair with mortar.

Picture cleaning. In the first step, remove the surface dust and swipe with a soft tool such as a sheep brush or a brush. The adhered dust is treated with acetone, ethanol, deionized water mixture cleaning agent and cotton paper. For the nail and the powdered part, first apply back the nail or strengthen the pigment layer. In the second step, gently remove the spider web with a sheep brush. The third step is to remove water stains. Apply a mixture of ethanol and acetone to the area where the disease is applied and apply it for 3-5 minutes to soften it. Subsequently, it was carefully removed with a bamboo knife, a scalpel, and the like.

The repair of the surface crack of the color painting adopts the traditional manufacturing process and materials, and the mortar of the same material is prepared according to the analysis result of the mantle material to fill the crack.

Grouting back to the empty drum. First, block the cracks in the color painting to avoid running the pulp. Drill holes and vent holes are drilled in areas where color painting is not important. Insert the catheter into the grouting area. The prepared lime mortar slurry was drawn using a large syringe. Insert the outer end of the catheter to push the syringe to grout. One person pushes the syringe for grouting, while the other person continually taps the grouting site and observes the grout. After the injection of the slurry is completed, the top of the top plate is fixed at the grouting place. 2-4 layers of rice paper on the top and color surface. Change the rice paper regularly to facilitate the drying of the grouting area and the removal of salt.

The solid color of the surface of the color painting is painted or sprayed three times with a 1% polyvinyl butyral ethanol solution. On the one hand, the pigment layer is increased in resistance to the natural environment of the environment, and on the other hand, the cohesion of the pigment layer and the bottom layer is restored, thereby extending the life of the color painting.

Aiming at the covered patterns in the repairs of the 1980s. Clean the later pattern, based on the residual condition and pattern outline. Secondly, use the original mineral pigments to re-trace and redraw the patterns, pigments and colors of the existing color paintings.

The full-color treatment of the repaired parts, the repaired parts are processed in full color, and the same color and traditional techniques are used for the full color, so that the far-sightedness is integrated, and the old and the new are different. The picture is harmonious and uniform, but the identifiable principle should be followed.

The overall protection of the screen is protected. After the whole color painting process is completed, each color painting is sprayed on the surface with a low concentration of 3% B-72. It can reinforce the missing unreinforced small piece of armor, increase the bonding force between the pigment layer and the mantle layer, and also isolate the harmful gas from damage to the picture.

The paintings of the Catholic Church are very rich in various periods. The indoor paintings and slogans with good preservation of authenticity should be strictly protected during the construction process to prevent rainwater, construction water, dust and other factors that may cause damage to the painting and slogans. For the painted front facade which is not consistent with the historical original appearance in the later period, it should be restored according to the historical original appearance, old photos and the traditional practices of similar buildings in the same period, and the status quo of painted cornice on both sides and back facade should be retained as far as possible.

5. CONCLUSION

For the maintenance of Meitan Catholic church, we must first respect the principle of history. In all previous maintenance processes, the cultural relics were destructed. This design seeks historical basis as far as possible and restores relics the appropriately according to the principle of minimal intervention. Second, we should adhere to the principle of not changing the original state of cultural relics. To avoid or minimize damage to the value of the cultural relics due to maintenance. Third, adhere to the principle of less intervention. Where it is necessary to intervene, additional means are used only in the parts requiring the intervene most, and the intervention should be reduced to a minimum. Fourth, we should prioritize the protection and the rescue. To protect the existing historical objects as much as possible. All technical measures should not prevent the maintenance of the original parts again. The parts that have been processed should be coordinated with the original parts and be identifiable. Finally, this maintenance primarily aims to lift the top maintenance. For maintenance, a full house frame should be built, and the top shelf should be able to prevent rain. According to the maintenance procedures, the tile roof should be first removed, and then the rafter, purlin, melon column and fangs should be separated from the top down to. The tenon should be prevented from breaking or splitting during the dismantling process. Before removing the wooden frame, the component number shall be given first, the component number shall be marked on the drawing, and the removed component shall be inspected carefully. Avoid damaging the wall when removing. Old components must be treated with anticorrosion and insect control if they are to be used continuously. The whole repair project shall be constructed in strict accordance with the drawings.

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Talking about the Normal Distribution and Its Application

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Abstract: Normal distribution is the most important distribution in probability theory and the most common distribution in nature. The normal distribution is widely used in life, especially in medicine, and has important applications. With the development of technology, the normal distribution is getting more and more attention. Theoretical research shows that many distributions can be approximated by the normal distribution, and some important statistical distributions can be derived from the normal distribution, and more importantly, the normal distribution has good. Therefore, it is very important in theoretical research. Through a simple description of the origin of the normal distribution, as well as concepts, this article focuses on the application of the normal distribution, especially in medicine, and shows the normality. Distribution is closely related to our lives and plays an important role in economic development, quality monitoring and medical diagnosis.

Keywords: normal distribution; mean; variance; limit theorem

1. INTRODUCTION

The object of probability theory and mathematical statistics research is random phenomena, and it is the discipline that studies harmony and the statistical regularity of random phenomena [1]. Probability theory originated in the seventeenth century. It originally originated from the development of insurance, but it came from gambling. The request of this person is the source for mathematicians to think about the problems in probability theory [2]. In the middle of the seventeenth century, the French nobleman, De Mei, was in dice gambling. The gambling funds were reasonably distributed by the prediction of the outcome, but I don't know what proportion of distribution is considered reasonable, so I wrote to ask Pascal, the highest mathematician in France at the time. It was this letter that pushed the theory of probability forward. Take the first step, Pascal and then the first-class mathematician Ferma studied the problem of dice gambling proposed by De Mei Hei [3]. Therefore, a new branch of mathematics-probability theory entered the history Stage. For the development of normal distribution, most of the existing literature talks about the theoretical work of a certain person or a certain stage of normal distribution, and mainly records and proves that the normal distribution ranges from being ignored to being widely used. Applied and no details were recorded, while the latter is more theoretical value and significance of mathematical research, which is currently the midpoint of research at home and abroad.

2. THEORY OF NORMAL DISTRIBUTION

2.1 Definition of Normal Distribution

Definition 1: definition in sample space Ω random variables taking values in the real number field $\xi(\omega)$. If its distribution function is

$$F(x)=p(\xi(\omega)\le x)=\phi(x)=\frac{1}{\sqrt{2\pi}\sigma}\int_{-\infty}^{x}e^{-\frac{(y-\mu)^2}{2\sigma^2}}dy,-\infty<x<+\infty \quad (1)$$

Then said $F(x)$ is a random variable $\xi(\omega)$, the normal distribution is often simply written as $N(\mu,\sigma)$, and the corresponding density function is

$$p(x)=\varphi(x)=\frac{1}{\sqrt{2\pi}\sigma}e^{-\frac{(x-\mu)^2}{2\sigma^2}},-\infty<x<+\infty \quad (2)$$

And said $\xi(\omega)$ is a normal variable. Here's μ with σ refers to the mean and standard deviation, respectively.

$p(x)$on $x=\mu$ point symmetry, in$x=\mu$reach great when μ when fixed, σ the smaller the value, $p(x)$ the sharper the image, σ the larger the value , $p(x)$ the smoother the image. From the nature of the probability density function, we can know that if $p(x)$ in μ the sharper and higher near the point, the random variable is μ the greater the probability of taking values near the point, in fact, for arbitrary compliance $N(0,\sigma^2)$ random variable ξ have

$$p(-\sigma\le\xi(\omega)\le\sigma)=\frac{1}{\sqrt{2\pi}\sigma}\int_{-\sigma}^{\sigma}e^{-\frac{x^2}{2\sigma^2}}dx\approx 0.688 \quad (3)$$

$$p(-2\sigma\le\xi(\omega)\le 2\sigma)=\frac{1}{\sqrt{2\pi}\sigma}\int_{-2\sigma}^{2\sigma}e^{-\frac{x^2}{2\sigma^2}}dx\approx 0.955 \quad (4)$$

$$p(-3\sigma\le\xi(\omega)\le 3\sigma)=\frac{1}{\sqrt{2\pi}\sigma}\int_{-3\sigma}^{3\sigma}e^{-\frac{x^2}{2\sigma^2}}dx\approx 0.997 \quad (5)$$

This shows that, random variables ξ the absolute value does not exceed σ probability is slightly greater than $\frac{2}{3}$, no more than 2σ the probability is above 0.95, while exceeding 3σ probability is only 0.003, i.e.

$$p(|\xi|>3\sigma)\approx 0.003 \quad (6)$$

Because $p(|\xi|>3\sigma)$ is small, and it is often thought that it will not happen in practical problems. That is, obedience $N(0,\sigma^2)$ random variable ξ, basically speaking, $|\xi|\le 3\sigma$, this approximation is said by some practitioners to be normally distributed " 3σ in principle".

From the discussion above, σ random variable ξ, the degree of dispersion of the values.

2.2 Properties of The Normal Distribution

Normal distribution is also known as "normal distribution", which has two parameters μ with σ^2, the first parameter μ is the mean of a random variable that follows a normal distribution, the second parameter σ^2 is the variance of this random variable, so the normal distribution is written as $N(\mu,\sigma^2)$. The probability law of random variables obeying the normal distribution is μ probability of neighboring values is large, while taking away μ the farther the value, the smaller the probabilit; σ the smaller, the more concentrated the distribution μ nearby, σ the larger the distribution, the more dispersed the distribution; therefore, the frequency distribution of variables that obey the normal distribution is given by μ, σ completely decided.

Property 1: Concentration, the peak of the normal curve is located in the center, which is where the mean is.

Property 2: Symmetry, the normal curve is centered on the mean value and is symmetrical on the left and right.

Property 3: Uniform variability, the normal curve starts from where the mean value is, and gradually decreases evenly to the left and right sides.

3. APPLICATIONS OF NORMAL DISTRIBUTION

3.1 Simple Application of Normal Distribution

The normal distribution has extremely wide applications, and the probability distribution of many random variables in production and scientific experiments can be approximated by the normal distribution. For example, under the condition of constant production conditions, the product's strength, compressive strength, indicators such as caliber and length; indicators such as body length and weight of the same organism; weights of the same seed; errors in measuring the same object; deviation of the impact point in a certain direction; annual precipitation in a certain area; velocity component, etc. In general, if a quantity is the result of many small independent random factors, then this quantity can be considered to have a normal distribution. In theory, the normal distribution has many good properties, many probability distributions can be approximated by it, and some commonly used probability distributions are directly derived from it, such as lognormal distribution, t distributed, F distribution, etc. Its main applications are as follows.

3.1.1 Estimated frequency distribution

A variable that obeys the normal distribution can estimate the frequency ratio in any range according to the formula as long as it knows its mean and standard deviation.

3.1.2 The theoretical basis of statistical methods

Such as t distributed, F the distributions are derived based on the normal distribution. μ the test is also based on a normal distribution. t the limits of the distribution, binomial distribution, and poisson distribution are normal distributions. Under certain conditions, they can be processed according to the principle of normal distribution.

n independent of each other $N(0,1)$ the sum of the squares of the variables is a parameter as n of χ^2 distributed random variables, because people are accustomed to calling the number of independent variables "degrees of freedom", so they are also called degrees of freedom as n of χ^2 variable.

Corresponding F the distribution is if ξ versus η independent of each other n versus m of χ^2 random variable $\varsigma=\frac{\xi/n}{\eta/m}$ is the parameter is n,m of F distribution, recorded as $F(n,m)$。

For μ test, often hypothesis H_0: $\mu=\mu_0$ true, then the subsample mean $\overline{\xi}$ should be in μ_0 sway around randomly without deviating μ_0 too large. In order to look up the table, we will $\overline{\xi}-\mu_0$ change to $\mu=\frac{\overline{\xi}-\mu_0}{\frac{\sigma_0}{n}}$.

In H_0 when true, follow the standard normal distribution. For a given level of significance α ,in case H_0, then $p_{H_0}\left(|\mu|\ge\mu_{1-\frac{\alpha}{2}}\right)=\alpha$.

In case $|\mu|\ge\mu_{1-\frac{\alpha}{2}}$（$\mu_{1-\frac{\alpha}{2}}$(Can be checked from the standard normal distribution table), then the null hypothesis is wrong, otherwise the null hypothesis holds.

3.2 Central Limit Theorem

The central limit theorem is a theorem that discusses the asymptotic and normal distribution of the sequence and distribution of random variables in probability theory. This theorem is the theoretical basis of mathematical statistics and error analysis. Conditions for the cumulative distribution function.

It is the most important class of theorems in probability theory and has a wide range of practical application backgrounds. In nature and production,

some phenomena are affected by many independent random factors. If each factor has a small effect, the total the influence can be regarded as obeying the normal distribution. The central limit theorem proves this phenomenon mathematically.

Theorem 1: In n Heavy Bernoulli trial, event A the probability of occurrence in each trial is $p(0<p<1)$, μ_n for n events in trials A occurrences, then $\lim_{n\to+\infty} p\left(\frac{\mu_n - np}{\sqrt{npq}} \le x\right) = \frac{1}{\sqrt{2\pi}}\int_{-\infty}^{x} e^{-\frac{t^2}{2}}dt$.

Theorem 2: If $\xi_1, \xi_2, \xi_3 \ldots$ is a list of independent and identically distributed random variables, and $E\xi_k = \alpha, D\xi_k = \sigma^2\left(\sigma^2 > 0\right), k = 1,2,\ldots$, then $\lim_{n\to+\infty} p\left(\frac{\sum_{k=1}^{n}\xi_k - n\alpha}{\sigma\sqrt{n}} \le x\right) = \frac{1}{\sqrt{2\pi}}\int_{-\infty}^{x} e^{-\frac{t^2}{2}}dt$.

3.3 Application of Normal Distribution in Medicine

Many medical phenomena obey normal distribution or near normal distribution, such as: the height of children of the same age, the number of red blood cells of healthy adults of the same sex, etc., many medical data are skewed, such as the incubation period of diseases, etc., after logarithmic transformation obey the log-normal distribution, so the normal distribution is often used in medicine to detect whether children are developing normally and the incidence of diseases. The normal distribution has therefore received widespread attention and application.

Formulating the range of medical reference values: also known as the range of medical normal values. It refers to the fluctuation range of the so-called "normal" anatomy, physiology, biochemistry and other indicators. When formulating the range of normal values, we must first determine that a batch of samples is sufficiently large. "Normal person", so-called "normal person" does not mean "healthy person", but refers to a homogeneous population that excludes diseases and related factors that affect the index being studied; secondly, an appropriate percentage cutoff value should be selected according to the research purpose and use requirements. Such as 80%, 90%, 95% and 99%, commonly used 95%; determine the unilateral or bilateral values according to the actual use of the indicator. If the white blood cell count is too high or too low, it is abnormal to determine the bilateral value. Another example is the abnormal upper limit of transaminase in liver function, which requires the determination of unilateral upper bound, and the abnormal low vital capacity, the determination of unilateral lower bound. In addition, according to the distribution characteristics of the data, appropriate calculation methods should be selected. Common methods are:

(1) Normal distribution method: It is suitable for data with normal or near normal distribution.

(2) Log-normal distribution method: suitable for log-normal distribution data.

(3) Percentile method: It is often used for skewed distribution data and data with no exact value at one or both ends of the data.

Table 1 Commonly used μ value

Reference value range (%)	Unilateral	Bilateral
80	0.842	1.282
90	1.282	1.645
95	1.645	1.960
99	2.326	2.576

For example, the blood lead content (ug/dl) of 100 normal adults measured in a certain place in a certain year is shown in Table 2. Try to determine the 95% reference value range of the blood lead content of normal adults in that place.

Table 2 Blood lead content of 100 normal people

4	4	5	5	6	6	7	7	7	7
7	8	8	8	8	8	8	8	9	9
10	10	10	10	10	10	10	10	11	11
11	12	13	13	13	13	13	13	13	13
13	13	14	14	14	15	15	16	16	16
16	16	16	16	16	17	17	17	17	17
18	18	18	18	19	20	20	20	20	21
21	22	22	22	23	24	24	25	25	26
26	26	27	27	28	28	29	30	30	31
31	32	32	32	33	35	41	44	50	51

According to experience, it is known that the blood lead content of normal adults is approximately log-normally distributed. Therefore, first, logarithmic transformation is performed on the original data to perform a normal sex test $\left(p > 0.50\right)$ and prepare logarithmic frequency table 3, and then use the normal distribution method to find the 95% reference value range.

Table 3 Prepare logarithmic frequency

Pair of array segments	Frequency	Cumulative frequency
0.6~	4	4
0.7~	2	6
0.8~	5	11
0.9~	9	20
1.0~	12	32
1.1~	15	47
1.2~	18	65
1.3~	14	79
1.4~	12	91
1.5~	5	96
1.6~	3	99
1.7~1.8	1	100
total	100	—

Solution: According to the data given in Table 1 above, we can therefore set x Is the group median of the logarithmic array segment, $n = 100, \sum f(x) = 118.2684, \sum f\left(x^2\right) = 145.7359$, the mean and standard deviation of the logarithms are: $\bar{x} = \left(\sum f(x)\right)/n = 1.1827$, $S = 0.2433$

Because the blood lead content is only abnormally high, the reference value range should be the upper

limit of 95% on one side: $\lg^{-1}\left(\bar{x}+1.645S\right)=38.28$ （ug/dl）.

That is, the reference range of 95% of the blood lead content of normal adults in this area is less than 38.28ug/dl. That is, those with blood lead content greater than 38.28ug/dl are abnormal people, that is, the blood lead content is too high, and corresponding medical treatment is needed.

4. CONCLUSION

In the practical context of linking nature, society, and thinking, we are based on the nature of normal distribution, and are characterized by normal distribution curves and area distribution maps (this map will emerge later when talking about normal distribution and normal distribution theory), abstraction and promotion, grasp the main philosophical connotation, and summarize the main meaning of normal distribution theory (normal philosophy) as follows:

4.1 Holism

The normal distribution reveals that we need to look at things from a holistic point of view. "The overall concept or overall concept of the system is the essence of the system concept." The normal distribution curve and area distribution map are composed of three regions: the base region, the negative region, and the positive region. The composition, the proportion of each area is different. Looking at things as a whole can clearly see the original appearance of things, can we get the fundamental characteristics of things. You can't just see the trees, but you can't see the forest. Based on the analysis of each part and each level, we must also look at things from the whole, because the whole has different characteristics from each part. Looking at the world from a holistic perspective, we must base ourselves on the base area and look at the negative and positive areas. When you see the main aspect, you also need to see the secondary aspect, you must see both the positive side and the negative side of things, and the backward side of things. It is a skewed or perverted thing, not the real thing itself.

4.2 Key Points

The normal distribution curve and area distribution chart clearly show the key points, that is, the base area occupies 68.27%, which is the main body, and we must focus on it. In addition, 95% and 99% show the comprehensiveness of the normal. Understanding the world and transforming the world it is important to stay focused, because the focus is the main contradiction of things, and it plays a major and dominant role in the development of things. If you grasp the focus, you can outline everything and everything. Things and phenomena are complex and complex. If you do not grasp the main contradiction, you will fall into infinite triviality. Due to the relative limitations of our time and energy, for the pursuit of efficiency, we should grasp the focus. In the normal distribution, the base area accounts for the main body and focus. If we combine the 20/80 rule, we can boldly treat the positive area as a focus.

4.3 Development Theory

Connection and development are the basic laws of the development and change of things. Anything has its history of generation, development and death. If we consider the normal distribution as the development process of any system or thing, we can clearly see this process. Going through the process from negative to basic and then positive. Whether natural, social or human thinking clearly follows such a process. To accurately grasp the historical process and stage in which things or events are located is extremely it helps us to grasp the characteristics and nature of things and events. It is an important basis and basis for us to analyze problems, take countermeasures, and solve problems. Different stages of development have different natures and characteristics, and the methods for analyzing and solving problems must be related to this. Adaptation, this is the specific analysis of specific problems, and it is also the essence of emancipating the mind, seeking truth from facts, and advancing with the times. The characteristics of normal development also reveal that most of the development of things is gradual and cumulative. For example, heredity is normal and mutation is abnormal.

Through the description of this article, we can see that the normal distribution is not only related to scientific experiments and economic development, it is also applied to our actual life, is closely related to our life, and has a great impact on our diet and health. Applications in real life are getting more and more attention and are being widely used.

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The Application of Industrial Robot in Intelligent Manufacturing

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Abstract: Industrial robot is a kind of mechanical device with multi degree of freedom or multi joint manipulator in the field of facial industry manufacturing. Through its own power and control ability to achieve its corresponding functions. Industrial robots can directly accept the command of human beings in their work, and can also run through pre edited and entered control programs. With the continuous development of industrial robots, the current industrial robots generally have the function of artificial intelligence, which can modify and improve their own operations through demonstration actions, sensor feedback and 3D visual feedback. Intelligent manufacturing is the development trend of manufacturing industry in the future, and it is also the core content that affects the development level of manufacturing industry. The application of industrial robots in intelligent manufacturing can effectively improve the development of China's intelligent manufacturing industry. It is an important measure to optimize the industrial structure of China's manufacturing industry, promote China's industrial manufacturing to move forward to the middle and high end, and build a manufacturing power.

Keywords: industrial robot; intelligent manufacturing; application

1. INTRODUCTION

China's industrial robots began to develop in the 1960s, but restricted by electronic information technology, bionics technology and artificial intelligence technology, they didn't make great progress until the 1990s. In recent years, industrial robots are widely used in the manufacturing industry of our country. With the continuous absorption and improvement of technical experience in practical application, industrial robot technology is constantly mature, and its practical application has also achieved fruitful results. However, in the process of development, there are still some problems in the application of industrial robots in intelligent manufacturing, which need to be further improved. In this paper, the development status of industrial robot industry and intelligent manufacturing industry is systematically analyzed, the existing problems are pointed out, and targeted improvement measures are proposed, hoping to contribute to the improvement of industrial robot industry and the development of intelligent manufacturing industry [1].

2. AN ANALYSIS OF THE DEVELOPMENT OF INDUSTRIAL ROBOT INDUSTRY IN CHINA

2.1 Rapid Development of the Market As A Whole

Manufacturing industry is the pillar of the national economy, the tool of rejuvenating the country, the foundation of establishing the country and the foundation of strengthening the country. Since the industrial revolution, the rise and fall of the world's powerful countries have repeatedly proved that if a country does not have a strong manufacturing industry as a support, it will not have a strong country [2]. Since the reform and opening up, China's manufacturing industry has developed rapidly, which provides a strong impetus for the overall development of China's economy and society. However, through a comprehensive comparison with the advanced countries in the world, it can be found that China's manufacturing industry is large but not strong, especially in the innovation ability, industrial structure, quality and efficiency, information morning reading and other aspects. The grand plan of "made in China 2025" was put forward in the government work report of the national two sessions in March 2015, which was jointly formulated by more than 100 academicians of the Chinese Academy of Sciences and made a detailed plan for the development of China's manufacturing industry in the next decade. Its core goal is to transform China's speed to China's quality, Chinese products to Chinese brands, and made in China to create in China, so that China will basically realize industrialization and become a manufacturing power by 2025.

Under the encouragement of relevant policies, China's manufacturing industry has carried out in-depth reform. In order to further improve the development level of manufacturing industry, China has increased the research and promotion of intelligent manufacturing. Among them, the wide application of intelligent robots brings new opportunities for the development of intelligent manufacturing. According to the statistics of China Business Industry Research Institute, the output value of China's intelligent manufacturing industry more than doubled from 2014 to 2018. In the

intelligent manufacturing industry, industrial robots are a hot field. Since 2009, the sales volume of industrial robots in the world has grown the most year. With the maturity of industrial robot technology, its application prospects are also expanding, and the demand of intelligent manufacturing for industrial robots will continue to increase. See the table 1 below for specific data [3-4].

Table 1. Output value and sales growth rate of industrial robots

Output value scale of China's intelligent manufacturing industry in 2014-2018			Sales statistics of global industrial robots in 2014-2018	
Year	Output value(Billion)	growth rate	Sales volume(ten thousand)	growth rate
2014	8101.1	78.40%	23.21	24.20%
2015	9962.9	22.98%	26.67	14.90%
2016	12235.0	22.81%	30.87	15.70%
2017	14995.6	22.56%	36.33	17.70%
2018	19480.1	29.91%	36.69	9.20%

2.2 Industrial Robots Need to Break Through to High-End Fields

Although the robot technology in our country is constantly innovating and developing, but our country has been lack of industrial robot manufacturing enterprises with independent brand and core technology. In the production of industrial robots, many core parts of related enterprises need to be imported from abroad, which leads to the development of industrial robots in our country. Because, the relevant enterprises and researchers in China should seize the opportunity of manufacturing industry development, actively innovate, assiduously research and develop, grasp the core technology as soon as possible, so as to promote the development of industrial robot technology in China.[5]

2.3 Market Characteristics of Industrial Robot Industry in China

The application of industrial robots in China first appeared in the automobile manufacturing industry. The development of economy and society promotes the development of automobile industry, and the development of automobile industry promotes the development of industrial robot market. As early as 2000, China's large-scale automobile manufacturers, such as FAW and ERW, relied on the advantages of strong innovation technology and high degree of automation to drive the demand of industrial robot market.

The regions with developed economy and high degree of industrialization are the main areas to promote the development of industrial robot market, especially the first tier cities such as Beijing, Shanghai, Shenzhen and Guangzhou. The application of industrial robots in these areas has accounted for more than half of the total application of industrial robots in China [6].

3. APPLICATION ADVANTAGES OF INDUSTRIAL ROBOTS IN INTELLIGENT MANUFACTURING

3.1 Lower Production Cost

As mentioned above, in recent years, all walks of life are facing the problem of increasing labor costs. Through the effective application of industrial robots, industrial costs can be effectively reduced. In the short term, some enterprises will feel that the price of industrial robots is relatively high. However, industrial robots only need regular maintenance to carry out long-term production activities, and do not need to bear the wages, social insurance, provident fund and other expenses that need to be borne in manual production. Therefore, in the long run, the application of industrial robots in intelligent production will be more economical [7-8].

3.2 Improve Production Efficiency and Quality

Industrial robots are often carried out through established procedures when they are carrying out production operations, which has certain efficiency compared with manual production. In addition, people will inevitably make mistakes in production, which will affect the quality of production. However, industrial robots will not make human errors. In addition, the production of precision instruments or important instruments often needs to be carried out under strict production conditions and high precision operation. Compared with human beings, industrial robots have higher operation accuracy and can adapt to various production environments.

3.3 Promote the Development of Industrial Robots and Intelligent Manufacturing Cycle

Industrial robot itself is the product of manufacturing. Through the wide application of industrial robot in the field of intelligent manufacturing, it can effectively improve the development of intelligent manufacturing industry. At the same time, in the process of wide application of industrial robot, it can realize the

continuous progress of industrial robot industry, so as to make the two harmonious development and common progress.

4. HOW TO PROMOTE THE APPLICATION EFFICIENCY OF INDUSTRIAL ROBOTS IN INTELLIGENT MANUFACTURING

4.1 Strengthen the Training of Professional Talents

Although most industrial robots have the ability of artificial intelligence, they are machines. Their R & D, production, operation and maintenance are inseparable from people. In order to ensure the sustainable development and application of industrial robots, all sectors of society need to strengthen the training of relevant talents. Some colleges and universities that have some research on industrial robots should conform to the development of society, and appropriately add some professional courses related to industrial robot research and development and application, artificial intelligence technology, etc. in automation, electronic information technology, computer and other related majors, so as to improve the comprehensive quality of students and promote the development of industrial robot technology. Relevant enterprises should also actively introduce new and high-tech talents in industrial robots and intelligent manufacturing, and regularly carry out technical training for technical talents in enterprises, so as to improve the depth of enterprises in terms of talents, and promote the improvement of enterprises' production efficiency through the training and introduction of talents, so as to enhance the competitiveness of enterprises.

4.2 Optimizing the System Structure of Industrial Robot

With the rapid development of China's intelligent manufacturing industry, the requirements for industrial robots are higher and higher. At present, the industrial robots produced in China often have a relatively single function. In the past, industrial robots are mostly used in cargo handling, equipment welding, assembly and other aspects, while intelligent manufacturing requires more complex and systematic functions of industrial robots. Therefore, in order to improve the utilization level of industrial robots and promote the development of China's intelligent manufacturing industry, relevant R & D personnel and technical personnel should optimize the system structure of industrial robots, and improve the system structure and functional composition of industrial robots by using the currently mature big data technology and artificial intelligence technology.

4.3 Improve the Level of Artificial Intelligence of Industrial Robots

Intelligent manufacturing should include intelligent manufacturing system and intelligent manufacturing technology. Intelligent manufacturing system can continuously enrich its own knowledge and skills reserve in the manufacturing process, and also has certain learning function. It can also collect and analyze its own state and surrounding environment information, and plan and judge its own behavior based on this. In order to adapt to the development of intelligent manufacturing, industrial robots should also have the corresponding level of artificial intelligence. For example, in the process of smart manufacturing of mobile phones, industrial robots can achieve fine inspection in the production process and improve production quality and efficiency by improving the intelligent identification and analysis ability of industrial robots. Due to the development of new technology and new materials, the control system of industrial robots is becoming more and more advanced, and will continue to develop in the direction of biomimetic and intelligent, and realize the transformation of industrial robots from participating in manufacturing implementation to production service

5. CONCLUSION

From the current development trend of intelligent manufacturing, industrial robots will gradually replace artificial, and become the main force of intelligent manufacturing. In the future, industrial robots will become more and more intelligent, with certain learning and analysis functions. In order to better promote the coordinated development of industrial robots and intelligent manufacturing, relevant enterprises and institutions should focus on this, and increase the training of relevant talents, so as to improve the overall level of Intelligent Manufacturing in China, and make corresponding contributions to the smooth implementation of "made in China 2025" plan.

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The Impact of Collectivist Culture on Tourism Consumption: Evidence Based on Household Microdata

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Abstract: Culture affects social development, enterprise production and people's life. As a dimension of culture, collectivism culture has a unique impact on people's life and economic behavior. At the same time, tourism, as a part of people's life, is closely related to national economic development. Tourism industry contributes a huge GDP to China every year. Starting from these dimensions, this paper wants to explore how collectivism culture affects residents' tourism consumption, and then put forward suggestions for the government to develop tourism.
Keywords: collectivist culture; tourism consumption; economic development

1. INTRODUCTION

Culture is not only a historical product of the long-term development of the economy and society of the country and the region. Culture is also the fundamental reason for determining the different historical trends of economic development in different countries and regions [1]. It's also an important factor behind the industrial revolution [2]. The existing research on culture also proves at multiple levels and levels. Culture influences individual preferences and social values and beliefs [3], determining their cognition, interaction, and strategic choices [4], which in turn influences interpersonal relationships, educational entertainment in personal life. Investment and consumption. This article focuses on the influence of collectivist culture on travel spending. [1]

2. AN OVERVIEW OF COLLECTIVIST CULTURE

As two aspects of culture, individualistic culture emphasizes individual independence, uniqueness and free choice, while collectivist culture emphasizes human interdependence, social embedding and the obligation and loyalty of internal groups (such as home). Individualism and collectivism are a key aspect of cultural distinction and one of the widely accepted methods of cultural classification [5]. A large body of literature also examines individualism and collectivism for economic growth, income distribution, and social welfare. Different roles and mechanisms in various aspects. However, the literature has rarely touched the influence of it on micro-individuals.

3. CHINA'S TRAVEL AND FAMILY TOURISM CONSUMPTION

3.1 Analysis of the Development Status of China's Travel Industry

According to the data survey of the China's Ministry of Culture and travel in 2018, the domestic travel market continued to grow at a high speed in 2018. The number of domestic tourists was 5.539 billion, an increase of 10.8% over the same period of the previous year. The total travel revenue for the year was 5.97 trillion yuan, a year-on-year increase of 10.5%. There is no doubt that travel is a major boost to economic development. How to promote the development of travel has also become a subject of research by many scholars [2].

3.2 Family Tourism Consumption

Tourism consumption has the function of expanding people's vision, enriching people's experience, and improving people's cultivation, thus we sometimes consider tourism consumption as a developmental consumption. Tourism consumption, as part of household spending, is influenced by many factors. The wealth of the family, personal preferences, and the geographical location of the family may affect a family's annual travel plan. As a unique cultural value, Collectivist culture may inhibit the individual's consumption behavior, and encourage people choose to save the money for family and to safeguarding collective interests. The part of the collectivism that unites relatives and friends may promote family travel, thus increasing tourism consumption. To verify the validity of these two assumptions, we are going to use microdata for regression analysis.

4. DATA INTRODUCTION AND EMPIRICAL ANALYSIS

4.1 Data Source and Sample Selection

This article uses the 2016 China Household Tracking Survey (CFPS) survey database from the China Social Science Research Center of Peking University. First, household-level data such as household income and total consumption expense, tourism consumption are selected. Secondly, obtain the personal level information such as the age and work background of the householder, and finally obtain the data at the provincial level, and screen the effective sample of about 12,000 households. This paper selects the family as the micro unit. Because the family is a component of Chinese society, members of the family have similar lifestyles, consumption concepts, personality traits,

and consumption habits, and are more likely to produce consistent family economic behavior [3].

For the collectivist culture, we set a dummy variable as proxy variable, which is "Do you think that 'make one's ancestors illustrious 'is very important", because this variable reflects the degree of respect of an individual to the collectivist of the family, and the person who conforms to this assumption is in line with the connotation of the cultural characteristics of collectivism. Due to the limited space, only a few explanatory variables are described here:

Table 1. Descriptive statistics of some main variables.

Variables	symbol	Obs	Mean	Std. Dev.
tourism consumption	Traverper	11,900	1.556	5.014
Collectivism Culture	Col_culture	11,900	0.904	0.294
Gender	gender	11,900	0.509	0.500
Age	age	11,900	50.254	15.426
ethnicity	ethnicity	11,900	0.0004	0.021
Education level	edulset	11,764	6.366	5.268
Income	log_tfinc	11,900	10.322	0.283
Debt	log_debt	11,900	10.323	1.559
deposit	logdeposit	11,900	2.039	4.072

The description of personal characteristics belongs to the householder

4.2 Empirical Analysis

Based on the above analysis and data description, this paper will construct a relationship model between tourism consumption and collectivist culture. Due to the particularity of the data sample, not every household has tourism consumption, the sample There are a large number of zero values, which are consistent with the characteristics of truncated data. Therefore, the Tobit model is used in this paper. The designed measurement model is as follows:

$$\text{Travelper} = \alpha\ \text{Col\_culture} + \beta\ \text{controls} + \text{u}$$

Among them, the dependent variable Travelper represents Proportion of tourism consumption in total household consumption, Col_culture is the proxy variable of collectivist culture, and controls are control variables. Here, the control variables are divided into three groups, namely, householder level, family level and province level, then add the regression equation in turn.

Table 2. Effects of Collectivism Culture on tourism consumption

Tobit regression				
Dependent variable	Travelper			
Col_culture	-4.521***	-1.612***	-0.918***	-0.814**
Average marginal effect of coefficients	-0.092***	-0.031***	-0.018***	-0.016**
	(0.000)	(0.000)	(0.006)	(0.014)
control variables of Householder	No	Yes	Yes	Yes
control variables of family	No	No	Yes	Yes
control variables of province	No	No	No	Yes
Pseudo R2	0.0385	0.4861	0.6873	0.7067
Observations	11,900	11,900	11,764	11,764

p-values in parentheses(standard errors in parentheses)

* p < 0.10, ** p < 0.05, *** p < 0.01

According to the results of the regression in table2, we can see that the coefficient and average marginal effect is significantly negative when the control variable is not added, which indicates that the collectivist culture has a [4]significant negative effect on tourism consumption when other conditions are the same. In this case, the collectivists spend an average of 0.1% less than the non-collectivists, while average tourism consumption account for only 1.5% of the total expense, which means that the marginal spending of travel has dropped by about 7%, and the overall expense of travel has fallen maybe more. Even after controlling more control variables, this negative effect is still very significant, indicating that collectivism has a significant inhibitory effect on household tourism consumption. This may be due to the effect of collectivist culture is likely to suppress individual desires, reduce tourism consumption, in order to safeguard collectivist interests [5].

5. CONCLUSION

Tourism consumption is an important part of household consumption and contributes to economic development. However, empirical analysis based on microdata proves that collectivist culture has a certain inhibitory effect on tourism expenditure, which may be caused by certain characteristics of this cultural value. Therefore, when the government wants to promote tourism development, they should consider starting from the cultural values of the residents, further explore the mechanism of the collectivist culture, and further use the means of propaganda and education to guide the residents to overcome the

inhibitive effect of collectivism culture on tourism consumption.

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Trends of the Adamantane Resistance among Human Influenza a Virus Isolated From Mainland China between 1956 and 2011

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Abstract: The molecular mechanism of adamantane resistance is associated with mutations on matrix gene2 (M2). One or multiple amino acid subsititution at position 26, 27, 30, 31 and 34 in the transmembrane domain of M2 leads to the possibilities of drug resistance. A total of 816 H1N1 viruses were anaylsed by COBALT and self-designed tools—Drug Resistance analyzer（DR analyzer）. Viruses were classified in terms of isolation time and isolation places; types and frequencies of gene mutations were recorded respectively. Our results show that the prevalence of adamantane resistance H1N1 viruses increased substantially since 2004 and mutation at position 31 was dominant among all of the sequence observed. These results highlight the necessity of tracking the emergence of drug-resistance viruses as well as developing new theraputics.
Keyword: influenza A; adamantane-resistance

1 INTRODUCTION

Influenza A is highly susceptible to influenza pandemics. Influenza A can be classified into several subtypes according to haemagglutinin (H) and neuraminidase (N) on its surface. H1, H2 and H3 subtypes of influenza A virus are mainly infected in humans, because they have high affinity with human cell surface receptors (containing alpha-2, 6-sialic acid); other subtypes can bind to the receptors (containing alpha-2, 3-sialic acid) on bird cell surface. At present, H1N1 and H3N2 subtypes of influenza viruses are prevalent in the population [1].

At present, there are two kinds of anti-influenza drugs used in clinic: amantadine and neuraminidase inhibitors. Amantadine has been used worldwide for nearly 30 years as a drug for the prevention and treatment of influenza, and it has also been used in some cities for the prevention of influenza pandemic [2]. Influenza matrix protein M2 is a transmembrane protein. Amantadine inhibits the viral dehulling process by binding to M2 protein and inhibiting the change of microenvironment PH near M2 protein, thus inhibiting the release of viral RNA, resulting in the viral particles unable to replicate in host cells. Amantadine resistance has been confirmed to be associated with mutations at M2 protein loci 26, 27, 30, 31 and 34; mutations at any one of these loci will lead to amantadine resistance [3].

We selected 816 M2 protein sequences of human H1N1 subtype influenza isolated from China on NCBI and analyzed their 26, 27, 30, 31 and 34 amino acids to preliminarily determine their drug resistance.

We classified 816 strains of H1N1 according to time (1956-2011) and region (34 provinces in China) and counted the number of mutants (M2 protein 26, 27, 30, 31, 34 mutations are recorded as mutants) and calculated their proportion to the total isolates, in order to judge the changing trend of H1N1 Subtype Influenza Resistance and to better prevent and control H1N1. Get ready for the flu [4].

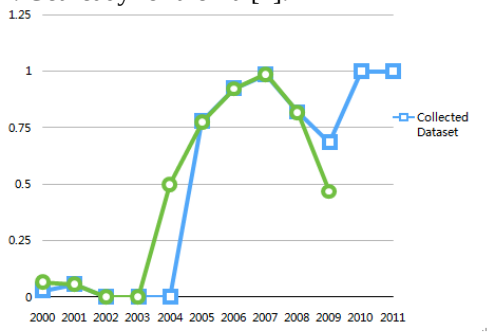


Figure1. Percentage of Resistance Mutation

2. METHODOLOGICAL PRINCIPLES

2.1 Sequence Acquisition

The sequence of this study is all from the protein database of NCBI. The search field is "H1N1 matrix protein 2 and human and CHINA". The search results contain 877 records. A total of 816 records were obtained for analysis by removing 877 records from China and containing only M1 protein information [5-6].

2.2 Multiple Sequence Alignment

816 amino acid sequences were screened and introduced into the COBALT tool of NCBI for multi-sequence alignment to identify the homologous regions of all proteins.

2.3 Data Analysis

After comparing the results of COBALT, we counted the amino acids at position 26, 27, 30, 31 and 34 of 816 M2 protein peptide chains. We classified and counted the mutants according to the year and area of isolation.

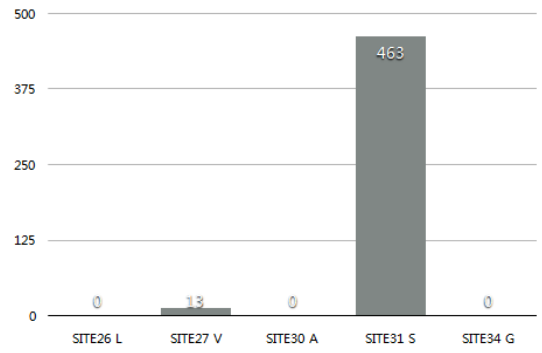


Figure 2. H1N1 Mutation Detected

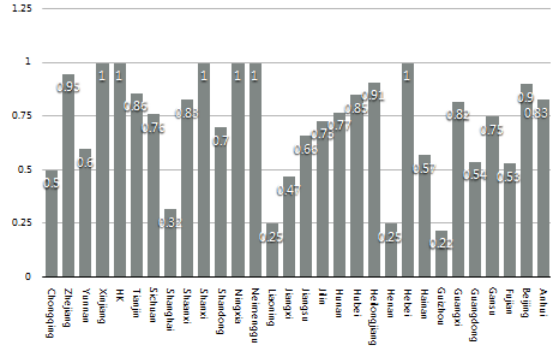


Figure 3: Statistical results of the proportion of H1N1 human influenza virus mutants isolated from mainland China by regional classification

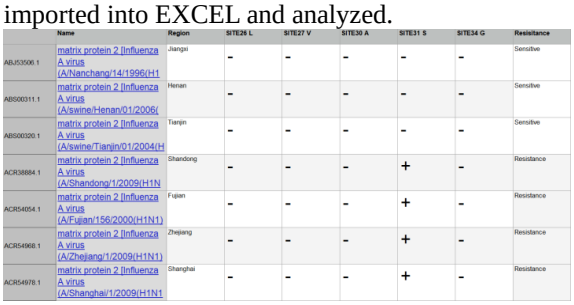
2.4 Analytical Tools

For a large amount of data, we try to design a program (Drug Resistance Analyzer, DR analyzers) that can quickly and conveniently analyze the existing data and calculate the required indicators. On the basis of Numbers software, we use its internal functions to enable users to convert the collected sequence data into corresponding statistical information through simple operations, including classifying mutants in time and space span, and counting the proportion of mutants and the information of mutant sites. With simple modification, the tool can be used to directly analyze the mutation of influenza M2 protein sequence searched by NCBI database, and make statistical charts for the mutation of 5 loci. The tool can quickly analyze the COBALT alignment results (tested faster than Mega 5, DR analyzer: 10 min; Mega 5: 30 min), and can be used for other types of protein or nucleic acid sequence specific site alignment and statistical analysis after improvement.

The main working principle of the tool is to compare the specific position of the sequence with the expected value, and to digitalize the results of the comparison, and then to digitalize the total mutation of each sequence. Finally, the sequence mutation is detected and counted by digitized sequence information. See Appendix for the operation interface (Figures 4 and 5).

Input		
ID	Name	Sequence
ABI21521.1	matrix protein 2 [Influenza A virus (A/Nanchang/13/1996(H1N1))]	PIRNEWGCRCNDSSDPLVVAASIIGIVHLILWIIDR LFSKSIYRIFKHGLKRGPSTEGVPESMRE
ABI21532.1	matrix protein 2 [Influenza A virus (A/Nanchang/15/1996(H1N1))]	PIRNEWGCRCNDSSDPLVVAASIIGIVHLILWIIDR LFSKSIYRIFKHGLKRGPSTEGVPESMRE
ABI21543.1	matrix protein 2 [Influenza A virus (A/Nanchang/16/1996(H1N1))]	PIRNEWGCRCNDSSDPLVVAASIIGIVHLILWIIDR LFSKSIYRIFKHGLKRGPSTEGVPESMRE
ABI21554.1	matrix protein 2 [Influenza A virus (A/Nanchang/17/1996(H1N1))]	PIRNEWGCRCNDSSDPLVVAASIIGIVHLILWIIDR LFSKSIYRIFKHGLKRGPSTEGVPESMRE
ABI21565.1	matrix protein 2 [Influenza A virus (A/Nanchang/19/1996(H1N1))]	PIRNEWGCRCNDSSDPLVVAASIIGIVHLILWIIDR LFSKSIYRIFKHGLKRGPSTEGVPESMRE
ABI21576.1	matrix protein 2 [Influenza A virus (A/Nanchang/26/1996(H1N1))]	PIRNEWGCRCNDSSDPLVVAASIIGIVHLILWIIDR LFSKSIYRIFKHGLKRGPSTEGVPESMRE
ABI93030.1	matrix protein 2 [Influenza A virus (A/Nanchang/21/1996(H1N1))]	PIRNEWGCRCNDSSDPLVVAASIIGIVHLILWIIDR LFSKSIYRIFKHGLKRGPSTEGVPESMRE
ABI95252.1	matrix protein 2 [Influenza A virus (A/Nanchang/8/1996(H1N1))]	PIRNEWGCRCNDSSDPLVVAASIIGIVHLILWIIDR LFSKSIYRIFKHGLKRGPSTEGVPESMRE
ABI95263.1	matrix protein 2 [Influenza A virus (A/Nanchang/11/1996(H1N1))]	PIRNEWGCRCNDSSDPLVVAASIIGIVHLILWIIDR LFSKSIYRIFKHGLKRGPSTEGVPESMRE

Figure 4: Sequence input interface: The results of COBALT sequence alignment can be directly imported into EXCEL and analyzed.



	Name	Region	SITE26 L	SITE27 V	SITE30 A	SITE31 S	SITE34 G	Resistance
ABJ53506.1	matrix protein 2 [Influenza A virus (A/Nanchang/14/1996(H1	Jiangxi	-	-	-	-	-	Sensitive
ABS00311.1	matrix protein 2 [Influenza A virus (A/swine/Henan/01/2006(	Henan	-	-	-	-	-	Sensitive
ABS00320.1	matrix protein 2 [Influenza A virus (A/swine/Tianjin/01/2004(H	Tianjin	-	-	-	-	-	Sensitive
ACR38884.1	matrix protein 2 [Influenza A virus (A/Shandong/1/2009(H1N	Shandong	-	-	-	+	-	Resistance
ACR54054.1	matrix protein 2 [Influenza A virus (A/Fujian/156/2000(H1N1)	Fujian	-	-	-	+	-	Resistance
ACR54968.1	matrix protein 2 [Influenza A virus (A/Zhejiang/1/2009(H1N1)	Zhejiang	-	-	-	+	-	Resistance
ACR54978.1	matrix protein 2 [Influenza A virus (A/Shanghai/1/2009(H1N1	Shanghai	-	-	-	+	-	Resistance

Figure 5: Drug-resistant strain statistics: Comparing the predicted location with the specific value, the comparison results are numeralized and analyzed statistically.

3. RESULTS

A total of 816 M2 protein sequences of human H1N1 subtype influenza virus isolated from NCBI in China were collected. One of them was lost during operation, and the mutant strain (473/816) accounted for 58.0%. Since 2004, the proportion of mutants has increased dramatically (before 2004: 3.1%; in 2004: 78.1%); in the following years, the proportion of mutants has maintained this level; in 2009, the proportion of mutants has decreased (68.2%); after 2009, all the nine viruses isolated are mutants (see Fig. 1). Among them, 31 serine mutants (463/473) accounted for 97.9% of the total mutants; 3 leucine mutants at 26, 15 valine mutants at 27, 30 alanine mutants and 34 glycine mutants were not found (fig. 2). Of 473 mutants, 460 mutants only mutated at 31 serine sites, 10 at 27 valine sites, and 3 at 27 and 31 sites.

In addition, we classified and counted the proportion of mutants in different regions. Among 816 strains of M2 protein sequence, 688 strains had a clear isolation site. One strain was lost during the operation. 127 strains were not identified (the virus was named after the administrative units under the prefecture level and municipality). (See Figure 3 for specific results.) Due to the emergence of mutant strains in mainland China in recent years, especially 31 serine mutant resistant strains, we need to closely track and observe the drug-resistant strains in various places. At the same time, amantadine may not be suitable for the use of mainstream anti-influenza drugs, and people need to develop new drugs to treat influenza.

4. DISCUSSIONS

Our results are basically consistent with those of the article published by the China Center for Disease Control and Prevention in 2010 (Fig. 1). In contrast, we collected 169 more M2 protein sequences of H1N1 subtype influenza viruses, and classified them in detail, which can better reflect the situation in different places and is more conducive to the prevention and control of H1N1 influenza according to local conditions. We counted the number of mutants of various types and found that 31 serine mutations occurred in most mutants. It has been reported that the transmission and variation of H5N1 subtype influenza are greatly affected by time and place. Next, we hope to further collate and analyze the distribution data of H1N1 mutant strains in different regions, and to establish phylogenetic tree of the strains isolated in different time periods and regions, and trace the strains isolated in different regions. The origin.

In addition, M2 proteins Val27, Ala30, Ser31 and Gly34 form a hydrophilic pocket at the N-terminal of the protein. Mutations at these sites often occur in drug-resistant strains; amantadine affects the proton transport function of M2 protein by encroaching on the pocket. Recent studies have found that by targeting amino groups at the hydrogen hydrate ion binding sites deeper in the pocket, we can design spirocyclic compounds with stronger affinity to M2. Cu2+ can directly act on histidine at M2 protein 37 site, thereby directly blocking proton transport without affecting hydrophilic pockets at M2 protein N-terminal, which also provides a new idea for drug design of drug-resistant strains.

ACKNOWLEDGE

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Research on Big Data Management of Food Enterprises

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Abstract: The level of big data construction plays an increasingly important role in the development of enterprises. Big data construction can track sales data, consumer preferences and analysis of consumer products, so as to make sales and profits accurate and maximized. This paper analyzes the relationship between big data construction and sales growth of enterprises through questionnaires and SPSS tools, and illustrates the importance of big data construction.
Keywords: Big data; Food enterprise; Sales management; SPSS analysis

1. SIGNIFICANCE OF BIG DATA

In the information age, the future development of enterprises is deeply influenced by data. In a complex and changing market, we are exploring solutions based on big data to improve the competitiveness of enterprises. Based on visual experience alone, anyone can feel that the big data era is going deeper and deeper into all aspects of the enterprise. Gartner, a research organization, defines big data as a massive, high-growth and diversified information asset that requires a new processing model to have stronger decision-making, insight and discovery capabilities and process optimization capabilities. The strategic significance of big data lies not in mastering huge data information, but in specialized processing of these meaningful data. In other words, if big data is compared to an industry, then the key to the profitability of this industry lies in improving the "processing ability" of data and realizing the "value-added" of data through "processing".

2. HOW TO BUILD BIG DATA FOR FOOD ENTERPRISES

The construction of large databases by enterprises should be the natural accumulation and preservation of data in the business process, rather than the separate deployment of systems. The construction of large data for the construction of large data not only consumes the resources of enterprises, but also causes data distortion due to the factors of manual control. The construction of large data for food enterprises should be combined with food traceability management. In the whole process of food traceability, there are many institutions, personnel, materials and information involved. These information should be kept in time, thus forming large data for enterprises. On the one hand, the requirements for food traceability are met, and on the other hand, data precipitation is formed [1].

To ensure that the food traceability certificate is the only non-replicable one-thing three-code traceability certificate that needs to be used, that is, each commodity generates three codes at the same time when assigning a value and corresponds to each other one by one, wherein the two codes are plain codes and passwords; consumers or verifiers can verify the information of the food by scanning a two-dimensional code on the surface and verify the authenticity thereof; after purchasing, the password can be opened and input, and the whole certificate is invalid; and the encryption method can prevent the certificate from being copied. Or because the cost of copying is too high, the counterfeiter is prompted to give up copying. Another code is the identification code. Through this identification code, the certificate can be transferred within the system. Through the transfer of the system, different participants can add and perfect the information generated by themselves.

3. THE USE OF BIG DATA CAN PROMOTE ENTERPRISE MANAGEMENT

3.1 Sales Management

After the central enterprise forms a big database, the enterprise can use big data for analysis, including the sales areas of different products, consumer acceptance, price formation mechanism of different products, and portrait description of consumers.

3.2 User Management

The use of big data can realize the management of users, the use of big data can analyze the sales indicators of dealers, can analyze whether dealers have cross-regional sales problems, can deal with malicious competition of dealers, and can provide favorable evidence and calculation methods to provide basis for punishment [2].

3.3 Food Safety Management

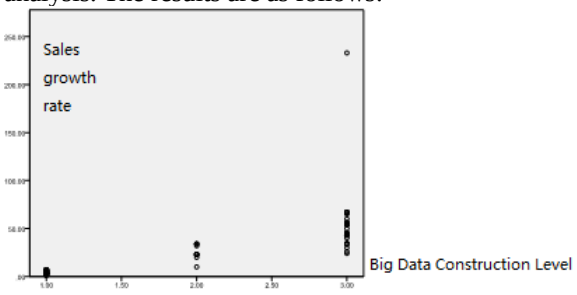
Big data can be used to manage food safety in enterprises. For food enterprises, food safety is the lifeline of the enterprise. However, if there is no big data construction, the products of the enterprise are easy to be counterfeited, knocked over, attacked by malicious complaints and malicious claimants. Once the public opinion effect is caused, the credit of the enterprise will be lost, and even irreparable losses will be caused.

4. EMPIRICAL RESEARCH

In order to verify the above assumptions, we randomly selected different food enterprises for empirical analysis. We selected 100 enterprises with different types of enterprises, different sales scales

and different regions for investigation and analysis, and analyzed the correlation between their sales growth and the level of big data construction.

Through their sales volume changes before and after using big data analysis, we conducted statistical analysis. The results are as follows:



Evaluation of Big Data Construction

We use the X-axis to indicate the level of big data construction of enterprises, of which 1 indicates that the level of big data construction of enterprises is relatively low and the utilization rate is relatively low, 2 indicates that the level of big data construction of enterprises is general and not frequently used, and 3 indicates that the level of big data construction of enterprises is good, the data collection level is high, there are specialized personnel, and the utilization rate is relatively high. We use the Y axis to represent the annual growth rate of sales. From the above figure, we find that the sales growth rate of different regions, different sizes and different types of enterprises has been obviously improved after using big data, and the range of the growth rate of enterprise sales is obviously limited.

We used SPSS tools to analyze the correlation between big data construction level and sales growth rate. The results are as follows:

		Sales growth rate	Big Data Construction Level
Sales growth rate	Pearson correlation	1	.855**
	Significance (bilateral)		.000
	N	100	100
Big Data Construction Level	Pearson correlation	.855**	1
	Significance (bilateral)	.000	
	N	100	100

**. Significant correlation was found at .01 level (bilateral)。

SPSS tool sales analysis

In the results, we can see that the correlation coefficient between "sales growth rate" and "big data construction level" is 0.855, i.e. | r |r|=0.855； ; There are two asterisks in the upper right corner and "* *" in the lower left corner, indicating that the correlation is significant at 0.01, indicating that the correlation between "sales growth rate" and "big data construction level" is significant. We generally think that the correlation coefficient |r| is highly correlated between 0.8 and 1.0; There is a strong correlation between 0.6 and 0.8. Therefore, it can be concluded that the better the enterprise big data construction, the higher the sales growth rate of the enterprise [3].

5. RECOMMENDATIONS

1. In the era of digital economy, enterprises should position the construction of big data as a strategic requirement In the era of digital economy, traditional enterprises and digital economy are gathering more and more closely.

2. Large databases should be built as early as possible to accumulate resources. The formation of enterprise's big database is a time process, which requires continuous accumulation, not overnight.

3. Set up big data management professionals, mining big data utilization value Talent strategy is an important strategic aspect of an enterprise, and talent is an important aspect of the implementation of big data strategy. Therefore, it is very important to set up a team that meets the big data capability. If an enterprise lacks appropriate talent or capability, the enterprise's big data strategy cannot be effectively implemented. In the process of building a big database for food enterprises, two aspects of data talent reserves can be formed, one is the data team in each division, the other is the specialized data management team. Set up under the post of general manager and set up chief data officer. The data team in the division is mainly practical and analytical, including user analysis, sales analysis, financial analysis, etc., and uses the analysis results to guide its management and sales strategy, etc. The specialized data analysis team carries out overall management of the big data of the whole enterprise, including data compliance, data platform development, data algorithm, data statistics, etc., and carries out the construction of the whole big data architecture.

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Development of Nb3Sn Superconducting Joint

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Abstract: With the continuous development and application of superconducting technology, the demand for high critical current density superconducting materials is increasing day by day. The critical properties of conductors made of intermetallic compound-based superconducting material Nb3Sn are higher than those of NbTi conductors. It is the material of choice for future fusion reactor superconducting magnets. This paper details the whole process from the preparation of Nb3Sn superconducting bulk to the completion of superconducting joints.
Keywords: Nb3Sn; Superconducting Joint; Mechanical Alloying Preparation

1. INTRODUCTION

1.1 Background

In 1911, Dutch physicist Kamerlingh Caners first discovered superconductivity, a characteristic phenomenon in which certain metals were cooled to very low temperatures, mainly because the resistance of the metal suddenly disappeared to zero. Then superconducting magnets came into being. It is a magnet with a superconducting wire as the exciting coil. Its remarkable features are light weight, low operating cost and high magnetic field strength. With the development of a century, human research on superconducting technology has made great progress. Superconductors have also been widely used in large-scale scientific engineering fields, mainly in thermonuclear fusion reaction devices and high-energy accelerators. Due to the large size of the magnet itself, the use of superconducting magnets will be the only choice for future nuclear fusion reactors. Most of the larger magnetically constrained nuclear fusion devices currently being built use superconducting magnets, such as the EAST Tokamak nuclear fusion device. Because the superconducting magnet can save a lot of energy compared with the conventional magnet, thereby improving the efficiency of energy use; secondly, it is easier to obtain a stable magnetic field for the superconducting magnet, and provide a magnetic field guarantee for the magnetic confinement nuclear fusion device; finally, the current of these superconducting magnets Higher density, which reduces the size of the device and saves money on investment. The analysis of large superconducting magnets has become one of the important research contents to explore the development of nuclear fusion.

1.2 Development of Nuclear Fusion

The development of nuclear fusion necessarily requires the continuous development and application of superconducting magnets, and the demand for superconducting materials with high critical current density is increasing. The superconducting material Nb3Sn based on intermetallic compound has special practical significance. The conductor made of it has higher critical performance than NbTi superconducting magnet, and Nb3Sn strand is also an important component of ITER magnet. section. Nb3Sn materials are typical low temperature superconducting materials and are mainly used in magnets such as high energy physics (HEP) and thermonuclear fusion (ITER) and high field nuclear magnetic resonance (NMR) [2].

1.3 Superconducting Characteristics

In recent years, due to the gradual improvement of the preparation process of Nb3Sn superconducting magnets and the development of high energy physical HEP and magnetic confinement thermonuclear fusion ITER, the development of Nb3Sn superconducting wire has brought a new direction. Therefore, Nb3Sn superconducting magnets have been rapidly developed. In 2002, OI-ST used the stacked Rod Process method to produce Nb3Sn superconducting magnets with a critical current density of 3000A/mm2 at 4.2K and 12T.The Nb3Sn superconducting material is a typical class II superconducting material with a brittle A15 crystal structure.Nb3Sn has the A3B form of A15 phase, B atoms are arranged in a body-centered cubic lattice structure with 2 A atoms per face, its critical temperature reaches 18.3K, and the lattice spacing is ~2.645 angstroms. .The solid solution range of Sn in the Nb3Sn material is 18% to 25% (at).Since the anisotropy of Nb3Sn is negligible and there is no problem of weak junction of high temperature superconducting magnets, the grain boundary is considered to be the Nb3Sn pinning center, and the upper critical field Hc2 is 27T (4K), which is suitable for High field magnets.

The main research work of this thesis

Chapter Ⅰ introduces the characteristics of low temperature superconducting material Nb3Sn;

Chapter Ⅱ Method of Mechanical Alloying Preparation of Nb3Sn with Nb, Sn powder;

Chapter III Process Methods of Superconducting Joints;

Chapter IV Characteristics of Superconducting Joints

2. METHOD OF MECHANICAL ALLOYING PREPARATION OF NB3SN FROM NB AND SN POWDERS

2.1 In the case of the Nb3Sn superconductor, Nb3Sn is formed at the Sn/Nb interface and gradually diffuses in Nb, but the progress is slow and the

reaction takes a long time to complete. The mechanical alloying process allows the Nb-Sn powder mixture to be completely and almost instantaneously converted to Nb3Sn, thus eliminating the need for a very long independent heat treatment during the processing of the Nb3Sn superconductor.

The material used in this study is 99.9% pure Nb powder and 99.9% pure Sn with a diameter of 3-7 microns. The mesh size is −325mesh (<44 microns).Mechanical alloying uses the 8000 SPEX high energy pulverizer. Dry grinding is carried out in a cemented carbide ball mill jar under argon to minimize oxidation [1].

By mechanical ball milling of the Nb and Sn powders, it was observed that Sn and Nb were alloyed to form a solid solution. Moreover, Nb has a BCC structure and is more brittle than Sn. Therefore, during the milling process, the brittle Nb is more easily broken than Sn and is wrapped on the surface of the tough Sn. Since X-ray diffraction occurs at a limited depth from the surface, the observed diffraction intensity may be the BCC-Nb phase rather than the Sn phase.

In the heat treatment mechanical alloying, it can be concluded that the Nb-Sn powder mixture can be used as an effective precursor for the preparation of nb3sn superconductors using the well-known in-tube powder method or bronze method.

An important conclusion that can be drawn from the current research is that a short Nb-Sn powder mixture with a short mechanical alloying time can be used as an effective precursor for the preparation of Nb3Sn superconductors. From the results, mechanical alloying can completely and almost instantaneously convert the Nb–Sn powder mixture to Nb3Sn, eliminating the need for long independent heat treatments typically required in Nb3Sn superalloy processing.

2.2 Preparation of Nb3Sn Superconducting Bulk

In this paper, the Nb3Sn superconducting bulk was prepared by powder metallurgy process. The influence of ball milling time and pressure forming on the phase formation of Nb3Sn was analyzed. The superconducting performance test and mechanism analysis of the sample were carried out. Nb powder (325 mesh, 99.95% Aladdin), Sn powder (325 mesh, 99.5% Aladdin) and Cu powder (200 mesh, 9.5% Aladdin) were used as raw powder for Nb3Sn, according to Nb, Sn, Cu The stoichiometric ratio was 3:1:1 mixed and then loaded into a ball mill jar. The QM-3SP4L planetary ball mill was used to perform high-energy ball milling on the mixed powder. The ball milling speed was 500 rpm, the ball-to-batch ratio was 20:1, and the ball milling time was 1h, 3h, 5h, 10h, 15h.The ball-milled mixed powder was placed in a circular tableting die having a diameter of 10 mm, and subjected to press forming by applying pressures of 10 MPa, 20 MPa, 30 MPa, and 40 MPa, respectively, and then the block was sealed in a vacuum quartz tube for heat treatment. The temperature was kept at 550℃ for 100 h, then slowly increased to 670℃ at a heating rate of 5℃ per hour, and then kept warm for 120 h and then cooled to room temperature with the furnace. In the ball milling process, steel balls with diameters of 6mm and 10mm are used, which not only can increase the impact efficiency of the ball mill, but also make the particle size more uniform, and can reduce the adhesion between the powder and the inner wall of the ball mill tank and the steel ball. To prevent oxidation of the sample, wet ball milling was used, and 5mL of absolute ethanol was added to the ball mill jar before ball milling. During the ball milling process, each ball was ground for half an hour, and the ball milling was suspended for 10 minutes to cool the ball mill.

in conclusion:

1) The pressure of the mixed powder compact has a great influence on the density. The bulk density increases from 10.8g·cm-3 to 8.03g·cm-3. When the pressure is increased to 40 MPa, the bulk density hardly increases.

2) Increasing the ball milling time makes the particle size of the mixed powder finer and uniform. When the ball milling time is 15 h, the average particle size of the mixed powder is reduced from 100μm of the original powder to about 10μm. After 3 hours of powder ball milling, Cu-Sn solid solution was formed, and the Cu-Sn solid solution increased with the ball milling time.

3) The longer the ball milling time, the more the superconducting phase content in the Nb3Sn bulk sample prepared, and the sample Nb3Sn superconducting phase with ball milling for 15h is the most, the content is about 29%.

4) When the molding pressure is 30MPa, the Tc values of Nb3Sn superconducting materials prepared by different ball milling time are very similar, about 17.6K, and the sample with ball milling for 15h has the best superconducting performance under the 10T back field. The Jc is about 150 A·mm-2.

2.3 Preparation of Nb3Sn Alloy Ultrafine Powder by Gas Phase Reduction

Chemical vapor deposition (CVD) is a simple, continuous process, short process, and high efficiency process. When the powder is prepared by this method, the obtained powder product has the advantages of high purity, fine particle size, and controllable particle size, thus obtaining A wide range of attention. Among them, the gas phase reduction method is a relatively simple and convenient powder preparation method. In fact, this method has been around since the 19th century, when it was mainly applied to the deposition of thin films. In the 1970s and 1980s, some scholars in the United States and Japan studied the preparation of ultrafine powders by vapor phase hydrogen reduction, and prepared fine powders of high-purity alloys such as Fe-Co and Fe-Ni. The particle size is around 100~600nm.Further, if a non-

metallic compound gaseous component such as NH3, NH2 or the like is added to the reaction gas, some high-performance ceramics such as iron nitride and the like can be synthesized.

The reduction was carried out in a self-made quartz reactor. During the experiment, argon gas is used as a carrier gas to carry chloride vapor, and two different chloride vapors are thoroughly mixed in the mixed gas zone; in the reaction zone, the mixed gas of hydrogen and chloride is thoroughly mixed and reacted; after the reaction The generated metal particles are solidified in the nucleation zone after being crystallized and nucleated, and are blocked by the filter in the collection zone and collected. The exhaust gas after the reaction can be discharged into the atmosphere after the gaseous by-product HCI is absorbed by the pure water absorption device. The entire experimental procedure was carried out in an open system at approximately 1 atm. After the reaction is completed, a very small amount of air is passed through the system to passivate the powder, and the product obtained on the collector is collected and ready for analysis.

Through analysis, the following conclusions can be drawn:

(1) An ultrafine powder of a bismuth tin alloy can be synthesized by a hydrothermal reduction method;

(2) XRD analysis showed that when the tin-tin alloy powder was prepared by this method, the original product obtained was a mixture of Nb3Sn and its hydride; TEM analysis showed that the powder particles were substantially spherical and their average particles were obtained. The diameter is between 20~40nm.

2.4 Preparation of Nb3Sn Strands by Nuclear Fusion Sn Method

The Nb rod and the Cu tube are combined to form a Cu-based multi-core Cu/Nb composite tube, and the Sn rod is processed into a hexagonal core rod (sub-component).19 sub-components (or 18 sub-components + +1 Cu cores) are bundled into a Cu/Ta tube in a close-packed hexagonal form to form a final blank. Finally, the final blank is processed into a wire and twisted at a certain pitch. A composite strand having a diameter of about 0.80 mm was obtained. In order to increase the strength of the Sn core in the billet, a small amount of Ti added in the Sn is embedded in the Sn matrix in the form of dispersed particles, thereby functioning as a dispersion strengthening. A acts as a barrier layer between the Cu region and the 19 subcomponents which are stable outside the strand, so that the strand prevents Sn from contaminating the external pure Cu region during the heat treatment of Nb3Sn.The size of the Nb core in the strand is 3~4μm, the thickness of the Ta layer is 6~8μm, and the ratio of the external Cu region (beyond the Ta layer) which is stable is 0.47~0.5 in the whole cross-sectional area, and the length of the single strand is up to More than 1000m.

In order to obtain multi-core Nb3 Sn strands, the composite strands processed into final dimensions must be heat treated. Compared with the bronze process, the heat treatment of the strands by the internal Sn process is not directly in the temperature range of 650-750 °C. The Sn and Nb cores in the Sn bronze are solid-state diffused to form the Nb3Sn core, but the Sn and Cu in the composite strand are first diffused to form tin bronze, and then the Nb3Sn vacuum is performed in the temperature range of 600-750 °C. Heat treatment. We sample a composite strand (Φ0.79mm) with a length of about 1m on a heat-treated skeleton with a threaded groove and a Cu ring at both ends. The skeleton material is Ti6Al4V, which is used for the skeleton surface. Graphite is sprayed to prevent adhesion of the wire to the skeleton during heat treatment. In view of the brittleness of the Nb3Sn material, the choice of the framework material mainly considers the coefficient of thermal expansion of the material. The prepared sample is placed in a tubular furnace under the protection of vacuum or Ar gas. The heat treatment is carried out at a temperature ranging from 210 to 750℃. In the range below 600℃, a bronze heat treatment of Cu/Sn is performed, Nb (3Sn heat treatment is a heat treatment stage at a temperature higher than 600℃. This process is a solid diffusion of tin bronze and Nb core to form a Nb3Sn layer, and the total heat treatment time is in the range of 200 to 400 hours.

The Nb3Sn strand was prepared by the internal Sn process. For a certain strand design, the Nb3Sn heat treatment was performed on the volume percentage of Nb3Sn in the strand and the grain of the Nb3Sn layer. Size and stoichiometry have a major impact.

3. SUPERCONDUCTING JOINT PROCESS

3.1 Strip Joint Welding Preparation

For different purposes, superconducting joints have a variety of connection forms, the basic form mainly includes lapping, bridging and docking. The two strips in the joint formed by the lap joint are directly connected together, and the current path is short, and the resistance obtained under the same conditions is usually the lowest among the three joints. Bridge joints are generally used for direct connection between coils when the single-cake coils are arranged in an overlapping manner, such as a double-cake or multi-cake coil, in such a way that the deformation of the strip is less affected. The two strips in the butt joint are in the same plane and do not form protrusions in the lap joint, which is suitable for applications where this is required.

In addition to the joint connection form, the strip orientation is also a key factor to consider before soldering. As previously mentioned, the high temperature superconducting coating strip is an asymmetric multilayer strip structure with one side of the superconducting layer defined as the front side

and the side of the base layer being the reverse side. Since the base layer is usually a non-metallic material with a large electrical resistivity, an ideal superconducting joint should avoid current flowing through the base layer to reduce the joint resistance. Therefore, for lap joints, it is best to use a front-to-front strip orientation; for butt and bridge joints, it is best to have the two strips facing the same.

3.2 Strip Pretreatment

Strip surface oxidation has a serious impact on the quality of the weld. On the one hand, the wettability and spread ability between the oxide layer and the solder are poor, the tin is difficult, the process stability is poor, and due to the stability of the oxide layer, it is difficult to melt reaction with the solder to form a uniform and firm connection layer. On the other hand, the resistivity of the oxide layer is much higher than that of the original strip, and the joint resistance value of the oxide containing layer is high. In addition, contaminants such as oil on the surface of the strip can also affect the wetting and spreading of the solder. Therefore, strip cleaning is required before soldering. The usual method is to clean the oil with anhydrous ethanol or acetone, and then apply an appropriate amount of reducing flux to deoxidize after heating. At the same time, the welding heating process should not be too long to prevent the strip from being oxidized again. It is also possible to use a fine sandpaper to slightly polish the surface of the strip to remove dirt or oxide layers. The degree of sanding can be tested by a surface roughness tester. Removing the metal stabilizing layer in the superconducting tape to reduce the distance between the superconducting layers in the two strips can further shorten the current passage path in the joint, thereby reducing the joint resistance. The removal method mainly includes a hot scraping method and a pickling method, and the hot scraping method is a physical method for grinding the strip material after grinding it with fine sandpaper several times; the pickling method is to immerse the strip material in a specific acid liquid or other corrosion. A chemical method for dropping a stable layer in a liquid, and a commonly used etching solution is nitric acid, hydrofluoric acid or the like. However, since the thickness of the stabilizing layer and the superconducting layer is very thin, when the stabilizing layer is removed, the superconducting layer is also easily peeled off, resulting in a decrease in the critical current and the n value of the strip.

3.3 Filling Solder

The choice of solder for superconducting strip connections requires consideration of multiple factors, and the trade-offs for specific strip characteristics are chosen to select the appropriate solder. First, the resistivity of the solder is an important parameter. From the characteristics of the current distribution at the joint, the solder is the necessary path, and the lower resistivity is favorable for obtaining the joint with lower resistance. Second, it is the wettability of the solder. The difference in wettability between different solders and different strip surface materials is different. The combination of poor wettability does not spread well on the surface of the strip. It is not easy to fuse with the surface material of the strip to form a connecting layer with a certain mechanical strength.

The solder application method includes pre-tinning, filling tin-band eutectic, and direct-on-tin. In the pre-tinning method, the solder is melted and applied to the strip by an electric soldering iron before the strip is heated and pressed. The tin-filling method is to directly purchase a solder ribbon of a specific thickness, pre-fill it between the strips, and then heat and pressurize the strip. The direct tin method is a method of quickly applying solder to the surface of the strip after heating the strip.

3.4 Strip Joint Production Process

At present, there are many preparation techniques for superconducting joints, such as brazing, cold welding, diffusion welding, fusion welding, sintering, and the like. If classified according to whether intermediate materials are needed for connection, they can be divided into two categories: 1. Intermediate materials are required, such as brazing, welding, and sintering; 2. Intermediate materials such as cold-welding and diffusion welding are not required. Among them, the brazing, welding and cold-welding processes appear earlier, and are currently used more widely; the diffusion welding and sintering processes appear later, and are still at the laboratory level.

3.4.1 Brazing connection

The brazed joint is a molten solder having a melting point lower than the annealing temperature of the superconducting material, and the gap of the full conductor joint is filled by capillary action, and a metallurgical reaction occurs, and the two superconductors are connected together after cooling. The brazing process is one of the earliest joint technologies used in superconducting joints, and it is a simple and easy method for general application. It has a wide range of applications and can be soldered in a variety of shapes, with simple equipment, easy operation and low cost. In the experiment, lap joints and bridge joints with contact areas of 240 mm^2 and 480 mm^2 were fabricated, and the bridge joints were divided into two ways: parallel bridge joints and vertical bridge joints.

The experimental results show that the larger the contact area, the smaller the joint resistance, the smaller the bridge joint resistance and the longer the joint length becomes. The parallel bridge joint resistance is smaller than the vertical bridge joint under the same conditions, and the auxiliary belt becomes wider. This trend is more obvious, so the direction of the auxiliary belt has an influence on the joint characteristics; in the case of the vertical bridge joint, it can be seen that the narrower the auxiliary

belt, the lower the joint resistance. The lap joint resistance is generally less than the bridge joint.

The brazing process is simple and easy to operate. The maturity of the parameters in the process, such as the welding area, welding direction, welding material and thickness of the weld layer, has reached a relatively mature conclusion. However, since the brazing does not completely form a metallurgical bond at the interface, there is a contact resistance, and the resistance of the brazed joint is generally large. Among them, although the lap joint resistance is generally smaller than the bridge joint resistance under the same conditions, since the bridge connection method has little influence on the magnetic field distribution, the method is very suitable for the connection between the high-temperature strip interpolating magnet double-cake coils, This method is worthy of promotion in the field of interposing magnets.

3.4.2 Diffusion bonding connection

The diffusion bonding method is to place the soldering device in a vacuum or a protective atmosphere and apply a proper pressure, and then heat it to a temperature lower than the heat treatment temperature of the superconductor for a certain period of time, and achieve the purpose of metallurgical bonding by diffusion of atoms.

3.4.3 Fusion welded joint

The fusion-welding joint is to soak the wires to be welded together in the molten solder, and the solder-cooled superconducting wires are connected together. This method is very suitable for multi-wire welding.

3.4.4 Cold pressure welding connection

Cold-welding is the plastic deformation of the welded part by the action of pressure at room temperature. Under the action of pressure, the contact surface of the welded surface is in close contact, and the welded parts are welded together by the mutual diffusion of molecules and atoms.

3.4.5 Sintering method the sintering method is a material chemistry method in which the position of the joint is filled with a suitable material and then directly processed at the crystallization temperature.

Conclusion: The brazing process has a wide range of applications, mature technology, simple equipment, and small joint resistance. It is generally suitable for the connection of high temperature strips. The diffusion welding process is slow, the temperature and pressure control requirements are high, and the performance is relatively stable. A relatively low joint resistance value is generally suitable for high temperature strips. If it can solve the temperature control during the process and prevent oxidation, the method is quite promising. The welding process involves the replacement of the matrix material, which makes the wire and solder contact sufficiently, the joint resistance value is very small, and the process is not complicated, which is a better method, generally suitable for low temperature wire. The cold pressure welding method is simple and easy, and the joint resistance value can also be made small, but the current process performance is not stable and generally only used for low temperature superconducting wires. The sintering method can make the texture of the joint part close to the base material from the microscopic level, and the grain boundary at the joint can be almost eliminated, but the process is complicated and the operation is difficult. Many parameters need to be explored, and the application is not widely used at present. Therefore, in the actual project, the electrical and mechanical properties of the joint should be considered according to the actual needs and operability of the project, and the appropriate superconducting joint process technology should be considered comprehensively.

4. CHARACTERISTICS OF SUPERCONDUCTING JOINTS

4.1 Electrical Properties of Superconducting Joints Between Composite Conductors

By applying SQUID (Superconducting Quantum Interference Device), it is possible to measure a voltage of 10^{-12}v sensitivity, which means that a joint resistance of $10^{-14}\omega$ can be measured. However, in this case, the current should not be directly applied to the connected superconducting wire because the noise of the power supply easily interferes with the operation of the voltmeter. Therefore, current is induced in this experiment. The measurement system consists of three main components for inductively inducing current on the superconducting loop, measuring the induced current, and measuring the induced voltage on the joint.

A 50 mm diameter superconducting coil was wound around the epoxy glass reinforced plastic bobbin located inside the lower lead coil, and a straight portion of the length included a straight portion of the test joint. The heating wire was wrapped around the 10 mm long portion of the ring. Place the Hall probe in the FRP spool of the winding loop. A lower superconducting solenoid is placed around the loop to induce current on the superconducting loop. The upper superconducting coil was placed approximately 230 mm above the test ring to create a magnetic field on the joint. The upper coil operates in a continuous power mode. The voltage lead connected to the connector is connected to the terminal of the voltmeter. For this measurement, the ring was immersed in a 4.2 K liquid. Current is induced in the loop and current decay is tested by measuring the magnetic field generated by the induced current in the loop using a Hall probe. Calibrate using the same superconducting loop with a known current.

The induced current of the loop is measured by a Hall probe and the voltage induced on the joint is measured. In this measurement, the current of the low coil is turned off during the excitation of the loop current. Then, after the heater is turned on, the

temperature is raised, the superconducting state is destroyed, and the resistance state is exhibited, and then the heat is consumed to make the current zero. The induction current is zero through the heater in 1000 seconds. The behavior of current and voltage attenuation appears to be a characteristic of measurements made on circuits containing resistors and inductors.

For a cold solder joint having a length of about 20 mm, the Cu substrate is removed by etching. Exposure to superconducting filaments. Then, each filament at both ends of the superconducting wire is pressed into the copper tube. The logarithmic dependence of current time and the inverse correlation of voltage time were observed. Depending on the attenuation mode of the two joints, we can determine the difference in quality between the welded joint, the cold weld and the spot weld joint, beyond the basic joint resistance.

We applied the SQUID voltmeter to study the electrical properties of the joint between the multifilament superconductors and obtained the voltage sensitivity of the microvolt range, which verified that the SQUID voltmeter is very useful for this application. In the experiment, using welded joints the current induced on the loop is almost exponentially attenuated, however, the current induced on the loops of the cold- and spot-welded joints is attenuated logarithmically [3].

4.2 Continuous Current Joint Technology Between Superconductors

The production of joints between technical conductors involves two general processes. The first is a metal matrix that chemically or mechanically removes superconducting filaments around each busbar. The second is some thermomechanical processes to create a superconducting interface for current transfer between the parent conductors. There are a variety of joining structures and manufacturing procedures to accommodate the widely varying physical properties of available technology conductors, including their filamentary structure, mechanical properties, and chemical composition.

4.2.1 General structure of continuous current connectors

The overall structure of the joint can be broadly described by its internal structure and the relative orientation of the input and output conductors. The first is a butt joint where the wire is connected from the tip to the tip. These are advantageous where minimal joint protrusions are required, such as those that are fabricated inside the coil windings that must maintain magnetic field uniformity. In fact, these are generally not used because of the contact area available for bonding and therefore the current transfer tends to be small. The second is a lap joint made by overlapping the conductors on each other, which is advantageous if the large flat superconductor area can be easily exposed along the length of the wire (for example in the case of a single ribbon).The lap joint also allows the application of uniaxial pressure, which is often necessary to connect ceramic high temperature superconductors. Sometimes a hybrid lap joint/butt joint is made or a series of zigzag steps are formed by polishing the conductor tip into a wedge angle. This minimizes joint protrusion while enhancing the current transfer area. The final structure is an indirect joint in which the parent conductor is connected by an intermediate superconducting material such as a solder, a powder/slurry or a bridge. In this case, the intermediate tends to have worse superconducting properties than the optimized parent conductor and is often a performance limitation. The relative orientation of the busbars in the joint can also be selected to suit the performance requirements. In most cases, a joint that is at a distance from the magnet coil is fabricated and accommodated in the region of the low stray field. Therefore, the wires to be connected are bound side by side and connected at their ends in a "termination" joint. The current is reversed when current is passed through the connector. Alternatively, if the purpose of the joint is to extend or replace the conductor within the coil winding, a 'continuation' joint must be used.

The physical composition of the joint is often quite complex compared to the busbar. The application of chemical and thermomechanical processes to filaments disrupts chemical and microstructural properties and locally changes superconductivity, most notably their upper critical field (H_{c2}) and critical current density (Jc).In most cases, the joint is indirect, so an intermediate superconductor having a generally poor upper critical field and critical current density is also synthesized between the filaments. An industry standard NbTi connector is a good example. They consist of a large number of partially contacting filaments, joined to PbBi solder, have a cast structure and dispersed Sn, Cu and oxide content, which cure in copper or brass cups. The non-uniformity of the joint manufacturing process inevitably leads to a critical current density in the joint and a non-uniformity in the upper critical field.

4.2.2 Voltage and current characteristics of continuous current connectors

The first is flux creep - the removal of flux lines from a finite pinned potential well caused by a thermal process. The second is the flux flow that occurs when the Lorentz force on the flux line exceeds the maximum base flux pinning force, so the magnetic flux begins to pass through the material. This produces a linear vi characteristic at higher electric fields. Although these two mechanisms are even present in homogeneous materials, real materials are inevitably non-uniform. Technical conductors typically comprise a plurality of filaments embedded in a low resistivity matrix, each filament having a slight change in chemistry, microstructure and cross-

sectional area. These changes cause a distribution of critical currents between the filaments and along the length of the conductor.

The most common V-I measurement technique used for technical superconducting wires is the four-probe method, which is also used for joint characterization procedures. In short, the background field and temperature for the measurement have been established, the slowly increasing current passes through the sample, and the generated voltage is monitored on two potential separation gaps l. At some currents, the voltage rises above the background noise level and the V-I behavior of the joint becomes measurable.

The IRT method, also known as the current or field attenuation method, measures the vi characteristics based on the time decay of the current flowing in the inductive superconducting circuit. This technique has been used to analyze the loss mechanism in the technical line and is a standard tool for characterizing joints. The sample in this case is a small inductor l coil, a closed loop containing the joint. The sample coil is typically cooled in a liquid cryogen bath at a single temperature (t), but a cryocooler and a temperature-controlled cryostat have been used to change the test temperature. Current is induced in the coil by magnetic force or by power source / PSC. Typically, several Tesla background magnetic fields are also commonly applied to joints to test their field performance, which is important for magnet design.

When the highest initial current is induced, the settling time is the shortest, which is believed to be due to the most uniform initial current distribution on the wire (i.e., the entire superconducting section is magnetic flux penetrating).The decay at an initial current well below the conductor is usually determined by the sedimentation effect in the wire in most vi ranges, limiting the range in which the fixed vi characteristics can be measured. This is problematic for joint testing because the induced current is naturally lower than the initial current of the conductor, so there is always a sedimentation effect [5].

4.2.3 Joint between superconductors

Welded joints: solder composition, microstructure and superconducting properties are closely related and clearly play an important role in determining joint performance, but the joint geometry cannot be eliminated from the analysis to suppress joint properties and inherent superconducting properties of the solder material. The ability to draw quantitative relationships between them.

Cold pressed NbTi joint: As a mechanical soft alloy, NbTi filaments can also be metallurgically bonded by simply pressing the filaments together at room temperature. Since this is a direct bonding technique, a joint with strong field characteristics can be realized, and the simplicity of the technique also enables a highly repeatable process. However, it cannot be applied to harder, more brittle intermetallic superconductors such as Nb_3Sn or Al.

Spot Weld Head: Spot welding (or resistance welding) is a technique commonly used to join metal sheets and is also used to join NbTi filaments. This technique involves sandwiching a workpiece between two electrodes (partially piercing the surface oxide) and passing a high current, short duration pulse. The resistance heating is sufficient to instantaneously melt the material at the interface, dissolve the oxide barrier and bond the workpiece. Therefore, considering the problems associated with oxidation, this technique is meaningful for connecting NbTi. An irreversible phase change caused by the high temperatures encountered in spot welding may mean that the method is not suitable for joining Nb_3Sn or Al wires.

4.2.4 Superconducting solder

The microstructure of the cast solder strongly influences the overall performance of the joint, whether superconducting or other important physical or mechanical properties.

Pb-Bi is a standard superconducting solder used in the industry to connect NbTi and Nb_3 Sn conductors. However, in this system, solid state diffusion is rapid even at 300 K, and due to changes in equilibrium solubility with temperature, the microstructure and thus superconducting properties change significantly with time at room temperature.

The eutectic lead-tin (Pb-Sn) system has been one of the most famous welding systems for decades. The system has a T c of approximately 7.5 K and a eutectic temperature of 183℃. It is also suitable for the manufacture of superconducting joints. The most commonly used superconducting solders are 40Sn-60Pb, 50Sn-50Pb and 60Sn-40Pb.However, the 60Sn-40Pb alloy has a plasticity range of 5℃ and is more suitable for the manufacture of superconducting joints than 40Sn-60Pb. The plastic range is 51℃. Reducing the tin content has the effect of lowering the critical field and lowering the wetting performance to increase the liquidus temperature, but reducing the alloy cost.

In/Pb alloys have lower T c and higher resistivity values and lower critical fields than Sn / Pb solders.

In lead-free solders, In-Sn eutectic has higher ductility, better wettability and longer fatigue life. The eutectic composition has a melting temperature as low as 120°C and a relatively high Tc of 7.45 K. In-Sn solder is a promising candidate for lead-free superconducting solder. However, the use of indium containing alloys may be unattractive due to the scarcity and high cost of indium.

4.2.5 Connector between REBCO superconductors

As a promising conductor for ultra-high field HTS magnets, if a commercial REBCO coated conductor (CC) is used, a reliable connection technique must be established that will be deployed in the PM magnet. The joints between these wires are particularly difficult to manufacture for a number of reasons. First,

REBCO has a low affinity for oxygen and therefore easily reacts with metals to form an oxygen-depleted REBCO and oxidized metal layer at the REBCO/metal interface. These reactive layers create contact resistance at the REBCO/metal interface. The lowest resistivity of the interface is naturally formed by metals having a low affinity for oxygen, namely noble metals such as Au and Ag. Even under highly optimized conditions (contacts that are subsequently deposited on the surface of the fresh REBCO under vacuum). Therefore, we can expect that a superconducting interface will never be produced by soldering directly to the REBCO surface with a metal superconducting solder.

Given the long oxidation time, the use of vacuum systems and laser drilling, this process is indeed much more complicated than the processes that magnet manufacturers are currently accustomed to. However, the success of this technology demonstrates the exciting prospect of winding a completely durable next-generation high-field magnet from REBCO CC.

4.2.6 Joints between BiSCCO superconductors

Two different Bi-based HTS compounds can be used for commercial conductors, $Bi_2Sr_2CaCu_2O_8$ (Bi-2212) and $Bi_2Sr_2Ca_2Cu_3$) O_{10} (Bi-2223). The critical temperature of Bi-2223 is as high as 110K.However, due to its chemical instability and slow reaction kinetics, it is particularly difficult to process in a single phase. The Bi-2212 is easier to process, although its transition temperature is lower, 80-90K.It benefits from superior transport performance at low temperatures. The initial work of the joints in the BiSCCO system was performed on a large number of samples and the results were very respectable. By pressing the surfaces of two Bi-2223 blocks together and heat treating, sometimes using the raw material BiSCCO powder as the filling material, Mutoh et al. successfully produced a diffusion bonded joint that carried the same current as the original bulk material. Murayama et al. obtained similar results on a Bi-2212 block joint formed by hot pressing. These results confirm that the PM joint in the BiSCCO system should be technically feasible.

4.2.7 Joints between magnesium diboride superconductors

The PIT technology was used to produce magnesium diboride (MgB_2) superconducting wire, using a series of jacket materials. The in-situ line is produced by adding a mixture of Mg and B powders in a metal tube and stretching to a desired diameter before heat treatment, so that the liquid assisted reaction of Mg and B forms a superconducting phase. The ex situ wire is prepared by reacting the precursor powder to form MgB_2, stretching to form a wire, and sintering at a high temperature (800-1000℃) before loading the superconducting powder into the metal sheath. Both methods can be used to form monofilament or multifilament, and consider ex situ processes. Although Jc (B) has better in-situ wire properties, it is more suitable for making long length wires.

Conclusion: Low temperature eutectic alloys such as PbBi, PbIn and PbSn are some of the easiest to manufacture Type II superconductors for basic physics research. The focus of the research is on alloys with a highly uniform microstructure to eliminate flux pinning (irreversible) effects. However, the joint manufacturing process results in a highly uneven microstructure in the solder, which should also be considered. These eutectic alloys comprise two phases, one or both of which may be superconducting. Studies of these systems have shown important roles in microstructure parameters such as composition and volume fraction per phase, strain and grain boundaries in determining overall superconducting properties. In addition, as low-melting alloys, their microstructures rapidly age even at room temperature, thereby changing their superconducting properties. Therefore, the superconducting properties of joints made with these alloys will be highly dependent on history.

NbTi is also investigating alternative lead-free direct bonding techniques. Cold pressing has been shown to produce good performance joints, but it is highly undesirable to use hazardous filament cleaning chemicals such as HF if it is indeed needed. Spot welding can provide HF-free options, but little research has been done on this technology in the public domain. Our recent work has shown that excellent adhesion can be achieved by this method, but at the cost of major microstructural modifications to NbTi.

The era of commercial HTS magnets is rapidly approaching. There are now commercial MRI magnets containing MgB_2 conductors that have the advantage of higher temperature operation and reduced or complete elimination of LHe from cryogenics. Permanent joints of in-situ and ex-situ lines of monofilament and multifilament construction have been demonstrated, primarily by PIT techniques similar to those used in wire production. Omen et al. recently demonstrated the first link between fully reactive commercial multifilament MgB_2 wires which were produced by hot pressing Mg + B powder with the exposed filament surface by polishing. A reasonable critical current of up to 50% of the wire Ic has been achieved, and as the process improves, it seems that an industrially compatible process will soon emerge.

The high field performance of the long BiSCCO and REBCO conductors at 4.2 K now exceeds the Nb_3 Sn conductor, both of which are candidates for high field magnets. The joint between the BiSCCO superconductors is usually manufactured by reproducing a processing method for the conductor itself. For the Ag / Bi-2223 PIT tape, this involves cold pressing the exposed filaments of the partially reacted ribbon and then performing the same

extensive thermomechanical treatment for forming the Bi-2223 phase in the conductor. For Bi-2212 conductors, standard melt processing techniques are typically employed during the bonding process. Due to the large cross-sectional area of the superconductors, these techniques can produce joints with higher critical current than the busbars. However, joints between multifilament BiSCCO conductors tend to have worse properties than monofilament BiSCCO joints because microstructural inhomogeneities limit the interconnection between filaments.

The formation of joints between REBCO conductors is extremely challenging because their superconducting properties are highly dependent on the microstructure and composition, both of which have a tendency to vary significantly at the high temperatures required for ceramic joining. A well-bonded lap joint can be formed by partially melting the REBCO layer under low PO_2 , and if carefully controlled, produces a very small amount of non-superconducting secondary phase. The reoxidation of REBCO after addition is a time consuming process, mainly because of the limited diffusion path of O_2 in the lap joint structure. At high PO_2 and by drilling a laser hole in the conductor, the diffusion is enhanced to fully restore the superconducting properties, but only after annealing for several hundred hours. Under these conditions, the critical current of the resulting joint replaced the critical current of the parent conductor at 77 K and self-field (84 A), and the resistance at 30% of the joint I c was less than 10^{-17} Ω [4]. This groundbreaking argument has made the prospect of PM REBCO magnet manufacturing tangible, but the current process is too complex and time consuming to be easily adopted in the industry without major changes to the complete production line. Future efforts should focus on producing scalable industrial processes that ideally eliminate the use of closed vacuum systems and lasers, as well as significantly reduce oxidation time. Achieving all of these goals may require a completely different connection technique, and for this purpose the field is absolutely open.

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Research on Teaching Reform of *Software Test Management* Based on CDIO

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Abstract: CDIO is an advanced engineering education concept and talent training mode. In this paper the application of CDIO is discussed in the teaching of the *Software Test Management* course. First, the characteristics of CDIO mode is introduced. In consideration of the existing problems in the course teaching as well as the reality of the software industry, the course objectives are adjusted and then the teaching contents of the course are updated accordingly. In practical teaching, the method of project driving and task leading is adopted. Through teaching practice, it is proved to be able to better mobilize students' enthusiasm and desire for knowledge, and improve students' ability of engineering application and team cooperation.
Keywords: CDIO; Software Test Management; Teaching Reform

1. INTRODUCTION

Software testing runs through the whole life cycle of software products. With the development of software industry, software testing is gaining more and more importance in the software life cycle. It brings a great demand for software testing talents. In view of this, domestic colleges and universities set up the direction of software testing to train those talents in the software engineering specialty [1]. For software testing graduates, they are required to be familiar with the software testing process, test case designing, and be able to find key defects and understand the defect management and tracking. They are also required to have strong capabilities of expressing, communicating and learning as well as an active conscious of learning new knowledge and technology [2].

In the training of software testing talents, a course that plays a necessary role is *Software Test Management*. Through the study of this course, students can understand and be familiar with software testing process, understand software testing theory, apply testing skills and methods to test various applications, and master the usage of test management tools [3]. Most abilities required by software testing profession are believed to be cultivated in practical teaching sections. Using CDIO for reference, we have reformed the teaching of *Software Test Management* from the aspects of course objectives, teaching contents, teaching implementation strategies, etc.

CDIO Engineering education mode is the latest achievement of international engineering education reform in recent years. Since 2000, the concept of CDIO Engineering Education has been established by the transnational research of four universities, including MIT and Royal Swedish Institute of Technology. And an international cooperation organization named after CDIO has been established [4]. CDIO represents *Conceive, Design, Implement* and *Operate*. It takes the life cycle from product development to operation as the carrier, and enables students to learn engineering in an active, practical and organic way [5][6]. CDIO training program decomposes the expected abilities of engineering graduates into four aspects, i.e. basic engineering knowledge, personal ability, interpersonal team ability and engineering system ability. It requires a comprehensive way to train students in these four aspects to achieve the intended goals. [7].

According to the training goal of software talents based on CDIO, we have explored the teaching contents, teaching methods and strategies of *Software Test Management* under the guidance of CDIO education concept. Practice has proved that the CDIO-based *Software Test Management* teaching can better mobilize students' learning enthusiasm and desire for knowledge, and improve students' engineering application ability and team cooperation ability.

2. COURSE OBJECTIVES

The ability goals of *Software Test Management* course mainly includes knowledge objectives, skill objectives and quality objectives.

2.1 Knowledge Objectives

The knowledge objectives of the course are listed as follows.

a) Software test management knowledge: understand software testing process, strategy, method, technology, workload estimation and risk control knowledge.

b) Software defect management knowledge: understand the concept, classification, discovery means and fix strategy of software defects; understand the causes of software defects; understand the concept, level and model of software defect management.

c) Software quality assurance knowledge: understand the basic concept of software quality, factors affecting software quality, software defect

measurement, analysis and prevention.

d) Knowledge of relevant tools: learn several software defect management tools and test management tools with high market share; understand the features and functions of those tools.

2.2 Skill Objectives

The skill objectives of the course are listed as follows.

a) Design ability: be able to analyze and design tests according to specific test requirements, tailor and define testing process and defect handling process, define software defect life cycle, determine testing methods and strategies, etc., and select appropriate software defect management tools or test management tools.

b) Management ability: be able to effectively control the software testing process and ensure the proper operation of testing process and defect handling process; correctly judge, describe, submit and track the defects found in different ways and technologies in various stages of software development to ensure that all defects are properly handled finally.

c) Analysis ability: be able to select appropriate defect measurement elements and measuring methods according to specific needs; be able to apply various software defect analysis technologies and tools to conduct qualitative and quantitative analysis of defect measurement data; be able to propose applicable software defect prevention measures and methods according to defect tracking management process and defect analysis conclusion, and help improve the organization's software engineering process specification .

d) Document ability: be able to independently formulate and use technical documents and forms involved in the software test management and defect management process.

2.3 Quality Objectives

The quality objective of the course is to have a good ability of independent learning, team working, communication, logical thinking and analyzing.

3. TEACHING CONTENT REFORM

3.1Theoretical Teaching Content Design

In terms of course content, based on CDIO's idea of conception, design, implementation and operation, we integrate theoretical knowledge learning with specific projects and tasks through "learning by doing" and "project-based education and learning". Combined with the development of software testing industry and the orientation of course objectives, taking the life cycle of engineering project as the carrier, the teaching content of *Software Test Management* course can be divided into seven tasks for teaching, as shown in Table 1.

Table 1 Theoretical Teaching Contents

No.	Teaching Tasks	Contents
1	Survey of software testing	General process and relevant specifications of software test, elements of software test management, methods of test management and standards of test completion
2	Test preparation process	Test strategy determination, test plan formulation and implementation, test design and development
3	Test execution process	How to build test environment, execute tests, view test results, evaluate test results, record and track software defects
4	Test analysis process	Measurement and analysis methods of software defects and test process, and writing of test reports
5	Other activities of test management	Some test management supporting activities, such as test organization and personnel management, configuration management, test progress management, communication management, environmental management and risk management, etc.
6	Standards and test process improvement	Relevant international and domestic testing standards, test process improvement process and models
7	Test tools and automation	Features and functions of different test management tools, using of common tools such as QualityCenter

3.2Practical Teaching Content Design

Practical teaching enables students to understand and master the general process and methods of software test management illustrated in class, and to use a test management or defect management tool, such as *QualityCenter (*abbreviated as QC*)*, more skillfully. Practical teaching adopts project oriented and task driven methods. Students are required to perform a complete testing project, and sublimate the knowledge and ability achieved in the theoretical teaching section. We combine the specific professional ability requirements of the testing management with the simulated software engineering project, decompose the project into multiple work tasks according to the roles or stages, and implement practical teaching in combination with the tasks. Task-based learning can not only enable students to master abstract theoretical knowledge in practice, improve their interest and self-confidence in learning the course, effectively break through the difficulties in teaching, but also cultivate their practical working ability.

Based on the idea of CDIO, the task contents of practical teaching of *Software Test Management* are designed as shown in Table 2.

Table 2 Practical Teaching Contents

Phase	Tasks	Output
Conceive	Select a project to be	

	tested	
	Assemble a testing team	
	Analyze and manage test requirements	Test requirements
	Write and manage test plan	Test plan
	Review test plan	
Design	Design and manage test cases	Test cases
	Review test cases	
	Write and manage test scripts	Test scripts
Implement	Build test environment	
	Perform tests and record defects	Defects
	Track and manage defects	
	Do regression testing	
Operate	Write test report	Test report
	Write test summary report	Test summary report
	Work summary and defense	

4. ORGANIZATION AND IMPLEMENTATION OF TEACHING ACTIVITIES

The teaching of this course is driven by projects. For example, the case of *Course Selection System for ** University* is introduced into the theoretical teaching activities, and knowledge points are decomposed into projects and tasks. In practice teaching, students can choose the software projects to be tested by themselves, which can stimulate their enthusiasm and initiative.

4.1 Conceive

At the beginning of the course, students choose software projects to be tested under the guidance of teachers. On the basis of understanding the general situation of the tested project, a testing team is established which is composed of 3-6 members. To simulate a real software company to carry out the testing work, each team needs to determine a test manager.

Each testing team is required to write a test requirement specification according to the given template on the basis of analyzing, discussing and sorting out the SRS of the system to be tested. Then the test requirements and their sub requirements are added to the *Requirements* module of QC. A QC test requirements tree is generated. And test requirements are transformed into the tests to be executed. The test manager determines the test scope, test type, test schedule, personnel allocation, risk management and relevant test criteria, and develops a test plan. After the test plan review is passed, it can be released to the *test plan* module of QC.

4.2 Design

Test cases are the core of software testing process and the basis of test execution. In this phase, test team members need to design the test data and test scenarios according to the test plan, considering the corresponding test type and test technology, and complete the preparation of test cases according to the selected template.

In the *test plan* module of QC, testers can add specific descriptions of test cases for each test. If *QTP*, *LoadRunner* or other automated testing tools are used, the test scripts can also be added to QC for management. After test case designing is completed, the test cases managed by QC can be exported to word document. After the review, the set of test cases is basically fixed.

4.3 Implement

After the test environment is built, testing team members test the system by manual or automatic means according to the existing test plan and test cases. In QC, the *test lab* module can be used to record and manage the execution process and the results of test cases, record and submit all the defects that have been found, and describe the severity, fix priority, reproducibility and other basic attributes of the defects. All submitted defects are automatically added to the *defects* module of QC. Testing teams can use the module to dispatch and track the defects of the project.

4.4 Operate

The *defects* module of QC supports the statistical analysis of various defects, which can help to evaluate the quality of the software version and generate corresponding test report. Under the guidance of teachers, testing teams analyzes their test data, defect distribution (including severity distribution, function distribution), workload distribution and problem sources, discuss and summarize their results and test processes, put forward suggestions for improvement, and write down test summary reports.

At the end of the project, each testing team needs to summarize and show the work results through the way of defense assessment. The supporting materials for defense include test requirements, test plans, test cases, defect lists, test reports, etc. During the process of defense, each team needs to answer questions from teachers and representatives from other teams, and learn together through the communication between team members and teams.

5. CONCLUSIONS

This paper discusses the application of CDIO to the teaching reform of *Software Test Management*. The characteristics of CDIO mode is introduced. In consideration of the existing problems in the course teaching as well as the reality of the software industry, the teaching contents of the *Software Test Management* course are updated accordingly. In practical teaching, the method of project driving and task leading is adopted. Through teaching practice, it is proved to be able to better mobilize students' enthusiasm and desire for knowledge, and improve students' abilities of engineering application and team cooperation.

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An Analysis on the Inheritance of "Wu" Culture of Miao Music in Western Hunan

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Abstract: The music of the miao nationality in western hunan has an indescribable "Wu" cultural characteristic. Influenced by multiple factors such as geography and history, its music is mysterious and full of magic. "Wu" culture is a unique part of miao music culture in western hunan. Even though the music has diversified development, the traditional national music has gradually disappeared in the long river of history. Our attention to the traditional national music is a kind of protection for it.
Keywords: "Wu" culture; artistic characteristics; protection; inheritance

Throughout the history of the miao nationality, the living conditions of the miao people in the ancient society are the carrier of the history and culture of the miao nationality. However, the cultural environment of "no writing" of the miao people encourages the dual development of language art and human art of the miao people, who not only save the characters as folk art, but also save a large number of historical and cultural materials. Miao inspiration is the miao art existing in the contemporary. Miao inspiration vividly depicts the ancestors of the miao people and the modern evolution of the social life of the miao people, recording the history and cultural development of the miao people.

1. BASIC CHARACTERISTICS OF "WU" CULTURE

The Yangtze river and the Yellow River have given birth to the 5,000-year-old civilization of the Chinese nation. Wu culture advocates nature, worships ghosts and gods, and believes that ghosts and gods control everything. The witch culture also converts the religious nature of the communication with ghosts and gods into the aesthetic nature. Perform the natural induction in the ceremony, and the spirit of the exchange.

1.1 The Primitive Nature of "Wu" Culture

The original witch culture is a kind of hunting time for the "god" of the specific expression, the original witch dance is to pray for god blessing. With the passage of time, the original witch dance has gradually retired from the stage of history. Nowadays, only some minority dances still retain part of the original appearance of the original "Wu" Culture dance. The original witchcraft covered all aspects of life and was an indispensable part of life. Therefore, the position of wizards was quite lofty in ancient China. It is recorded in the book of the red stone star that "there were two stars of sorcery and officials, in the southwest of fang (xing), the Lord served as healer and sorcerer". The representative of the sorcery is wu xian, who is a respected divination authority. At that time, the sorcery's divination would be "the day of the sorcery....." Based on many ancient Chinese books are witch books, among which the book of changes is a witch book describing divination, and the book of mountains and seas is a witch book recording all kinds of materials. Here you can see not only the activities of witches and wizards, but also the belief and worship of ancient nations and other documents. It can be seen that the existence of witch culture has penetrated into the history and culture of China, and has become a part of the Chinese nation.

1.2 The Religious Nature of "Wu" Culture

In ancient times, people who could understand ghosts and gods were witches. The sorcerer is also in charge of offering sacrifices. In addition to offering blessings through dialogue with the gods, he can also use divination to make people seek good fortune and avoid evil. Primitive people's incomprehension of various natural phenomena has long given rise to primitive religion, primitive ghost worship, natural worship, that is, the origin of sorcery. Nature is mysterious and unpredictable, and people in ancient times depended on it for survival. At that time, human cognition was limited, and they could only express their gratitude to nature by worshipping nature. Ancestor worship gradually evolved into ghost worship. After the death of the ancestors, the descendants who miss him will dream of him. They also believe that the spirits of the ancestors will become the messengers of god and benefit the future generations. In addition to ancestor worship, ancient miao or tribal and clan heroes, saints and leaders are worshipped and sacrificed. Miao people believe that everything that happens in the world has cause and effect and is controlled by ghosts and gods. In order to please the ghosts and gods, the miao people would perform pious sacrifices and expect the gods and spirits to bless them. The mystery of the witchcraft culture also lies in its religious nature.

1.3 Artistic Features of "Wu" Culture

"Wu" Culture are all-purpose wise men who can sing and dance. The origin of dance is the prayer dance of wizards. In the course of praying, a wizard's mouth makes strange noises and his body expresses wild feelings. Their feelings are expressed in the dance, their emotions are expressed in the dance. They use

howls instead of words; their dance expresses romance, they use the functions of body parts to express their inner feelings as much as possible, and their dynamic language reaches an insurmountable height in their dance movements, which has become an irreplaceable text. The sorcerer USES songs and dances to pray for good fortune and drive away evil spirits. "Nine songs" is the music and dance of sacrificial heaven and earth that has thick wu culture color, and qu yuan's "LI SAO" also inherits the grand scene of this kind of song and dance directly, just "LI SAO" main character will be by wu.

The teacher replaced ling jun, which made qu yuan's "LI SAO" by the profound influence of the witchcraft customs has been proved.

2. "SORCERY" OF MIAO MUSIC IN WESTERN HUNAN

2.1 The Originality of Miao Music in Western Hunan

Since ancient times, the west of Hunan province has been advocating ghosts and gods. Poems dating back thousands of years describe this place of worship. It is recorded that "nine songs of chu ci" contains elements of the miao witch songs. The west area of yuanshui and Hunan has been reciting "nine songs", that is, reciting for a thousand years, by the poet qu yuan's "nine songs". There is a description in "chu ci zhang and sentences" that "once upon a time, the city of southern ying of chu, between yuan and xiang, its vulgar belief in ghosts and good temple, the temple will be music to encourage the music of the gods". Obviously, the description is miao wu, miao ancestors, including the "barbarian" is "believe in ghosts and good temple" a kind of laity. Of course, the worship of nature by the miao people could not come out of nothing. The reasonable explanation for this phenomenon is that in the primitive hunting times, when human cognition was limited, they used to regard themselves as part of nature and considered themselves nurtured by nature when they could not explain the natural phenomena at that time. On the one hand, humans see external forces and natural phenomena and tend to mistakenly believe that they can evoke and have the power to create them; Humans, on the other hand, often have to live in the natural world with human and foreign bodies, including their own vitality. This is how the original "animism" concept was formed. The primitive concept of "animism" influenced the ancestors of the miao people in western hunan, and later gradually evolved into the primitive religious worship. The miao people like to personalize all the natural things, such as the gods and ghosts that the miao people often sacrifice, and "nuo gong nuo mother" and so on. This not only represents the thoughts and feelings of the miao ancestors, but also describes the inheritance culture of the miao people.

2.1.1 The Content of Miao Ethnic Music in Western Hunan Reflects Its Originality

For the ancestors of the miao nationality in western hunan, everything in the world has the spirit, from the heaven and earth to the flowers and plants, no matter the animals and plants have the spirit. These natural phenomena are the same as human beings are fresh life, there are language, there are emotions, there are good and bad.The miao ancient song records the daily life of the miao people from the creation of the world to the miao people, which is a very unique record of the miao culture from The Times.

The miao ancient song is the memory of the miao people. It is an encyclopedia describing the miao society, which still exists in the 21st century. The ancient song of the miao people is passed on from mouth to mouth among the miao people mainly in the form of the miao language, and is recited for major celebrations, festivals and memorial ceremonies. The content of the miao ancient song involves the formation of the sun, moon and stars, the generation and development of miao and sorcery culture, human reproduction, inter-clan wars and alternation, which is a classic of miao history and unique miao culture.

2.1.2 Musical Instruments of the Miao Nationality in Western Hunan Embody the Primitiveness

In the 21st century, traditional Musical Instruments of the miao people are often used in miao activities. Such as the ox horn, not only the ancient miao people used in the war a horn, but also the ancient and modern miao people in the sacrificial activities of a necessary instrument. Such as "song", "xiangwu", "solitaire" and other important miao song have bragging part. Miao people in western hunan and miao people in northeast guizhou usually offer sacrifices to their ancestors. The miao language translates to you gong, which is chiyou in the period of three sovereigns and five emperors. According to legend, the custom of killing cattle to offer sacrifices to ancestors of the miao people in southern sichuan originated in chiyou's time. In the war between chiyou and the yellow emperor, chiyou was defeated and killed, and the leader of miaomin was killed by an arrow in the process of migration. When burying these two miao heroes, the miao ancestors blew the horn, summoned the drums, and blew out the lusheng. Drums, which in ancient times might have been used only to drive leopards and boost morale, have changed over time. According to research, the oldest miao drum is only made of tree trunk and bamboo, and later began to have the miao people's bronze drum, until the people learned to use animal skin to make the drum surface, there is the present miao drum prototype. There is a record of "drummer, hulusheng" in the music house miscellaneous records of duan 'an festival in the tang dynasty. Both drum music and lusheng are traditional Musical Instruments of the miao people, representing the traditional culture of the miao people.

Lusheng is a traditional national instrument of miao people and a symbol of miao culture. The lusheng performance not only plays the lusheng, but also

combines dance and music with it. The lusheng also plays an important role in the splendor of miao ethnic culture. According to the records, every 'year meng chun, choose the flat ground for the field, men blowing lusheng, women ringing bell, hovering dance, that jump on. The miao people have an old saying, "the sound of the reed is not loud, the grain is not long."Lusheng is also one of the main Musical Instruments in the sacrificial, festival and festive activities of the miao people.

2.2 Religion of Miao Music in Western Hunan

The miao region in western hunan has always been popular with witchcraft, miao ancestors with their own wisdom, created a very rich miao witch culture. Believing in ghosts and worships many gods makes miao witch culture famous at home and abroad. According to historical records, the primitive religion known as ghost religion and witch religion is the ancestor of the miao people; Wu culture is the historical culture of the ancestors of miao nationality. Most of the miao music in western hunan describes the life of the miao people and records the history of the miao people.

The culture of China up and down five thousand years is extensive and profound. The custom of offering sacrifice to cattle often appears in major sacrificial ceremonies. For the miao people in western hunan, "verte-ox sacrifice" is the most solemn sacrifice, which is a religious activity to drive away disasters and ward off evil spirits. The simplicity of the miao people in western hunan can be fully expressed in the lyrics.

The sacrifice of vertebra cattle of miao nationality in western hunan is a sacrificial ceremony rich in miao culture and miao nationality characteristics. One is that the ancestors of the hmong were attacked by demons on the move, and that the hmong, in order to defeat the evil demons, performed a joint pledge of blood and victory. Later, not only to celebrate the victory, but also to commemorate the heroic dedication of the ancestors in the struggle, the miao people held a grand cattle sacrifice ceremony, generation after generation, finally became the most grand festival of the miao people in western hunan; Another legend is that the ancestor of the miao people, chiyou, fought with the yellow emperor tribe. Later, chiyou was defeated and his blood was spilled on the sand field. From the perspective of these two legends, the production of the cow sacrifice has a strong religious nature. Vertebral cows everywhere its traditional and religious offerings, jump the lively scene of drum is to simulate the ancient tribal organization collective life and work, the system of the mother right is supreme in the embodiment of the miao people's heart is now people greatly Revere of mother, is the job of cattle the thorn cattle in the plot is the manifestation of people advocating the battle.

Incense dancing is an activity to worship and sacrifice the "god of grain" and "god of heaven" among the natural gods. It is also another manifestation of miao wu culture. Dancing incense is in every autumn after the harvest, grain and poultry have a good harvest. The beginning of the incense dance was the ceremony of the Lord's prayer. A man with a crown of fir announced the official beginning of the incense dance with three sounds from his braggart corner. Then he knelt on the futon and began to recite the mantra and song: "please return to your seat. Arrow (that is, sincere) rendezvous, god's wish ".After reciting the mantra, the wizard would blow the horn three more times, then dip his finger in the water from the pot and sprinkle it on the ground, then dip his finger in the water and sprinkle it on the edge of the house, praying for good weather and good harvest in the coming year. It not only absorbs the dance, art, literature and music of miao art culture, but also is a ritual of miao witch culture. Thus it can be seen that dancing incense is a kind of religious miao witch culture in western hunan.

3. CONCLUSION

The folk art of the miao nationality in western hunan has a profound folk culture, which represents the heritage of western hunan, has a very high artistic value and profound cultural connotation, and has a profound national aesthetic psychology and ancient historical rhyme.We should absorb the essence of national art and national aesthetic consciousness to explore this tradition, integrate it into our modern art creation and carry it forward.

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The Cultivation of Students' Musical Ability in Piano Teaching

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Abstract: The piano is a school of music, piano learning from individual to general, from the concrete to the abstract, from physiology to psychology, from technology to art education, pay attention to skills training at the same time, should put the music ability, the cultivation of the ability of music appreciation and music expression ability through every link of pianos, open music view, thus improving the cultivation of the students' ability in music. Music itself will be eclipsed, music teaching will not succeed. And the music expression ability to some extent, also need to understand from the tone, style, speed, rhythm and strengthen various aspects such as finger skills training to improve and improve, so in piano teaching can not only in the abstract to inspire students, more can let the students listen to get more specific way, live, feel it. Therefore, in piano teaching, we should not only pay attention to the appreciation of piano music, but also pay attention to the cultivation of students' ability of sound perception, rhythm perception and musical expression.
Keywords: piano learning; musical ability; piano teaching

"The piano is a perfect instrument with a huge and rich artistic function," said professor niegaz, a famous piano educator and performer of the former Soviet union. The piano is a music school, it's learning from individual to general, from the concrete to the abstract, from physiology to psychology, from technology to the cultivation of the art, the piano is no longer limited to play it on the other hand, the development of diversified brought it into the cultivation of the ability of music teaching, making it the required course for every piano learner. In piano teaching, musical ability is a very important content, which enables students to improve their ability to feel, appreciate, express and create beauty through listening and perceiving music. It plays a very important role in expanding students' horizons, purifying their minds, cultivating their taste and improving their taste for music.

1. CURRENT SITUATION OF STUDENTS' PIANO MUSIC ABILITY

1.1 Current Situation of Students' Piano Music Ability

Piano art has a history of hundreds of years, it can be said that it is with the development of human civilization. Nowadays, piano has become the first choice in preschool education in many developed countries. However, even after a long period of piano study, students are still weak in musical ability.

1.2 Cause analysis

First, students focus on skills. Most of the students are too pay attention to the piano skills training and neglect of piano music ability, this is the last to work originally to express and reflect the feelings and thoughts are not expression, rather than blindly dazzle those boring technique, so as to make the work of monotonous, boring, stiff and unattractive. A good performer should not only express the skills of the work, but also express the emotion that the composer wants to express in the work well, and present it to the audience through his own unique expression.

Second, piano teachers pay little attention to the cultivation of musical ability. The author believes that another important reason for the weakness of students' piano music ability is that piano teachers do not attach importance to the cultivation of students' musical ability. Many teachers read from the book when teaching, and their musical ability is insufficient, let alone mastering and using it. There is no doubt that teachers' musical quality directly affects students' interest in music learning.

2. MAIN ASPECTS OF MUSIC ABILITY CULTIVATION

2.1 Piano Language Can Cultivate Students' Musical Aesthetic Ability

Piano language is a tool for the communication of musical ideas and a key to the opening of the hall of music. In terms of the structure of the piano and how it sounds, it's hard to find a more sophisticated instrument. From timbre, range, volume and playing style, the piano has a unique and solid material foundation, which makes it the king of instrumental art. Piano performance is super, piano has a rich tone, powerful volume, and piano has the ability to express complex music. The study of musical language is conducive to enriching students' musical culture, increasing their musical art accomplishment, and enabling them to place themselves in the realm of musical art, so as to improve students' musical aesthetic ability.

2.1.1 Music perception

Music feeling ability is the music feeling mentioned by the author, which can improve students' aesthetic ability and taste. The cultivation of music sensibility in piano learning is divided into two aspects: music "sound" feeling and music "language" feeling.

2.1.1.1 "Sound" perception

Piano music belongs to the art of sound. To feel the

"sound" is one of the important factors to pay attention to emotional expression and cultivation in piano learning. The first musical instrument, the piano, which has been developed for hundreds of years, is a very strong technical and artistic instrument, its technical difficulties can be imagined. The piano is one of the most powerful instruments. It is like a well-composed orchestra, capable of being both extremely strong and extremely weak in sound, with a contrast in strength that no other single instrument can match. Therefore, the feeling of piano "sound" is conducive to students' control of the strength, which can be unified with the content of the music, so that students can have feelings in their hearts and move themselves, so as to find the most beautiful sound, and express students' artistic understanding and experience of the piano through the change of strength.

2.1.1.2 "Language" perception

The elements of musical language are the basic of expressing the ideological content and artistic beauty of a musical work, including: melody, rhythm, beat, speed, strength, tone area, timbre, harmony, polyphony, mode, tonality and so on. For those who study music, they must first learn to speak in "language". Musical language is the soul of music. As the medium of music creation, the piano can play any instrument and enrich the performance of every piece of music. As a piano with eighty-eight keys, it has a very wide range of tones from the lowest to the highest. Learners can play harmony freely and include and concentrate all the musical arts in themselves. The piano is any musical instrument is incomparable, it is a powerful "band", it can make students in the study of music language can give unlimited play to the extraordinary rich harmony and polyphony of multi-part melody.

2.1.2 Music comprehension

Mr. Zhao xiaosheng, a famous Chinese piano educator, said, "the development history of piano art is essentially a history of western music thinking and musical thinking." Piano music art embodies a large number of musical styles. Although the piano is completely in today's form and has experienced a history of hundreds of years, the whole keyboard instrument can be traced back to the ancient Greece. In terms of the history of western music, it enables students to focus on the evolution of music styles and concepts in different periods and the deep cultural phenomena, and to have an understanding and reflection on the generation. Through the understanding of the background of music culture, main schools, social events, composers and their music works as a whole, the students' artistic vision is expanded, and the students' perceptual understanding of composers, styles and schools in the development of western music culture is enhanced, so as to improve the students' artistic appreciation and the ability to analyze and judge music culture. Students can not only understand and master the basic vein and creation style of western music history, but also have aesthetic experience and cultural cognition of representative works of different periods. It is beneficial to the cultivation of students' creative thinking, encouraging students to express their music aesthetic experience independently, and promoting the balanced development of students' historical knowledge, perception ability and critical thinking ability.

2.1.3 The imagination of music

Due to the range of a piano is very broad, as in many art auditory art music can stimulate people's imagination, most and piano music is different from other instruments, it can imitate the sound any instrument was dripping wet delicate, played the piano sound spread through space to the listener's ear, give the listener the art of aesthetic feelings. Some piano works embody the sound effects like symphony is rich, just symphony played by the command and the band members "pace" consistent but take responsibility to complete, while the piano need players with their own mind ACTS as a command and control with both hands this "big" symphony orchestra, piano performance vehicle great and profound contents, which not only have superb skills, but more important is to have good music imagination. The timbre simulation in the piano is powerful, it can imitate the timbre of any instrument. Therefore, under the strong musical imagination of the piano, it is beneficial for students to judge the piano music and the quick thinking ability, so that students can more accurately judge the color changes of music and the ups and downs of music emotion, and give play to the infinite imagination of music.

2.2 Piano language can cultivate students' musical expressiveness and creativity

The expressiveness and creativity of piano music include playing skills, musical sensibility, musical imagination and creative ability. These capabilities are mutually reinforcing and developmental. In order to make students creatively express the content of music, students should be inspired to give full play to their rich imagination and creative ability, add their own emotions in the piano playing, make the music more appealing. As each person's living environment is different, life experience is different, so there are different musical imagination and creation. That's why the same piece of music can be played differently by different people. Even for the same person, the same piece of music, because of the environment when playing, the state of mind is different, will also play out different feelings and effects. Therefore, to improve students' expressive force, students must be guided to strengthen observation in life, strengthen the experience of life and emotion, and use colorful imagination to create new musical images.

The author believes that the analysis of piano music works under the guidance of teachers is an effective

measure to help students deeply understand music images, master various techniques of expression, and improve music feelings and creative ability. At the same time, the teacher to student supervising insights and innovation performance, also should be given encouragement, absolutely can't kill the students' personality, because students in learning the piano is not just blindly imitate, but should have their own individual characteristics, is more than just play a song composer, also should put his feelings to work.

3. MEASURES FOR THE CULTIVATION OF PIANO MUSIC ABILITY

3.1 Attach Importance to the Cultivation of Students' Humanistic Spirit

In the process of cultivating students' excellent musical performance ability, it is necessary to instill the cultivation of students' humanistic spirit. While instilling the basic knowledge and skills of piano music, it also guides students to form a correct outlook on life and values. Make it develop generous, optimistic, positive personality and personality. Through various music practice activities, students are trained to feel beauty and create beauty, develop healthy aesthetic taste, guide students to discover and develop themselves in music practice, and make music learning and personality develop in harmony. Humanistic cultivation will greatly promote the artistic accomplishment of music, which can better help students to experience the rich connotation of music, and more accurately publicize the emotional essence of works in performance.

3.2 Attach Importance to Students' Understanding of Musical Works

3.2.1 Train students to listen more

Listening more is a basic skill to develop the art of piano performance. When different performers play the same work, there are differences in artistic processing, such as li yundi playing Beethoven's sonata and lang lang have their own characteristics. The perception of music depends on listening to music and more actively involved in music practice activities to develop, only for the music she is playing with a keen feeling ability, can obtain the success of the play, also can make the students can in music performance in both emotional and rational understanding, and give full play to the students' creativity. Let the students listen to music from different countries, foreign and Chinese. Through continuous appreciation, absorption, to achieve a subtle effect.

3.2.2 Explain and analyze the works

It is necessary to analyze and study the style, structure, harmony, texture and the background of the music, as well as the different versions of music. The author asks students from practice to performance, always understand the work, performance music content as their primary task. Students are required to play, always with music in the heart, using the performance skills to express the music's moving place, to communicate people's hearts. If you want to play Chopin's revolutionary etudes well, it requires the fingers of the left hand to be flexible and powerful, the octaves and chords of the right hand to be firm and accurate, plus a good wish, Chopin's heartfelt affection for the motherland and people, full of resolute and heroic spirit, you can express this etudes well.

3.3 Train Students' Basic Skills

3.3.1 Teach according to people and students according to their aptitude

Students from different families should be taught according to their aptitude. For the students who have a certain correct keyboard foundation, can take advantage of the situation, according to its existing degree to improve; For the students who have the experience of playing the piano but the method is wrong, the teaching should focus on correcting the mistakes, so that they gradually master the scientific and correct playing methods; To finger condition "tight and hard", the student that lacks keyboard foundation, should follow the principle of step by step, start from zero, undertake patient and meticulous skill training, enhance its self-confidence, make it can get normal development.

3.3.2 Attach importance to students' basic exercises and training

The basic exercises of scales, arpeggios and chords are the technical basis for playing good music and an essential part of keyboard teaching. Piano teachers should not pursue teaching progress and ignore the teaching of this link, and students should not neglect it because of the "boring" teaching content. In the whole process of piano teaching, no matter in the beginning stage or in the senior grade, teachers must constantly pay attention to the basic practice.

3.3.3 Etudes teaching

Etudes are specially written to solve the problem of playing skills in different stages of learning. Any etude has its different pertinence and purpose. In the teaching of etudes, teachers must clearly point out to students the different skills of each etude practice purposes, so that students do "know what to expect", consciously, purposefully to practice "etudes", so that students' playing skills steadily, comprehensively improve and improve.

3.3.4 Strengthen students' basic training

When teaching, the author asks students to pay special attention to the following points when practicing the new lesson :(1) remember the tune mark of the music;(2) accurate rhythm and beat;(3) pay attention to fingering. All the fingering methods marked in the score are the most scientific and should be used strictly.(4) distinguish musical phrases. Phrases are like reading a text. Pay attention to punctuation. While practicing, students should also pay attention to the trend of musical phrases. For example: up, down, breathing, etc. Only when these four points are well done, can we have a solid

foundation.

3.4 improve students' sense of music in piano performance

Musicality refers to the ability to feel, understand and express music. In reality, different people have different abilities to experience music. Only by consciously cultivating students' sense of music can teachers improve students' ability to feel music.

4. CONCLUSION

The vitality of any form of artistic expression has much to do with its inheritance and its popularity and improvement. The cultivation of a person's quality needs to go through a long period of precipitation, so does the cultivation of musical ability in the piano. Today, when innovative education has become a major development trend in the world education circle, every music educator should constantly explore new teaching methods to better improve the cultivation of students' musical ability in piano learning. Only by paying attention to the cultivation of piano music ability can piano learners better understand and express their works, and the piano music accomplishment of Chinese piano players can be improved at a higher level.

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Analysis of the practical value of intellectual property technology standardization

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Abstract: Standards and intellectual property rights are compatible with each other, and the disclosure of standards inevitably involves the disclosure of intellectual property rights. Many patents or technical secrets hidden in the standards, through the publicity means and Strategies of standards, will get the first chance in the market competition. To integrate into the market, we must enter into its standard system and conduct production, management and operation in accordance with its standards.
Keywords: Technical Standards; Market Competition; Standardization IP

1. TECHNICAL STANDARDS AND THEORETICAL BASIS OF STANDARDIZATION

The so-called technical standard refers to a kind or a series of documents with certain mandatory requirements or guiding functions and detailed technical requirements and relevant technical solutions, whose purpose is to make relevant products or services meet certain safety requirements or market entry requirements. The essence of technical standards is to set up one or several production technologies that must meet the requirements and the implementation technologies that can meet the requirements [1]

The national standard (gb3935.1-83) thinks that the standard is: "the standard is a unified regulation of the concept of repetitive things. It is based on the comprehensive results of science, technology and practical experience, approved by the competent authority and issued in a specific form by consensus of the relevant parties, as the guidelines and basis for common compliance. " Therefore, from the definition of the standard, we can get the following main contents: the object of formulating the standard is "repetitive things and concepts"; the standard of "things" is generally management standards and method standards; the standard of "things" is generally product standards; the standard of "concepts" is generally terminology, code, symbol standards, etc. Therefore, only "repetitive" things and concepts can make standards, and the purpose of making standards is to "unify". "Unification is the essential feature of standards, different levels of standards are the unification within different scopes, different types of standards are the unification from different angles and different sides; the basis for formulating standards is" comprehensive achievements of science, technology and practical experience ", which comes from social practice and is higher than practice to guide practice; the necessary condition for formulating standards is" coordination by relevant parties ". Consensus "must be" approved by the competent authority and issued in a specific form; standards are the product of consensus in scientific research, production, use and other aspects, and are the concentrated embodiment of interests in all aspects.

Consensus in all aspects is conducive to ensuring the quality and implementation of standards. Standards have no legal effect without the approval of the competent authority. The role of standards is "the standards and basis to be abide by jointly" by scientific research, production and use departments, enterprises and institutions. The definition of standards generally reflects the scientific, advanced, democratic, statute and applicability of the standards. Technical standards are the standards for technical matters that need to be coordinated and unified in the field of standardization. Technical standards are the main body of standardization work and a common technical basis for production, construction and commodity circulation. Management standard is a standard formulated for scientific management methods and management technologies that need to be coordinated and unified in the field of standardization, mainly involving technology management, production safety management, quality management, equipment energy management and labor organization management. Work standard is the standard of work quality formulated according to the work position. It is the regulation on the scope, composition, procedure, requirement, effect, inspection method, etc. of the work. It is the work specification and operation specification that specifically guides a work or a processing procedure. Service standard refers to the standard that specifies the requirements of service to ensure its applicability, which can be formulated in such fields as laundry, hotel management, transportation, automobile maintenance, telecommunication, insurance, banking, trade, etc.[1]

Some scholars in our country think that the technical standard should contain at least two meanings: draw a line for the level of technology to be achieved, as long as it does not meet the line, it is unqualified production technology[2] the technology in the technical standard is complete, if it does not meet the production technical standard, it can seek the

technical license from the standard system, pay the license fee, and obtain the corresponding production technology meeting the standard. Technology, which is the most important reason why technical standards pay more and more attention to licensing[3]

2. RELATIONSHIP BETWEEN TECHNICAL STANDARDSANDIP

2.1 Different Between Technical Standards and IP Rights

The standard is open, it is a kind of public product, which has the characteristics of non consumption and non competition. It is the result of the general acceptance and selection of the public. The purpose of formulating and implementing the standard is to widely promote the standard in a certain industry or a certain product or a certain service. Therefore, the standard itself is not a private right or any administrative privilege. Different from the essential attribute of standard, intellectual property is private right, which originated in the embryonic period of Roman commodity economy. At that time, people began to realize that mastering a certain skill can also bring wealth. As Adam Smith said, "thinking is productive, because it saves labor", and labor is creating value, that is, thinking has value[4].

This may be an early evaluation of knowledge and an early understanding that knowledge has value. It was not until the promulgation of Venice patent law in 1474 that the inventor had the right of "monopoly" on the technology he owned, that the system began to protect the inventor's private rights.

After the formation of the intellectual property system, with the continuous development of science and technology, its fields and scope are also expanding. Although people have different opinions on the nature of intellectual property, it seems that people have basically recognized that intellectual property is private right. In this regard, Mr. Zheng Chengsi once pointed out that [5].The private right of intellectual property rights is the right that people realize that it is the right of individual human beings or their combination to the results of individual mental workers' individual or cooperative creation, or the exclusive right that people legally enjoy on the results of their intellectual creation (with technology as the core).

Even though the meaning of intellectual property is embodied by the way of defining copyright, patent right, trademark right and so on, it also reflects the nature of its private right; for example, copyright is defined as the exclusive right given to the author, art staff and publishers for their original work[6]

The patent right is defined as the exclusive right to the inventor to produce, use and sell his invention[7]

Regard trademark right as the right that trademark law gives trademark owners to prevent others from applying their trademark to their goods or services. From these individual definitions, their commonness is "exclusiveness and absoluteness". That is, without permission, no other person may engage in business or any other business activities with the above-mentioned intellectual property rights. It can be seen that the essence of intellectual property is private right, which is different from the standard public right attribute.

Specifically, there are the following differences:

First, different purposes. The purpose of promoting the use of standard technology is more focused on promoting the development of industry, while the granting of patent technology focuses on encouraging scientific and technological innovation and protecting the interests of patentee. Sometimes, the promotion of standards will inhibit the innovation activities of science and technology.

Second, the application conditions are different. Standard technology is a public technology, which has universality, no conditions for use, and can be used free of charge; while patent technology is a proprietary technology, patent right is an intellectual property right, and a monopoly If the non patentee wants to use a patented technology, he must obtain the license of the patentee and pay a certain royalty as agreed.

Third, different stages of technological development. Standard technology is mostly mature technology, and patent technology is innovative technology. Although there are many differences and conflicts between standards and patent technology in traditional concepts, although with the development of economy and technology, they have begun to combine, but the gap and formation stage between them are different.

2.2 Connection between Technical Standards and IP Rights

First, standards and intellectual property rights are open.

The basic purpose of standard formulation is to promote and apply, make the corresponding departments and fields acceptable, and make the majority of consumers know. Therefore, the basic system and content of the standard must be open. Similarly, the real value of intellectual property lies in the promotion and application. The knowledge that cannot be disseminated or the knowledge that cannot be transmitted is not entitled to property rights. In fact, standards and intellectual property rights are compatible with each other. The disclosure of standards inevitably involves the disclosure of intellectual property rights. Moreover, the possibility of technology transfer or technology license is often hidden behind standards. For example, multinational companies are interested in the standard not because of the knowledge content of the standard itself, but because of many patents or technical secrets hidden in the standard. If other enterprises do not use their technology, they cannot produce or provide products that meet the standard. They use standards to control their competitors. Through the publicity means and Strategies of "standards", once consumers agree with

their standards in the market competition, they will seize the opportunity. Anyone who wants to share a market must enter their standard system and produce according to their standards. At this time, the latter has to obtain corresponding technology and other intellectual property rights through commercial channels from the standard makers or participants[9]

It can be seen that the use of standards is bound to involve the use of intellectual property rights. The disclosure of standards is the disclosure of intellectual property rights. It can even be said that the establishment of standards serves to promote the intellectual property rights of its makers or participants.

Generally speaking, the combination of standards and intellectual property mainly includes the following situations[8]:

2.1.1 standard

the technical elements in the standard include the description of a product's performance, shape, quality regulations or other technical indicators, or the attitude, mode and quantity of a service, rather than the patent or proprietary technology itself, because the latter is a specific scheme or implementation step or measure meeting the above requirements or corresponding indicators, which is the essence of the technology.

2.1.2technology

the technical elements in the standard describe some features of products or services, and patents and know-how are effective means to realize the above features. For new technologies, in order to maintain their competitive advantage, technology owners usually do not turn their solutions into standards. They mostly extract some key indicators or parameters and turn them into the basic contents of standards. Therefore, the first two methods are commonly used for new technologies.

2.1.3 Technical elements

if the technical elements of the standard not only include the performance, shape, quality, specification, etc. of the product, but also include all the features of the technology and its implementation scheme, steps, means, etc., the technical elements of the standard constitute a complete technical scheme. At this time, the standard has been integrated with technology, and it is more accurate to call it standard technology than technical standard. However, such standards generally do not have too much high-tech content, or are already public technology, which can be used by anyone free of charge. In reality, there are almost no such standards with high technology content. Even if there are, they are also integrated with related objects of intellectual property system protection, such as DOS system, windows system, CPU technology, etc.

Second, improving the intellectual property system is the basic guarantee for the formulation and implementation of standards.

The standards established on the basis of intellectual property rights can only be legally, reasonably and effectively promoted and applied through the intellectual property rights system. That is to say, only the intellectual property rights and technologies that can be fully protected can enable the standard makers or leaders to actively formulate and implement new standards under the standards. It is impossible to imagine how standards based on unprotected intellectual property rights can be established and implemented. From the perspective of the history of standardization, its vigorous development comes from the rise and improvement of the intellectual property system. Intellectual property protection is the premise and guarantee of standard formulation and implementation, technology transfer is the internal interest driving force of standard makers, while protection is the core content of intellectual property system, and technology transfer is one of the main objectives of intellectual property system[9]

This relationship makes standards inseparable from the intellectual property system. As Mr. Sanders said: the effect of standardization can only be shown when the standard is implemented, otherwise even if it is published forcibly, if it is not implemented, it will be worthless[10] its implementation depends on whether the intellectual property owner, as a standard participant, supports and actively promotes it, which largely depends on whether its legitimate interests can be fully and effectively protected and the reality.

It can be seen that whether the intellectual property system is sound or not is the core of formulating and implementing standards.

Third, the standard is the key for enterprises to obtain market competitive advantage by using intellectual property system.

Generally speaking, the enterprises that make or have standards can't obtain monopoly market position or competitive advantage by themselves, because standards, like scales, are used to measure whether a product has met certain technical requirements or specifications, and whether it has been accepted by the market. They are generally known by many consumers, producers or providers of similar products (service products). Enterprises with new technology standards must force competitors to use their own protected intellectual property rights if they want to establish a monopoly position or market competitive advantage, that is, if the latecomers want to produce or provide products that meet the technical specifications or requirements and can be accepted by consumers, they cannot do without their intellectual property rights.

It can be said that the standard is external, but the hidden intellectual property is internal. It is the internal cause of the power of the standard. That is to say, only through the intellectual property system can the standard become a competitive weapon. Of course, only through the external rigid form of standards can

the intellectual property rights of the oblige give full play to the greatest potential of creating wealth and gaining competitive advantage, especially the "chemical reaction" that occurs when different intellectual achievements are synthesized by standards (such as patent pool, patent and know-how, and joint package or package deal between the former and copyright or trademark). Its benefits are much higher than the benefits that a single intellectual property transaction creates for standard holders. From a certain point of view, the relationship between standards and intellectual property rights is just like that between lips and teeth, and that between lips and teeth is "teeth cold". Although "teeth" still exist, their degree of profit is far less than that under the protection of "lips". In fact, transnational corporations have made good use of the close relationship between them to realize their private rights under "intellectual property" through specific public products -- standards; standards have become a powerful tool for them to realize their strategic intention of global distribution and ultra-high profits through intellectual property system, or to gain competitive advantage in the intellectual economy. New weapons[11].

Fourth, standards are a powerful driving force for the promotion of intellectual property trade and cooperation[12].

In the market, if a certain standard is widely accepted, the products of the same kind of production enterprises must meet certain technical indicators to be regarded as conforming products. If services or technology are provided, they must also

Only when certain technical indicators are met can they be regarded as meeting the standards, so that they can be accepted by consumers; and the realization of technical indicators

None of them relies on specific technologies, i.e. the technologies involved in the standard formulation scheme. Once the standard is established

After that, the intellectual property rights under the standard will go to the market with the promotion of the standard, which forces the competitors in the same industry who fail to establish the standard to follow the standard. Otherwise, they can't make another set of things compatible with the system equipment under the standard, or they can't be accepted by the market, which is the fundamental reason that many enterprises try to launch their own standards or participate in the standard formulation. As mentioned before, if we want to meet the requirements of bench marking, we must use the technology-based intellectual property under the standard, so that intellectual property transfer, licensing, etc. will appear on a large scale. When an intellectual property owner wants to obtain benefits through licensing, he must hope to have more licensees.[13]

And standards offer them that opportunity. When a standard consists of intellectual property rights of many intellectual property owners, all members participating in the standard formulation must obtain the license authorization of one of the technical rights holders, so that the transactions between them also occur, and the interrelationship between technologies will certainly expand the scope of the license. In reality, franchising and licensing processing are distributed around the world.

Fifth, standardization is conducive to the improvement and development of intellectual property system[14]

As the impact of standards is closely related to the intellectual property system, and standards are based on intellectual property, and intellectual property system is the premise of the establishment and implementation of standards, therefore, the improvement or perfection of intellectual property system is directly related to the interests of standard holders.

Technical standards are supported by a technical system, in which the core technologies are mostly technologies that are protected by law in the form of patents; technology monopoly is mainly realized through patent protection, and standards organizations include patented technologies into the standard system through the establishment of technical standards; the adoption of a technical standard requires the adoption of the patents involved in the standard, so the implementation standard is actually to Use the relevant technology involved in the standard. This is the binding effect of standards and patents. Technology owners successfully package their own "private rights" into "public rights" by hitchhiking their own patented technologies to maximize their economic benefits. For this reason, the technical right holders in the standard will pay high attention to any deficiency or defect of the relevant intellectual property system for the consideration of interests.

Once there is a dispute or problem caused by inadequate protection, they will urge and require the relevant institutions to plug the legal loopholes in time and complete the relevant systems to protect their own rights and interests. The relationship between standards and intellectual property rights is a complementary exterior interior relationship. The perfect combination of the two will have a positive impact. Standards can guide, encourage or regulate the behavior of intellectual property owners to maximize their interests, promote the circulation and diffusion of intellectual property rights, promote cooperation between intellectual property owners, promote the improvement of intellectual property systems, and promote technological progress. Step, improve the quality of human life. At the same time, intellectual property is the basis of the formation of standards, and its system is the premise of the establishment and implementation of standards; the rapid development of intellectual property with technology as the core will promote the development of standards, and the improvement of its system will

make standards further play a role. But at present, both standards and intellectual property system are more conducive to the advantages and interests of all people. How to balance the interests between standards and the owners and users of intellectual property is a problem that human beings need to solve.

3. PRACTICAL VALUE OF STANDARDIZATION

With the rapid development of the globalization of science and technology economy and the industrialization of high and new technology, the integration between technical standards and intellectual property rights is increasingly close. At present, there is a very obvious trend in the world, that is, more and more countries, governments and multinational enterprises use the high-tech standardization to affect the whole industry competing with it. In particular, some developed countries in Europe and the United States formulate technical standards for some products and monopolize core technologies to determine their own voice in global commodity trade, which to a certain extent also increases the cost for developing countries to acquire corresponding technologies. For example, from March 1, 2007, according to the regulations of the Federal Communications Commission (FCC), the TV exported to the U.S. market must be digital TV, and the TV over 13 inches must meet the technical specifications of the ATSC standard. As one of the supporting measures of ATSC standard, there are patents to protect the modulation and demodulation, signal compilation, digital interface and so on. In order to meet the ATSC standard, the export products must obtain license and pay royalties for the patents involved. In order to meet the ATSC standard, Chinese color TV enterprises export digital TV to the United States, each of which has to pay a cumulative patent license fee of 20-30 US dollars to Thomson, Sony, LG and other multinational enterprises.[15]

Therefore, with the rapid development of knowledge economy, the standardization of intellectual property rights has become a global competition.

The important means of competition and the important chips for enterprises to seize the commanding heights of future development and enhance their core competitiveness. In a word, the right to formulate standards is in the hands of the person whose technology will become the dominant standard and the person who will control the market initiative. Moreover, with the development of science and technology and the acceleration of trade liberalization, international economic competition has shifted from the traditional pure dependence on capital, equipment, cheap labor and raw materials to the competition of high and new technology, and the combination of core technology and standards, so as to grasp the commanding height of global competition, which is also the highest form of scientific and technological competition at this stage. As some scholars have said, third-class enterprises sell coolie, second-class enterprises sell products, first-class enterprises sell patents, and super first-class enterprises sell standards[16]

It can be seen that standardization plays an important role in the competition of modern enterprises. In order to grasp the initiative and the right to win in the global economic competition, many countries have set up various technical trade measures with high and new technology as the leader and standards as the basis, combined with the corresponding technical regulations and the assessment procedures of market access, and regard the competition and control of global technical standards as the international economic and technological competition. The core strategy. We should make full use of technology, especially the combination of patented technology and standards, and establish strict conditions for market access, so as to establish the right to speak in the international economic competition.

Because almost all the high-tech standards of our country are in the hands of the western developed countries, they are influenced by him.

Our restriction and control have seriously affected our high-tech products entering the market of western countries. For example, Fujitsu's patent applications in China are mainly invention patents, 97.3% of which are owned by Japan's headquarters, and are mainly distributed in the main fields of integrated circuit, communication, flat panel display, storage, automotive electronics, etc. Especially in recent years, aiming at the development of China's automobile industry, the company has accelerated the layout of relevant technologies in the field of automobile electronics.

In intelligent transportation, vehicle electronics, body control, automotive semiconductor devices, sensors, CAD computer aided

There are invention patents in the field of assistant design. However, in China's automobile industry, especially in the automotive electronics industry, the number of applications for invention patents is far from it. For example, in the development of 3G mobile phone license (TD-CDMA standard) in China, as early as August 2018, Qualcomm has applied for 1609 patents in China, including 526 applications in part H (involving mobile communication related fields), accounting for 82.6% of all patents. In China's TD-CDMA standard, several key technology areas, such as power control part, soft switching technology and so on, are bound to involve Qualcomm's patents. If these patents can not be licensed by the oblige, then the standards formulated are empty and can not be implemented. Even with the permission of the oblige, the executor and user of relevant standards shall pay royalties to the oblige. [17]

Therefore, technology standardization has become a new trade barrier for international economy and technology after tariff and quota barriers. Mr. Feng

Xiaoqing once pointed out that under the background of economic globalization and trade liberalization, it is an increasingly important strategy for developed countries to establish their own technical standards with patent technology as the backing. With the development of high and new technology, the demand for international standards is also growing. The internationalization of standards has become an important international trend, and patents have become a means of technical barriers to trade in the form of standards. At the same time, technical standards have a direct relationship with the development of specific industries. They usually correspond to the technical routes and technical communities of an industry, and have a final decisive role in the development direction of enterprise products. This particular makes it have an extraordinary ability to control and influence the market, and become a barrier and attack for market access, and a killer for crowding out other competitors.[18]

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Discussion on the Current Situation and Countermeasures of Feed Enterprise Logistics under the Mode of Supply Chain Management

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Abstract: with the rapid development of social economy and the continuous improvement of people's living standards, all industries in China have been well developed. Among them, as an important part of social economy, feed industry plays a positive role in promoting the development of industry and agriculture, which makes feed enterprises springing up. With the continuous expansion of feed production and sales scale, higher requirements are put forward for feed enterprise logistics. How to effectively reduce feed transportation costs and improve the economic benefits of the enterprise has become a key research topic for feed enterprises. Based on this, this paper analyzes the current situation of feed enterprise logistics under the mode of supply chain management, and puts forward corresponding solutions, hoping to provide reference for the sustainable development of feed enterprises.
Keywords: supply chain management; feed enterprises; logistics status; Solutions

1. INTRODUCTION

In the current development process of animal husbandry, feed enterprises play an important role, effectively promoting the development of rural economy. The main work of feed enterprises is to produce feed, and carry out processing, storage, transportation and sales activities related to feed. It is an enterprise chain organization closely connected with the market mechanism. At present, the animal husbandry is actively changing, the traditional animal husbandry is changing to the modern animal husbandry, the 13th five year plan also put forward the development goals and directions for animal husbandry, and in this process, feed enterprises play an important role. As the key point of feed enterprise cost, logistics cost needs to change the traditional working concept and innovate the management mode in time, so as to take effective measures to reduce the logistics cost, realize the modern logistics approach, and promote the stable development of animal husbandry while improving the economic benefits of the enterprise itself.

2. SUPPLY CHAIN MANAGEMENT

With the rapid development of social science and technology, the supply chain has developed from individual to collective. The supply chain includes many links, such as suppliers, manufacturers, retailers, etc., which effectively strengthen the interaction and communication between each link, better realize the complementary advantages, and optimize the operation of production and operation. Under the background of current economic globalization, every enterprise can be regarded as a basic link in the supply chain. Through the integrated management idea, the finished supply chain is finally formed. With the support of information technology, the whole supply system is continuously optimized, which accelerates the transmission and sharing of information and improves the control of cost [1]. The logistics cost and user service level of feed enterprises have always been the focus of supply management. In order to effectively achieve the balance between them, it is necessary to closely link the departments involved in the whole supply chain and give full play to the overall strength. At the same time, in the supply chain management, we should give full play to the role of information technology, so that the supply chain management can be modernized and informationized, so as to effectively improve the efficiency of work, realize the control of cost, and then improve its market competitiveness.

3. LOGISTICS DEVELOPMENT STATUS OF FEED ENTERPRISES

3.1 The Logistics Development of Feed Enterprises Lags Behind

The logistics development time of feed enterprises in China is relatively short, and there is still a large gap between China and developed countries. Some feed enterprises still use traditional ideas and models to carry out logistics business, which undoubtedly improves the cost of logistics transportation. At the same time, the service that feed enterprises can provide in logistics is also very limited. Some small-scale enterprises are difficult to provide complete storage, training and transportation, which seriously affects the efficiency and service quality of logistics [2]. In addition, part of the rural economy in China is relatively backward, and the income of farmers is not high, so the demand for logistics business of feed enterprises is low.

3.2 Lack of Logistics Base, Facilities and Information Technology

At present, feed enterprises in China still have the problems of backward logistics bases, facilities and related technologies. The main reason for such

problems lies in the lack of reasonable planning and management of logistics parks in China, and the lack of attention to the update of related information technology. Due to the influence of ideas and investment funds and other factors, many feed enterprises lack of investment in infrastructure construction, still use the traditional business management mode, lack of mechanized operation, which seriously affects the efficiency of feed enterprise logistics, and can not meet the needs of customers. Due to the lack of application of information technology, information can not be shared in time, which hinders the communication between enterprises and customers. At the same time, feed enterprise logistics pays too much attention to basic business and other value-added business, so it is difficult to form an effective logistics supply chain.

3.3 Lack of Comprehensive Ability of Logistics Talents

Human is the executor of various activities, and it is no exception in logistics activities. High quality talents are the innate conditions to ensure the quality of logistics work in feed enterprises. However, in terms of the actual situation, most of the feed enterprises are lack of professional logistics talents, and their professional ability and comprehensive quality are relatively poor, so they are not competent for the logistics work effectively, which affects the efficiency of the work [3]. The logistics personnel of some feed enterprises are not fresh graduates, lack of rich logistics experience, or originally do other work, lack of professional basic knowledge. Such a lack of professionals is easy to appear in the work of various conditions, can not effectively meet the needs of customers, is not conducive to the development of feed enterprise logistics.

3.4 Feed Enterprise Logistics Provides Limited Service Functions

In the supply chain management mode, it effectively improves the service level of enterprises and reduces the cost input. In the current era, the logistics service of feed enterprises should be diversified, so as to meet the trend of social development. But the actual situation is not so, some feed enterprises are very single in the logistics service function, and can not provide rich services, thus limiting their competitiveness.

4. COUNTERMEASURES TO SOLVE THE PROBLEMS IN THE LOGISTICS OF FEED ENTERPRISES

4.1 Vigorously Develop the Third Party Logistics

Feed enterprises need to strengthen the application of information technology and add consulting services, so as to achieve the expected goal on the basis of the original third-party logistics. The logistics business environment has a great impact on the development of logistics enterprises, which requires the government to strengthen the regulation of the logistics business environment, reduce or eliminate multi management and local protectionism, and improve the openness and transparency of the logistics industry [4]. At the same time, feed enterprises need to strengthen the input of third-party logistics, flexible application of information technology, to promote the formation of large-scale development of logistics.

4.2 Strengthen Logistics Information Technology Support Capacity and Platform Information Construction

In order to achieve better development of feed enterprise logistics, it is necessary to keep pace with the development of the times, fully integrate modern information technology, strengthen the construction of information platform, and further strengthen the service scope of feed enterprise. Feed enterprise logistics also needs to strengthen the integration with e-commerce and modern logistics industry, effectively integrate all aspects of resources, establish a perfect public information platform, and enhance the core competitiveness of the fourth party logistics. In addition, under the supply chain management, feed enterprise logistics needs to make logistics plans according to the needs of customers, so as to improve its planning and design ability.

4.3 pay attention to the construction of feed enterprise logistics system

Perfect logistics system is the necessary condition to guarantee the quality and efficiency of feed enterprise logistics. Therefore, feed enterprises need to strengthen the combination of the third party logistics and the fourth party logistics, form a good strategic relationship, and then form a complete logistics system to achieve common development. The fourth party logistics can effectively provide technical and resource support, while the third party logistics can provide good service support for the fourth party logistics. Through the formation of dynamic strategic alliance, risk and profit sharing can be realized, so as to play the role of supply chain management and improve the market competitiveness of the fourth party logistics [5].

4.4 Accelerate the Training of Comprehensive Logistics Talents

In view of the lack of talents, feed enterprises need to strengthen the construction of high-quality talents. First of all, in the selection of talents, the relevant personnel are required not only to have solid theoretical knowledge, but also to have strong operation ability. Feed enterprises can strengthen the cooperation between schools and enterprises with relevant colleges and universities, so as to provide good practice opportunities for students and improve their practical operation ability. Secondly, strengthen the training of on-the-job personnel, regularly organize staff to carry out training and learning, guide employees to plan their own career, so as to improve the comprehensive quality of employees with the times.

5. CONCLUSION

In a word, feed enterprises play an important role in the development of China's social economy. At present, there are various problems to be solved in the logistics work of feed enterprises, which limit the sustainable development of feed enterprises. In this regard, feed enterprises need to update their ideas in time, take effective measures to improve the efficiency of work, and then reduce their own cost input, and ensure their own economic benefits.

ACKNOWLEDGEMENTS
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Research on Price Forecasting Method Based on Multi Intelligent Algorithm Combination

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Abstract: according to the historical price data, we classify the price according to the season, and choose the appropriate algorithm to establish the classification prediction model of the price. Select appropriate algorithm, such as average method, regression fitting method, weight combination method, nonlinear intelligent algorithm fitting or EMD decomposition method to combine multiple results, establish a reasonable index system, and compare, analyze and verify the quality of the model.
Keywords: season classification; EMD decomposition method; genetic algorithm

1. PRICE COMBINATION FORECASTING METHOD

1.1 Time Series Method

Autoregressive AR model. The formula is:

$$Y_t = \varphi_1 Y_{t-1} + \varphi_2 Y_{t-2} + \cdots + \varphi_p Y_{t-p} + e_t \quad (1)$$

Moving average MA model. The moving average model includes moving average method and exponential smoothing method.[1]

Autoregressive moving average ARMA model. The formula is:

$$Y_t - \varphi_1 Y_{t-1} - \varphi_2 Y_{t-2} - \cdots - \varphi_p Y_{t-p} = e_t - \theta_1 e_{t-1} - \theta_2 e_{t-2} - \cdots - \theta_q e_{t-q} \quad (2)$$

Table 1 Time series method

Model	AR(p)	MA(q)	ARMA(p，q)
Autocorrelation coefficient	Tailing, exponential decay	Q-order backward truncation	Tailing, exponential decay
Partial autocorrelation coefficient	Backward truncation of lag p-order	Tailing, exponential decay	Tailing, exponential decay

1.2 Neural Network Method

Neural network algorithm is one of the most widely studied prediction algorithms to solve nonlinear problems. The artificial neural network is processed by many neural units in parallel. There is a functional relationship between input and output:

$$Y_j = f\left[\sum_{i=1}^{n} W_{ji} x_i - \theta_j\right] \quad (3)$$

Generally, any linear continuous function can be used as the excitation function. The results show that it is a widely used activation function because of its smoothness and easy derivation. [2]Its expression is:

$$f(x) = \frac{1}{1+\exp(-x)} \quad (4)$$

After derivation

$$f'(x) = \frac{1+\exp(x)}{[1+\exp(-x)]^2} = f(x)[1-f(x)] \quad (5)$$

The value range is between 0 and 1, and its curve shape is S-shaped.

Firstly, the input data is normalized in order to reduce the dimension difference between the predicted data and the actual data and reduce the quantity level difference between the input and output. [3]There are two methods of data normalization: to find the average and variance of the sequence, the formula is:

$$x_k = (x_k - x_{mean}) / x_{Var} \quad (6)$$

The maximum and minimum values of the sequence are calculated. The formula is as follows:

$$x_k = (x_k - x_{\min}) / (x_{\max} - x_{\min}) \quad (7)$$

In the formula, the minimum value, maximum value, mean value and variance of the sequence are respectively represented.The standard deviation normalization method is adopted, the average value of data is 0, and the sequence variance is 1.[4] The expression is:

$$x^* = \frac{x-\mu}{\sigma} \quad (8)$$

Secondly, the number of input layer output layer and hidden layer is selected. Select 24, and select the reference formula for the number of hidden layers:

$$\begin{aligned} l &\prec n-1 \\ l &\prec \sqrt{(m+n)} + a \\ l &= \log_2 n \end{aligned} \quad (9)$$

N. M is the number of input layer and output layer respectively, a is a positive real number within 10; 3

is selected for hidden layer; and 1 is selected for output layer.[5]Their structure is as follows:

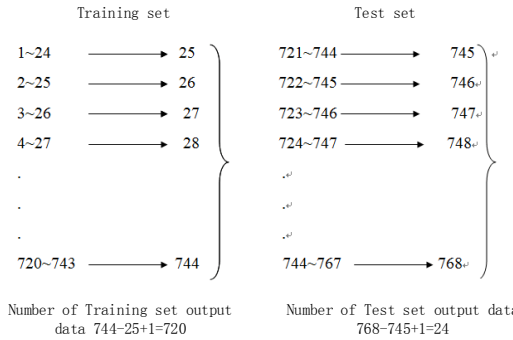

Figure 1 Construction of training set and test set

1.3 Support Vector Machine Method

K is the corresponding kernel function type. Generally, the default is radial basis kernel function (RBF). The expression of the function is:, its prediction schematic is as follows:

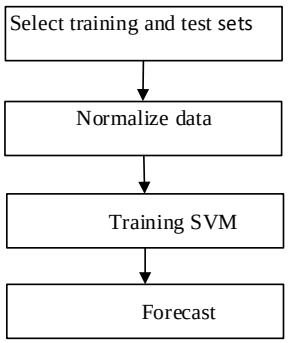

Figure 2 Prediction principle of support vector machine

1.4 Combination Forecast Method

Firstly, EMD is used to decompose the target sequence, and nine sub items with different frequencies are obtained. Then, neural network method is used for the high frequency term, SVM method is used for the middle three frequency terms, and time series method is used for the low frequency term.

1.5 Error Index

Mean absolute percent error, defined as:

$$\sigma_{MAPE} = \frac{\frac{1}{N}\sum_{i=1}^{N}|P_i - P_i'|}{\overline{P}} \quad (10)$$

Mean absolute error is defined as:

$$\sigma_{MAE} = \frac{1}{N}\sum_{i=1}^{N}|P_i - P_i'| \quad (11)$$

2. EXAMPLE ANALYSIS AND SIMULATION RESULTS

Based on the price history data of the U.S. electricity market from January 1 to January 30, 2014, the 24-hour price of the next day is predicted. The historical price curve of the U.S. electricity market in January is as follows, and the price unit is $/ MW. H.

2.1 Time Series Method

In MATLAB, autocorrelation function autocorr() and partial autocorrelation function parcor() are selected to draw the autocorrelation function and partial autocorrelation function in the first 30 days of spring as follows:

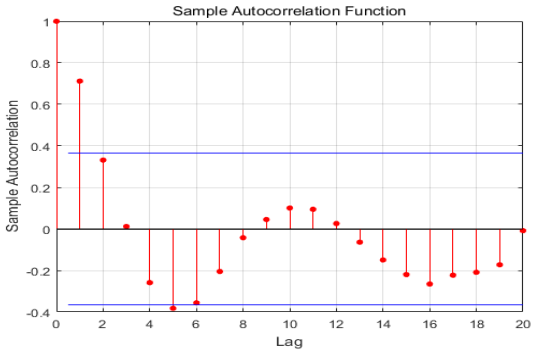

Figure 3 Autocorrelation function of the first 30 days of spring

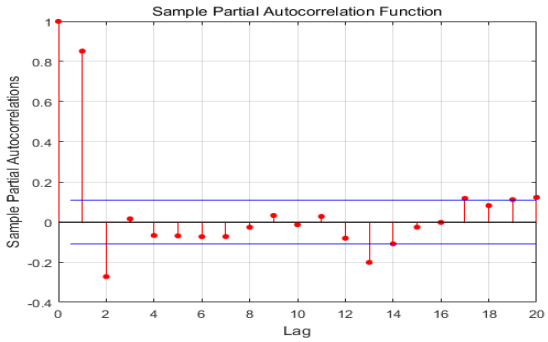

Figure 4 Partial autocorrelation function in the first 30 days of spring

The order of ARIMA (P, D, q) can be determined. Q = 2, P = 3, the sequence becomes stable after the first-order difference, so d = 1. Determine whether the ACF function decays rapidly. If the function does not decays rapidly to zero, it is a low-order process. In the low-order process, q = 1 or 0. Finally, ARIMA (3,1,2) was chosen as the prediction model for spring.

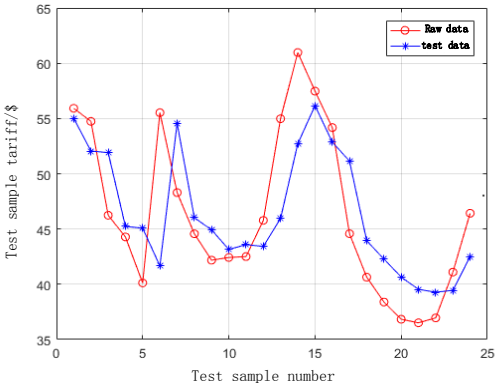

Figure 5 Forecasting 24-hour price in spring with ARIMA model

2.2 Neural Network Method

Firstly, the data of electricity price is normalized by the network method, and the data is mapped to the [0,1] interval. The matlab function mapminmax is used, and the normalized information is reflected in the structure.

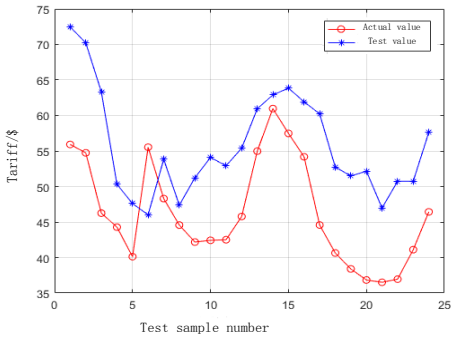

Figure 6 Prediction of 24-hour price in spring by neural network method

2.3 Support Vector Machine Method

Different from neural network, the normalized data should be transposed to meet the requirements of libsvm toolbox. Use the functions svmtrain and svmpredict in MATLAB to train the network. The higher its value is, the more intolerable the error is. The larger the selection of C is, the greater the penalty for error cases is, which may lead to over fitting of the model. C can generally be selected as: 10 ^ t, t = - 4 to 4, that is, 0.0001 to 10000, best C = 0.25. Gamma is a parameter brought in the function after selecting radial basis function as kernel Number, which implicitly indicates the feature distribution after the data is mapped to a new space. The default value is the reciprocal of attribute K.

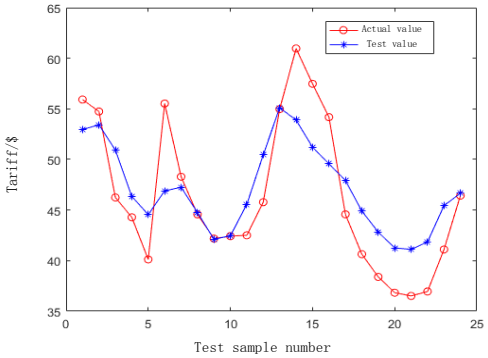

Figure 7 Prediction of 24-hour price in spring by support vector machine

2.4 Combined Forecasting Method

After EMD decomposition, the sequence becomes nine components of different frequencies; for the three components of high frequency, neural network method is used; for the three components of intermediate frequency, SVM is used for processing; because time series is suitable for relatively smooth data, and for the three components of low frequency, time series method is used for prediction.

The electricity price of March 1 is forecasted by SVM, time series method and support vector machine. The chart is as follows:

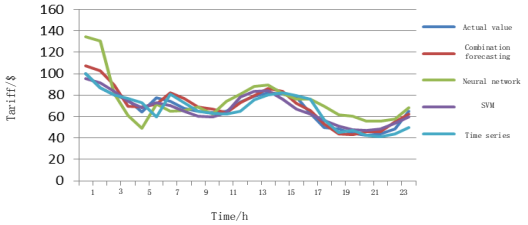

Figure 8 Comparison between the results predicted by various prediction methods on March 1 and the real values

3. CONCLUDING REMARKS

For electricity price forecasting, this paper uses three basic methods: time series method, neural network method and support vector machine to forecast electricity price. The combined forecasting method first decomposes the electricity price through EMD, decomposes different frequencies, then adopts different methods, and then superimposes different components and remainder to get the final forecasting results.

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Motion Continuity Conditions of Globoidal Cam Planetary Deceleration Mechanism

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Abstract: The meshing characteristics of the globoidal cam planetary deceleration Mechanism are further studied, and the relationship between the continuity of motion and the number of tooth engagement is analyzed. The relationship between the number of planetary wheels and the number of teeth of rolling elements on planetary wheels and the structural parameters such as toroidal warp angle and worm warp angle is deduced under the condition of continuous motion. The correctness of the relationship is verified by motion simulation, which provides a theoretical basis for the design and optimization of toroidal drive.
Keywords: Globoidal Cam; warp angle; Motion continuity

1. INTRODUCTION

A globoidal cam planetary deceleration mechanism is also called as a toroidal drive in many studies. In view of the advantages of the globoidal cam planetary deceleration mechanism, such as small size, high transmission efficiency and large carrying capacity, many scholars at home and abroad have extensively investigated its engagement principle, manufacturing and carrying capacity. For instance, Peeken et al. [1] have gradually completed their research on structural design, load distribution calculation and stator pitting of this transmission form since 1980. In China, Xu Lizhong [2] made a deep research on engagement theory, load and stress distribution, friction and lubrication and mechatronics integrated supertoroidal transmission after structure improvement. Besides, Yao Ligang, Zhang Chunli, Tan Yuanqiang and Liu Beibei [3-6] also researched into transmission efficiency, structure improvement and optimization design, processing methods of key components, fluctuation of transmission torque and modeling methods.However, there is less research on the angle of the outer globoidal cam that can wrap planetary gears and the angle of the inner globoidal cam that can wrap planetary gears. This makes it highly blind to choose the parameters of the inner and outer globoidal cam wrap angles in the design of the mechanism.

According to the incomplete statistics of published literature, the parameters of the inner and outer globoidal cam are mostly between 80° and 140°. The transmission ability of the globoidal cam planetary deceleration mechanism is related to the number of meshing teeth on the planetary gear. The number of meshing teeth on the planetary gear is not only related to the number of planetary gears, but also related to the enveloping angle of the inner and outer globoidal cams which are meshed at the same time. Because the engagement principle of this transmission mechanism is essentially the engagement principle of globoidal cam, this paper will start from the perspective of globoidal cam. Based on the existing research results, the author will further explore the transmission principle of the mechanism, and will analyse the relationship between the inner and outer globoidal cam wrap angles and the structural parameters.

2. TRANSMISSION ANALYSIS

As shown in Figure 1, the globoidal cam planetary deceleration mechanism is mainly composed of four parts: the outer globoidal cam, the inner globoidal cam, the planetary wheel (rolling body) and the planet carrier. It is a complex spatial meshing transmission mechanism.

As an original motive part, the outer globoidal cam is similar to a central worm and externally engages with planetary gears. In order to obtain better deceleration transmission effect, the number of heads of the outer globoidal cam is set as z_1, generally $z_1 = 1$, and the spiral angle of the throat calculation circle is set as λ, and the wrap angle of the outer globoidal cam is set as α_1(Figure 2). The inner globoidal cam is engaged with the planetary gear, and the number of teeth on the gear is set as z_2, the helix angle of the throat calculation circle is set as β, and the wrap angle of the internal arc cam is set as α_2(Figure 2). In principle, the number of teeth z_2 on the inner globoidal cam is as large as possible under the condition of satisfying the parameter requirements and non-interference. The planetary gear is meshed with the inner and outer globoidal cams at the same time, which is the transmission component of the mechanism power. The number of the planetary gears is set as m. And the planetary gears are arranged to evenly distribu te around the axis of the outer globoidal cams. Each planetary gear has z rolling bodies which evenly distributed around the center of the planetary gear. The rotation motion is input by the outer globoidal cam, which drives the planet gear fixed on the planet carrier to rotate. When the inner globoidal cam is fixed, the planet carrier rotates through the engagement of the spiral groove on the inner globoidal cam and the planet gear, so as to realize the output of the motion. The relationship between parameters involved in the globoidal cam planetary deceleration mechanism could be known from

reference [9].

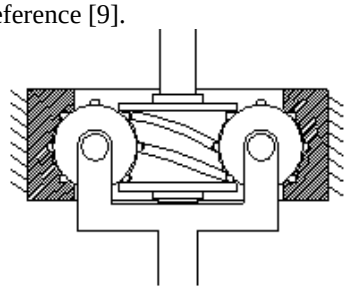

Figure 1 Globoidal cam planetary deceleration mechanism

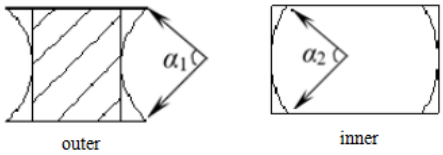

Figure 2 Outer and inner globoidal cam wrap angle

2.1 Transmission Ratio

When the inner globoidal cam was fixed, the outer globoidal cam was used as the input component while the planetary carrier was adopted as the output component. Consequently, the transmission ratio could be written as:

$$i_{1H} = 1 \pm \frac{z_2}{z_1}$$

In the above formula: ± denoted that when the spiral directions of the inner and outer globoidal cams were the same, it was positive; otherwise, it was negative.

2.2 Proper Engagement Conditions

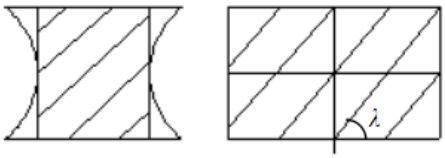

Figure 3 Unfolded diagram of an outer globoidal cam

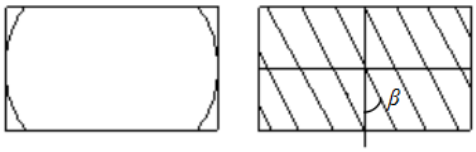

Figure 4 Unfolded diagram of an inner globoidal cam

Figure 3 presented the cylindrical unfolded diagram of the outer globoidal cam with the diameter calculated from the throat, and Figure 4 showed the cylindrical unfolded diagram of the inner globoidal cam with the diameter calculated from the throat. The proper engagement condition equation of the globoidal cam planetary deceleration mechanism was as follows:

$$z_2 \tan\beta = \frac{z_1}{\tan\lambda} + 2z$$

2.3 Assembly Conditions

In the set mechanism parameters, the number of the planetary gears and the tooth number of inner and outer globoidal cams had to meet the assembly conditions, and ensuring that the arbor did not interfere in the machining of shaft holes of planetary gears. The assembly relationship was shown in Figure 5.

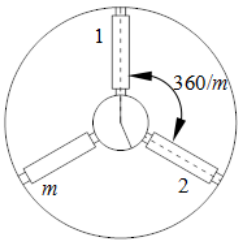

Figure 5 Diagram of assembly relationship

$$m = (z_1 \pm z_2)\frac{1}{N}$$

In the above formula: N was a positive integer; m>0 meant that the spiral directions of the inner and outer globoidal cams was the same, whereas m < 0 meant the opposite. In the existing design of globoidal cam planetary deceleration mechanism, the principles for the selection of the two basic parameters, namely the outer globoidal cam wrap angle α_1 and the inner globoidal cam wrap angle α_2, have not been involved in the determination of required basic parameters. Therefore, in the above relations, this paper deduced the minimum parameters of the outer globoidal cam wrap angle α_1 and the inner globoidal cam wrap angle α_2 with continuous transmission ensured at the same time.

3. RELATIONSHIP BETWEEN INNER AND OUTER GLOBOIDAL CAM WRAP ANGLES AND TRANSMISSION CONTINUITY

3.1 Phase Difference Between Two Adjacent Planetary Gear Teeth

There were m planetary gears uniformly distributed around the central axis of the outer globoidal cam, and there were z rolling elements uniformly distributed on each planetary gear. Then the phase difference between the same tooth of the i planetary gear and the i+1 planetary gear was (i=1, 2, 3…, i+1≤m):

The transmission ratio of a planetary gear to the outer globoidal cam was: $i_1^{\mathrm{H}} = \frac{z}{z_1}$

Then: $\frac{\varphi_1 - \varphi_{\mathrm{H}}}{\varphi^{\mathrm{H}}} = \frac{z}{z_1}$

In the above formula, φ_{H} referred to the angular displacement of the planetary carrier, and $\varphi_{\mathrm{H}} = \frac{2\pi}{m}$; φ_1 referred to the angular displacement of the outer globoidal cam, and $\varphi_1 = [1 - (\pm\frac{z_2}{z_1})]\varphi_{\mathrm{H}}$; and φ^{H} referred to the rotation angle of the same rolling element on a planetary gear relative to the planetary carrier.

After reorganization: $\varphi_1^{\mathrm{H}} = -(\pm\frac{z_2}{z})]\frac{2\pi}{m}$, A modified formula for assembly conditions: $N = \frac{z_1}{m} \pm \frac{z_2}{m}$.

According to the above conditions, generally z_1=1 because of the pursuit of large transmission ratio. To satisfy the above phase angle relationship and the requirement of N as an integer, $\frac{z_2}{m}, \frac{2z_2}{m}, \frac{3z_2}{m}, \ldots, \frac{(\mathrm{m}-1)\ z_2}{m}$ could not be integers. Therefore, the following conclusions were drawn:

(1) After m uniformly distributed planetary gears were superimposed along the circumference, the rolling elements on all planetary gears would not coincide and would be distributed at the nodes of $\frac{2\pi}{mz}$.

(2) After m uniformly distributed planetary gears were superimposed along the circumference, the rolling elements in the arc section of $\frac{2\pi}{z}$ belonged to different planetary gears, and the order of rolling elements in each arc section of $\frac{2\pi}{z}$ remained the same.

As shown in Figure 6, planetary gears with m=3 and z=6 were selected as an example. The distribution of rolling elements on planetary gears after superposition along the circumference was shown in Figure 7 (Note: Blue represented planetary gear 1, red represented planetary gear 2, and green represented planetary gear 3).

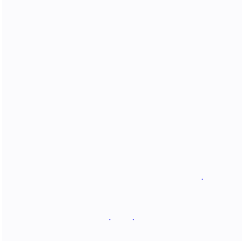

Figure 6 Diagram of a planetary gear

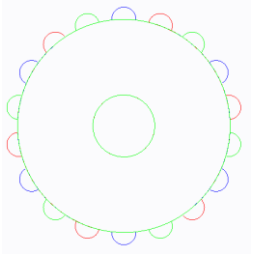

Figure 7 Distribution diagram of rolling elements

3.2 Conditions for Continuous Transmission

To make the mechanism move continuously, the inner globoidal cam should engage with at least one rolling element on each of i planetary gears, and the outer globoidal cam should engage with at least one rolling element on each of remaining $(m-i)$ planetary gears at the same time.

3.3 Minimum Values Of Outer Globoidal Cam Wrap *angle* α_1 *and inner globoidal cam wrap angle* α_2

In order to satisfy the above conditions, the minimum number of rolling elements on the planetary gear was fixed at 2. In other words, z was a positive integer and $z \geq 2$. Moreover, the number of planetary gears m was also a positive integer.

(1) When m=1, the situation became complex. At this time, the only planetary gear should have rolling elements engaging with both the inner and outer globoidal cams. So the relationship between worm wrap angle α_1 and supertoroidal wrap angle α_2 was as follows:

$$\alpha_{1\min} = \alpha_{2\min} = \frac{2\pi}{z}$$

This situation could only exist in theory. But in actual structure, the existence of only one planetary gear would lead to serious eccentric load. Reasonably, this situation would not be considered in actual design.

(2) When m=2, there should be a rolling element on the same planetary gear that would either engage with the outer globoidal cam or with the inner globoidal cam. So the relationship between the inner and outer globoidal cam wrap angles was as follows:

$$(\alpha_1 + \alpha_2)_{\min} \geq \frac{2\pi}{z}, \quad \text{and} \quad \alpha_{1\min} \geq \frac{2\pi}{mz},\ \alpha_{2\min} \geq \frac{2\pi}{mz}.$$

At this moment, if the values of the inner and outer globoidal cam wrap angles were both minimal, there were two points involved in engagement in this transmission mechanism, with one rolling element on one planetary gear engaging with the outer globoidal cam, and another rolling element on the other planetary gear engaging with the inner globoidal cam. In other words, if the transmission was continuous, at least two points on all planetary gears should be involved in the engagement, with one point engaging with the inner globoidal cam and the other point engaging with the outer globoidal cam.

4. SIMULATION RESULTS AND ANALYSIS

According to the above analysis and based on the spatial engagement and assembly relationship, the structural parameters of the globoidal cam planetary deceleration mechanism were selected and simulated. The basic structural parameters were listed in Table 1.

Table 1 Table of basic structural parameters

Name & Symbol	Value
centre distance a (mm)	45
number of rolling elements on the planetary gear z	6
number of planetary gears m	5
tooth number of an outer globoidal cam z_1	1
tooth number of an inner globoidal cam z_2	36
calculated radius of a planetary gear R (mm)	24

It is known that the number of planetary gears of the

mechanism should meet the assembly conditions. There are two situations, when N=35, m=1. And when N=35, m=1. Theoretically, the mechanism can install one or five planetary gears. (1) When m=1,in the case that other conditions are meet, the parameter of the wrap angle of the outer and inner globoidal cams is taken as: $\alpha_{1\min} = \alpha_{2\min} = 60°$. The model is shown in Figure 8. (2) When m=5,in the case that other conditions are meet, the parameter of the wrap angle of the outer and inner globoidal cams is taken as: $(\alpha_1 + \alpha_2)_{\min} = 60°$, and $\alpha_{1\min} \geq 12°$, $\alpha_{2\min} \geq 12°$. Taking 6°as the angle change increment, the minimum value of the outer and inner arc cam envelope angle can be taken as shown in Table 2 below:

Table 2 Outer and inner cambered cam wrap angle value

$(\alpha_1+\alpha_2)_{\min}$	α_1	α_2
60°	12°	48°
	18°	42°
	24°	36°
	30°	30°
	36°	24°
	42°	18°
	48°	12°

Because of the manufacturing of the inner globoidal cam is a technical difficulty in the transmission mechanism, the wrap angle of the inner globoidal cam should be reduced as much as possible to facilitate the manufacturing. Therefore, on the basis of meeting other conditions, the critical value of the enveloping angle of the outer and inner globoidal cam is selected as α_1 =48°and α_2=12°respectively (Figure 9) .

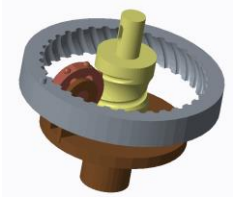

Figure 8 Schematic diagram of mechanism model (α_2=60°)

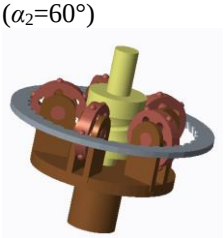

Figure 9 Schematic diagram of mechanism model (α_2=12°)

The motion analysis of the two models is carried out. The inner globoidal cam is fixed, and the outer globoidal cam is added with a drive to make it move around the axis in a circle with an angular velocity of 72deg / sec. The time that can make the planet carrier rotate for more than half a circle is given, 100s. The angular velocities of the planet gear and the planet carrier are shown in Figure 10 and Figure 11 respectively. That is to say, when the given motion parameters are constant, changing the wrap angle of the outer and inner globoidal cam can make the motion continuous, and the motion transmission ratio meets the conditions. The angular velocity of the planet wheel is 12deg / sec, and the angular velocity of the planet carrier is 2deg / sec.

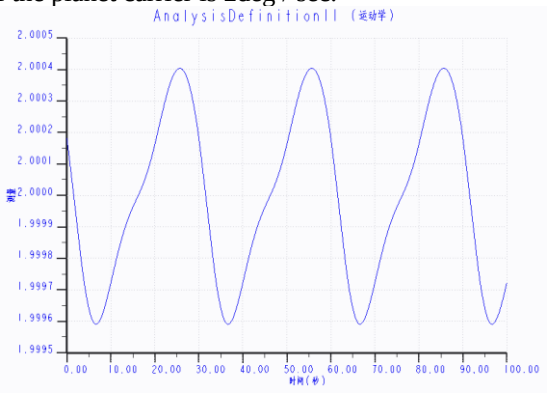

Figure 10 Angular velocity of planet gear (α_2=60°and α_2=12°)

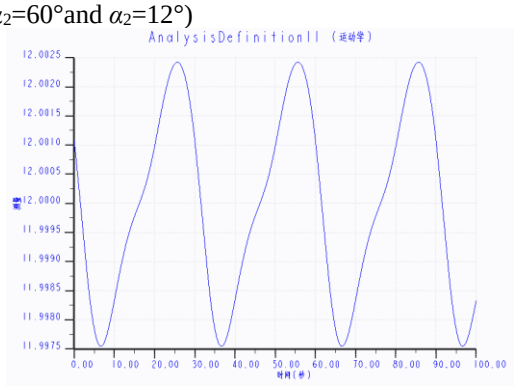

Figure 11 Angular velocity of planet carrier (α_2=60°and α_2=12°)

5. CONCLUSIONS

The motion continuity conditions and the conclusions are as follows:

(1) When the number of rolling elements on the planetary gear z was fixed, the minimum sum of the inner and outer globoidal cam wrap angles was also fixed and would not decrease with increasing number of planetary gears m. And the possible minimum values of the inner and outer globoidal cam wrap angles respectively would decrease with increasing number of planetary gears m.

(2) When the values of the inner and outer globoidal cam wrap angles were the smallest, the number of engaging point was increased with the increasing number of planetary gears.

(3) When the number of planetary gears m and the number of rolling elements on the planetary gears z were fixed, the number of engaging points could be increased by increasing the inner and outer globoidal cam wrap angles.

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Related Analysis to Weights and Feather-Growing Characters of 0-10 -Week Old Sichuan White Geese

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Abstract: By 280 0-10-week-old Sichuan white geese's living body measurement to the 10 characters of their weights, feather lenghts on nape dorsal parts, feather lenghts between shoulder blades, feather widths between shoulder blades, feather lenghts on basins, feather widths on basins, feather lenghts of main wings, feather widths of main wings, feather lenghts of chest bones, and feather lenghts of bellies, and through our related analysis, the result indicated that Sichuan white geese's weigh characters appear "growth infection points" in the 5th week, The body weight's most superior Logistic regression equation is: Wt=2,7285/[1+e-0,6752(t-5,0904)], R2 is 0,99(P<0,01), Fabric feather will change into young feather in 4-5 weeks, It stops at age of 10 weeks, and they appear the 2nd feather changing on their necks, waists, chests, bellies, except feather of main wings and feather between shoulder blades, Here exists a strong relevance among their body weights, week ages, and various feather characters at the same time, These research findings can be uesd for important evidences for Sichuan white geese to be chosen to breed according to their weights and feather characters
Keywords: Sichuan White, Geese, Body Weight, Feather, Feather Changing

1. INTRODUCTION

280 one-day-old Sichuan white geese hatched on the same day were sorted out. 140 geese were raised on Sichuan geese breeding farm in spring, Nanxi District, Sichuan, while the other 140 geese were raised under the same condition, but in autumn. 0-4-week old geese adopted plane-raising on nets, and then 5-10-week old geese adopted plane-raising on ground [1-5]. The feeding way of geese's freely eating food and dringing water all the day was adopted. growth

2. Index Measuring and Data Processing

2.1. Weight Measuring

Weight traits of 0-10-week old geese's empty stomach weight are represented by X0.Logistic growth curve model is used to analyze their cumulative growths. weight;A represents growth limit, that's the maximum weight;k represents the growth rate The fitted curve 1 Brief introduction to the writer: Zeng Raoqiong, female, assistant professor in Yibin Vocational & Technical College, master. Research area: Animal logistic model is: $Wt=A/[1+e^{-k(t-b)}]$. Here: Wt represents t-week old parameter; t is weeks old; b represents weeks old of growth inflexion. Logistic growth curve model's accuracy is checked by the fit represented by R^2.

2.2. Feather Character Determination

As for feather's length and width out of the external skin of the 0-10 weeks old geese, SAS 9.0 (Statistical Analysis System, Version 9.0, SAS) Statistical Analysis System software is used for statistics, correlation and regression analysis. X1-X9 are respectively indicated 9 feather traits. Measured part as follows [2-8]:

Feather length on nape dorsal part (X1): the longest feather's length of the feathers on the 5^{th}-8^{th} cervical lateral neck area;

Scapular feather's length (X2): the longest feather's length of the feathers on body dorsal part between scapulars.

Scapular feather's width (X3): the longest feather's width of the feathers on body dorsal part between scapulars.

Feather's length on waist saddle blanket section (X4): the longest feather's length of the feathers on trunk dorsal and waist saddle blanket section near back midline.

Feather's width on waist saddle blanket section (X5): the longest feather's width of the feathers on trunk dorsal and waist saddle blanket section near back midline.

Main wing feather's length (X6): the 10^{th} main wing's length counting from wing tip.

Main wing feather's width (X7): the 10^{th} main wing's width counting from wing tip.

Feather's length on breastbones (X8): the longest breastbone feather's length of the feathers located behind the sternum feather plume area, as Table 1.

Stomach feather's length(X9): the longest stomach side feather's length of the feathers at the back of breastbone feather plume area.

3. The Measured Results

See measured values of Sichuan white geese's budy weights and feather characters in Table 1.

3.1. Growth Weight

3.1.1. Sichuan geese's Absolute Daily Weight Gains of Each Week-Old

Data in Table 2 can be drawn from the analysis:The maximum absolute value of the average daily weight

gain of Sichuan goose's appears in the fifth week, That's, the fifth week is its weight's "growth inflection point."

Table1. Body weight and 9 feather character's measured values

Weeks group	X0	X1	X2	X3	X4	X5	X6	X7	X8	X9
0	0.084±0.01		3.00±0.28		3.20±0.29		3.33±0.29			
1	0.216±0.02	2.63±0.24	3.20±0.29		2.97±0.28		1.61±0.15		1.39±0.12	1.51±0.12
2	0.402±0.04	2.43±0.22	2.52±0.21		2.84±0.27		2.20±0.20		1.34±0.13	1.47±0.13
3	0.698±0.08	2.42±0.21	3.28±0.31		3.62±0.35		2.81±0.25		1.93±0.15	1.90±0.16
4	0.931±0.01	2.41±0.23	3.11±0.29		2.62±0.25		3.09±0.28		2.03±0.19	2.05±0.18
5	1.772±0.18	1.75±0.15	2.63±0.25		2.08±0.19		3.74±0.34		2.15±0.20	2.32±0.21
6	1.785±0.02	2.28±0.21	2.29±0.20		2.04±0.19		3.95±0.35		2.52±0.24	2.50±0.22
7	1.941±0.24	6.60±0.58	7.68±0.64	1.63±0.15	3.06±0.28	1.25±0.11	6.05±0.52	1.56±0.15	3.60±0.35	3.66±0.32
8	2.196±0.25	3.78±0.36	9.72±0.75	1.28±0.13	4.43±0.36	1.56±0.15	7.08±0.64	1.56±0.14	3.75±0.35	3.25±0.29
9	1.515±0.22	4.35±0.42	11.39±1.13	3.37±0.28	5.26±0.45	2.10±0.19	11.77±1.10	2.25±0.21	4.01±0.35	4.01±0.39
10	2.713±0.28	4.25±0.39	13.98±1.52	3.82±0.31	5.24±0.52	2.19±0.18	14.97±1.24	3.04±0.29	4.98±0.35	3.79±0.35

Note: The empty indicates that the data was absent.

Table 2. The every week's absolute daily gains of sichuan white geese (g)

Weeks old	1	2	3	4	5	6	7	8	9	10
Determination Group	0.023 ±0.002	0.016 ±0.002	0.050 ±0.005	0.040 ±0.004	0.056 ±0.006	0.013 ±0.004	0.048 ±0.005	0.049 ±0.005	0.031 ±0.003	0.022 ±0.002

3.1.2. Fitted Logistic Growth Curve

Use SAS 9.0 software to fit the most optimal regression equation and calculate the various parameters.The estimated values of logistic growth curve parameters are respectively 2.7285, 5.0904, 0.6752, 0.99.

Optimal.fitting.Logistic.regression.equation:Wt=2.7285/[1+e-0.6752(t-5.0904)].Goodness of fit R^2 is:0.99(P<0.01). The most optimal fitted regression equation is:$Wt=2.7285/[1+e^{-0.6752(t-5.0904)}]$. Fitting gegree R^2 is 0.99(P<0.01).

3.2. Feather Growth

3.2.1. Feather Replacing Time

Analysis of the data in Table 1 shows: Sichuan white goose's baby feather replacing sequence is: firstly, primary wing feathers (1 week old), then belly feathers (2 weeks old), sternum feathers (2-3 days old), then lumbar portion saddle blanket feathers (2 weeks old), Finally, nape side feathers (5 weeks old olf) and inter-scapular feathers (4-5 weeks old). It takes 4-5 weeks to measure plumules changing into juvenile plumages. It stops at 10 weeks old. Except primary wing feathers and feathers between scapulars, feathers on bake nape side, feathers on waist saddle blanket, feathers on breastbones, and feathers on stomach all have been copleted the second chanaging from juvenile plumages to yong feathers.

3.2.2. Every Part of the Feather Growth Speed in the Same Period

Data in Table 1 indicates:

For 4-week-old greese, feather growth value's size order is: primary wing feathers> scapular feathers> waist saddle blanket feathers> nape back side feathers > belly feathers> sternum feathers.

For 7-week-old greese, feather growth value's size order is: waist saddle blanket section feathers > nape back side feathers > main wing feathers> belly feathers> sternum Feather> waist saddle blanket feathers.

For 10-week-old greese, feather growth value's size order is: primary wing feathers> scapular feathers> waist saddle blanket feathers> sternum Feather> nape back side feathers> belly feathers.

3.2.3. Related Analysis to among Various Parts of 8-Week-Old geese's Feathers

Computing resut in Table 3 shows: There is a very significant correlation between the nine traits of Sichuan white geese's feathers. Except that X2, and X3, X3 as wellas X4-X9's phenotypic correlation coefficient ranged between 0.2300 - 0.2800, the other feather characters' phenotypic correlation coefficients all are more than 0.9000, and the correlation was significant (P <0.01).

Table 3. the Related Coefficients between 9 plumage's Traits of 8-Week-Old Geese

	X1	X2	X3	X4	X5	X6	X7	X8
X1								
X2	0.9588**							
X3	0.2383**	0.2528**						
X4	0.9376**	0.9472**	0.2372**					
X5	0.9527**	0.9472**	0.2678**	0.9793**				
X6	0.9627**	0.9272**	0.2738**	0.9583**	0.9763**			
X7	0.9724**	0.9572**	0.2583**	0.9683**	0.9835**	0.9879**		
X8	0.9627**	0.9357**	0.2637**	0.9483**	0.9853**	0.9857**	0.9867**	
X9	0.9672**	0.9737**	0.2783**	0.9837**	0.9865**	0.9957**	0.9967**	0.986**

Note: The "**" indicates extremely significantly, P<0.01

3.2.4. Relationships between Feather Shapes and Weeks Old.

Using the process of SAS9.0's CORR, respectly calculated the related coefficient between 5-8-week old geese's nape back side feathers' length, 5-10-week old geese's scapular feathers' length, 7-10-week old geese's shoulder back feathers' width, 4-6-week old geese's waist saddle blanket section feathers' length, 2-10-week old geese's main wing feathers' length, 7-10-week old geese's main wing feathers' width, 5-8-week old geese's sternum feathers' length, 5-8-week old geese's belly feathers' length and weeks old. Significant positive correction of straight line has been found between these 8 feather characters and weeks old. By F test and T test, all the corrections were significantly, P <0.01.After using the process of SAS 9.0 REG, the best regression equation between these 8 traits X10 and weeks old has been fitted.(See Table 4)

3.3. The Relationship between Weight and Feather Traits of 10-Week-Old Geese.

Table 4 The Best Regression Equation and the Related Coefficient between These 8 Traits X10 and Weeks Old

	The best regression equation and The related coefficient between these 8 traits X10 and weeks old
5-8-week old geese's nape back side feathers' length	Y=-3.1721+1.042X(r=0.6181**)
5-10-week old geese's scapular feathers' length	Y=-10.5053+2.4603X(r=0.9734**)
7-10-week old geese's shoulder back feathers' width	Y=-4.8367+0.8662X(r=0.8901**)
4-6-week old geese's waist saddle blanket section feathers' length	Y=1.6980+0.1900X(r=0.8901**)
2-10-week old geese's main wing feathers' length	Y=-2.6415+1.4711X(r=0.9092**)
7-10-week old geese's main wing feathers' width	Y=-1.9461+0.4796X(r=0.9126**)
5-8-week old geese's sternum feathers' length	Y=-0.1280+0.4897X(r=0.9526**)
5-8-week old geese's belly feathers' length	Y=0.9021+0.3557X(r=0.9021**)

Note: "r"indicates the correlation coefficients between traits and weeks. The "**" indicates extremely significantly, P<0.01.

Table 5 The Related Analysis between 10-Week-Old Body Weights and 9 Feather Traits

	X1	X2	X3	X4	X5	X6	X7	X8	X9
Y	0.272**	-0.2105**	0.5257**	0.1927**	0.7426**	0.0820**	0.7935**	0.7345**	0.7341**

Note: The "**" indicates extremely significantly, P<0.01.

Using the process of SAS9.0's CORR, respectly calculated the related coefficient between weights and 9 traits. The related analysis between 10-week-old body weights and 9 feather traits is seen in Table 5.

In Table 5, The related analysis between 10-week-old body weights and 9 feather traits shows: there is a strong correlation between weight trait X0 and weight trait X2,X3,X5,X6,X7,X8,X9. and the correlation was significant (P <0.01).Wherein the related oefficient r X9 of weight and X5, X7, X8 both are greater than 0.7000, and shows a strong correlation, which provides an important value for future further breeding.

4. DISCUSSION

4.1. Analysis to Different PARTS's Feather-Changing Time

The whole body of Sichuan white goose's newborn goose overgrows plumules, and they are yellow-white.With the increase of age after being hatched out, the plumules are gradually replaced by juvenile feathers and young feathers[2].The order of young feather replacing juvenile feathers as follows: the main wing feathers (1 week old), belly feathers (2 weeks old), sternum feathers (2-3 days old), waist saddle blanket section feathers (2 weeks old), and finally the neck dorsal feathers (5 weeks old) and inter-scapular feathers (4-5 weeks old).It takes 4-5 weeks for plumules to replace juvenile feathers, and it stops at 10 weeks old. Except main wing feathers and shoulder blade weathers, nape side feathers, waist saddle blanket feathers, sternum feather and abdomen feathers all have completed the 2nd moulting.This conclusion is basically consistent with Zeng fantong etc's moulting sequence study for Sichuan white geese.That's, wing → rump → chest → head [2].It is also consistent with Lincheng etc's related research for mule duchs' feather growing rate and related traits[3, 4]. and the disscusion in the "Poultry Science" mainly editted by Qiu Xiang pin. "That's, after the goslings being hatched out, the whole body is covered with plumules. Presently, they begine to mult, the real feathers are called juvenile feathers this moment, and multing order as follows: wing→ rump→ chest and abdomen → head. This process will usually be completed in about six weeks. The second multing will carry out in 6-13 weeks old, which the weathers are called young feathers. There will be another multing from 13 weeks old to laying eggs, which the feathers are called adult feathers."

4.2. Analysis to Feather Growth Rates in Different Parts

Through the sorting of 4-week-old feathers' length value, we can see that the primary wing feathers grow fastest, followed by inter-scapular feathers, waist saddle blanket feathers, then neck back feathers and belly feathers, and finally sternum feathers. The Liu GuiQiong's research results of show that: Chest's cashmere yield is the larhest among belly's, back's, and neck's, and the difference between them was significant. Though chest's cashmere yield is the

larhest, and there are many velvet flowers, the length is naturally short[6-13]. Comparing with research result's this poin, does it illustrate whether the largest cashmere yield parts will be limited as sheet feathers grow or not? The conclusin will wait for a further discussion. After four weeks, the lengths of feathers all show that big sheet feathers and wing feathers grow faster. However, there are obvious hollow feather shafts below this kind of sheet feathers. The rapid growths of big sheet feathers and wing feathers possibly have some connection with the flying habit suitable for aves animals[5, 7], and it also associated with the development of body weight. Pingel, and Ge Wenghua etc. have confirmed that there is a close positive correlation between growing goose's body weight and feather growth of the gorwing geese[8, 13]. Shi Jianzhong etc[9] reported the relation of Huoyan geese is Y = 0.10 W0.85 (r = 0.59). Toth etc. reported the related coefficient of body weight and feather yield is 0.26 to 0.52. Liu GuiQiong etc [10] reported that duck's body weight is in connection with its feather's growth, and generally, large size ducks' feathers develop better.

4.3. The Related Analysis among 9 Feather Traits

During geese's juvenile feathers, after related analyzing to 9 feather trait measured values and weeks old, there exists a strong positive correlation except inter-scapular feather's width. and the degree of correlation is very significant. Accordingly, the most optimal regression equation between 9 feather traits and weeks old has been fitted out, which provides a theoretical basis for using other traits to assistedly and aimedly choose, especially it is time for the trait's second moulting. There is a lower related coefficient between X3 trait for scapular feathers' width and other 8 traits. This may be because the shoulder feathers' activity is strong, or or in the case of drylot feeding, feathers' fat-containing is lower than it in grazing, or because pinnules' two sides' epiphytic feather branches bend inward, this leads to feather width decreases and the degree of correlation among other traits gets lower[4, 11-13].

4.4. The Research Direction in Future

To consider farmers' economic interests, this test's measured time is only to 70 days old, and we didn't keep on feeding them for feathers changing into adult feathers. Supposing we can measure to their 112 days in future studies, the law for feather traits to grow and develop will be more apparent and prominent. This needs a further study.

5. CONCLUSIONS

Sichuan white geese weight traits appear growth inflection points in the fifth week. The weight's most optimal logistic regression equation is: Wt = 2.7285 / [1 + e-0.6752 (t-5.0904)], R^2 is 0.99 (P <0.01). Sichuan white geese's replacing sequence for plumules changing into yong feathers is: the main wing feathers (1 week old), abdominal feathers (2 weeks old), sternum feathers (2-3 days old), waist feather saddle blanket section (2 weeks old) , finally, the nape side feathers (5 weeks old) and inter-scapular feathers (4-5 weeks old). It takes 4-5 weeks to measure part feathers from plumules changing into yong feathers, which stops at 10 weeks old. Except main wing feathers and shoulder blade weathers, nape side feathers, waist saddle blanket feathers, sternum feather and abdomen feathers all have completed the and moulting. There exists a strong correlation between weight, weeks old for growth and feather traits, feather traits in the same period. It can provide an important reference for Sichuan geese's breeding.

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Research on the Countermeasure of Our Government to Promote the Construction of Innovative and Entrepreneurial Universities

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Abstract: Innovation and entrepreneurship education has become a new trend in the reform and development of higher education, In order to promote the innovation and entrepreneurship education reform and meet the demand for innovative and entrepreneurship talents in the construction of an innovative country, the author studies the Countermeasures of our government to promote the construction of innovative and entrepreneurship universities, According to the conclusions of the survey, it is recommended to accelerate the development of innovative entrepreneurial talent training models and standards, The study found that with the continuous development of new development concepts and innovation-driven development strategies, the construction of innovative and entrepreneurial universities is imperative, and a number of innovative and entrepreneurial universities will emerge as the main force to promote "popular innovation, entrepreneurship," At the same time, in the future, colleges and universities should fully understand the significance and role of carrying out innovation and entrepreneurship education

Keyword: Government; innovation and entrepreneurship; university construction.

1. INTRODUCTION

At present, China's economy is in the midst of a three-stage superposition period of "growth speed shift period, structural adjustment pain period, and early stimulus policy digestive period", realizing economic transformation and upgrading, and smoothly transitioning to the new economic normal [1]. To build a modern economic system, it is necessary to adjust the economic structure and transform the economic growth mode. On the one hand, the scale of local colleges and universities continues to expand, and the contradiction between scale and quality is gradually highlighted [2]. On the other hand, the homogenization of local colleges and universities is widespread, the characteristic advantages are inherently insufficient, and resource competition is more intense [3]. Foreign scholars believe that entrepreneurship is a dynamic process of creating and growing wealth. It is a process of discovering and capturing opportunities and thus creating novel products or services and realizing their potential value. From the perspective of the integration of the world's knowledge economy, innovation and entrepreneurship education has become the general trend of economic and social development in the 21st century [4]. Domestic and foreign scholars in this field are increasingly rich in research [5]. But generally speaking, the theme of domestic research is to introduce the current situation of "entrepreneurial" universities in Europe and America, and hardly mention the construction channels of "entrepreneurial" universities from the perspective of students' employment [6]. In a broad sense, entrepreneurship refers to entrepreneurs' various entrepreneurship practice activities, whose function is to achieve the great cause of the country, the collective and the group.

The meaning of "innovation" is broad, that is to say, compared with individuals, if they have made innovative, unique and valuable spiritual or material achievements, then such achievements are innovative achievements [7]. China has put forward a new development concept of "innovation, coordination, green, open and sharing". Opportunities and challenges coexist in local colleges and universities [8]. In a narrow sense, entrepreneurship refers to the production and operation activities of entrepreneurs, mainly to start small businesses of individuals and families. This opinion is of great significance to promote the comprehensive reform of higher education and the innovation of mass entrepreneurship [9]. The history of innovation and entrepreneurship education in Chinese universities is relatively short. The article argues that the employment perspective is more conducive to the further extension of entrepreneurial university construction, which can solve the related construction ideas and the transformation of teaching practice mode [10]. How to actively adapt to the new situation of education reform, adjust the orientation of running schools, deepen comprehensive reforms, create characteristic advantages, and achieve transformational development, becoming the strategic choice of local colleges and universities. In essence, entrepreneurship education refers to the educational activities of cultivating students' entrepreneurial awareness, entrepreneurial quality and entrepreneurial skills, that is, how to adapt students to social survival, improve their ability, and conduct self-employment methods and ways.

2. THE CURRENT SITUATION OF CHINESE

GOVERNMENT PROMOTING THE CONSTRUCTION OF INNOVATIVE AND ENTREPRENEURIAL UNIVERSITIES

2.1 Problems in The Innovation And Entrepreneurship of Chinese Universities

Based on the theory of resource dependence, the government should provide material resources and policies and regulations for the innovative and entrepreneurial universities studied in this paper (the typical innovation and entrepreneurship universities in central universities), and it is also the role of its policy makers. Based on the strategic requirements of innovative national development, the needs of regional economic and social development, and the actual running of local universities, they are actively adapting to the current new economic normal. Realizing the transition to an innovative entrepreneurial university is a favorable choice for the transformation and development of local universities. According to UNESCO's explanation, entrepreneurship education is an education that fosters individual initiative and adventurous spirit, entrepreneurial and independent work, and technical, social, and managerial skills. Innovative entrepreneurship education is an important way to train high-quality talents. The subject of innovative entrepreneurship education has not been established yet, and it is separated from professional education. The educational resources of innovative entrepreneurship talents training are scarce, and the policy environment needs to be improved. The "workshop" operation of scientific research activities. For the construction of innovative and entrepreneurial universities, the policy documents on innovative system and mechanism and strengthening overall coordination provide guarantee for strengthening the top-level design of universities and establishing a strong leadership core.

From Figure 1, we can see that the number of documents issued at all levels is increasing from 2015 to 2018. Overall, the development level of innovation and entrepreneurship policy is constantly improving, the level involved is also constantly deepening, and the diversity and flexibility of policy tools are constantly increasing.

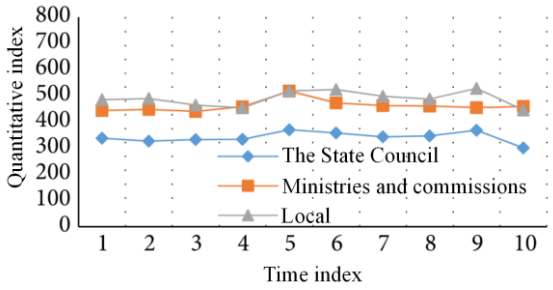

Figure 1 Annual changes in innovation and entrepreneurship policy documents

2.2 Emphasis on Talent Training

Foreign scholars emphasize that facing the change of external environment, universities need to respond with a more flexible way and a more positive attitude. Policies on stimulating creativity, building innovation and entrepreneurship platforms and developing entrepreneurship services help to create a good environment for innovation and entrepreneurship. Policy documents on expanding venture capital, invigorating financial markets and optimizing fiscal and taxation policies ensure the allocation of resources. In the concept of running a school, we should integrate and actively serve the development of regional economy and society. In personnel training, we should pay attention to the cultivation of students' innovative spirit and entrepreneurial ability. Innovation and entrepreneurship education is to cultivate students' innovative spirit of exploring and pioneering. It is integrated into the overall work of school education and teaching reform, strengthens the research on the theory of innovation and entrepreneurship education, and focuses on the relationship between innovation and entrepreneurship education and professional education and quality education. The random sampling method was adopted to select the second, third and fourth year students of the Sias International College of Zhengzhou University as the survey subjects. The professional categories of the selected samples were more comprehensive. Covering science, economic management, humanities, medicine, law, foreign languages and other majors, the sample professional structure of the survey is relatively reasonable. At the four levels of strengthening overall coordination, developing entrepreneurial services, optimizing fiscal and taxation policies, and inspiring creativity, government departments at all levels have issued more policy documents and higher levels of attention.

3. PRACTICAL EXPLORATION ON PROMOTING INNOVATION AND ENTREPRENEURSHIP EDUCATION IN COLLEGES AND UNIVERSITIES IN CHINA

3.1 THE Construction Path of Innovative and Entrepreneurial Universities

French management scholar Fayol generalizes planning, organization, coordination, command and control into the operational functions of administrative management. The construction path of innovative and entrepreneurial universities answers the core issues of theoretical research and practical operation of how innovative and entrepreneurial universities go and how to build innovative and entrepreneurial universities. For more than a decade, the work of innovation and entrepreneurship has gradually attracted the attention of universities. Therefore, how to effectively identify, guide and cultivate students' personal interests. It is the core issue of cultivating innovative and entrepreneurial talents to improve students' innovative and entrepreneurial qualities around their personal interests. Understanding of the concept of entrepreneurship education is not in place among

University managers. As a result, the development of entrepreneurship education in universities is insufficient, which hinders the process of the construction of entrepreneurship universities. Secondly, we should refine the relevant policies and measures of innovation and entrepreneurship, adhere to the linkage of various departments, and formulate a complete set of policy documents. This issue covers all aspects of running innovative and entrepreneurial universities. Simply promoting innovative and entrepreneurial education is not equivalent to building innovative and entrepreneurial universities.

3.2 Enriching the Content of Innovation and Entrepreneurship Construction

Different levels and departments should take into account the integrity of the policy system, enrich the content of innovation and entrepreneurship construction, and formulate supporting policies to promote implementation when enriching the policy documents formulated by their departments or institutions and enacting laws and regulations. Local innovation and entrepreneurship is not the same as the construction of innovative and entrepreneurial universities. It must be promoted in an integrated way, and the development strategy of serving the local economic and social development must be firmly centered on the new situation and new requirements of the continuous development of regional economy and society. The reason why college students want to start a business is that in recent years, government departments and education authorities have attached great importance to the cultivation of innovative and entrepreneurial talents. At the same time, colleges and universities should invite entrepreneurs to lectures in colleges and universities, share entrepreneurial experiences with students, etc., so that college students can understand the actual situation of entrepreneurship and improve their entrepreneurial practice.

4. CONCLUSIONS

Based on human capital theory and resource dependence theory, combined with the function of the government, this paper expounds the relationship between the government and innovative and entrepreneurial universities, and then makes a clear positioning of the role of the government in promoting the construction of innovative and entrepreneurial universities. In order to build an innovative and entrepreneurial university, the school level should mobilize the elements of the whole university through the administrative force to reassemble and promote the optimization and adjustment of the internal structural elements. Take the “going out, please come in” way to organize innovative and entrepreneurial education experience exchange meetings, symposiums, research activities, sum up the experience of innovation and entrepreneurship education, and promote the outstanding achievements of innovation and entrepreneurship education. All in all, the innovation and entrepreneurship education of higher education institutions should raise the spirit of cultivating college students' innovation and entrepreneurship to the height of school-running purposes and sustainable development, and integrate all the students, combine professional education, and integrate innovation and entrepreneurship education into the whole process of talent cultivation.

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Study on the Evaluation Index System of Diabetes

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Abstract: Nowadays, with the development of big data, medical treatment has gradually started to use the services of big data terminals to analyze patients' medication records, electronic medical records and other data to achieve precision medicine, In this paper, multiple indexes affecting diabetes were integrated into one overall index, For the influence indicators obtained in clinical practice, literature analysis method and expert consultation method were used to screen the indicators, and analytic hierarchy process was used to determine the weight of each evaluation factor and then the weight vector was obtained, After that, a fuzzy mathematical evaluation model was established, and the classified evaluation factors were evaluated with the fuzzy matrix method, Finally, a fuzzy comprehensive evaluation system was established to evaluate the therapeutic effect of diabetes
Keywords: Analytical Hierarchy Process, Fuzzy Comprehensive Evaluation Method, Diabetes Index

1. INTRODUCTION

Many medical institutions in hospitalized patients with diabetes management very casual, medical mechanism in the certain problem, in the era of big data, through the analysis of the various data of hospital, analyze the treatment mode of hospital is the patient's condition of easing is to improve the level of hospital an effective way to achieve satisfactory therapeutic effect, so we by determining evaluation index to evaluate the therapeutic effect of the hospital [1-5].

2. The Establishment of Analytic Hierarchy Process Structure

First, by analyzing data and asking doctors, we selected 10 representative indicators as the factors to evaluate the medical effect, and divided the problem into three levels, namely, the target level, the criterion level and the scheme level.

The target layer is treatment effect, the criterion layer is treatment intensity, recurrence time interval, treatment time and treatment result, and the program layer is 10 selected evaluation indexes as shown in figure 1.

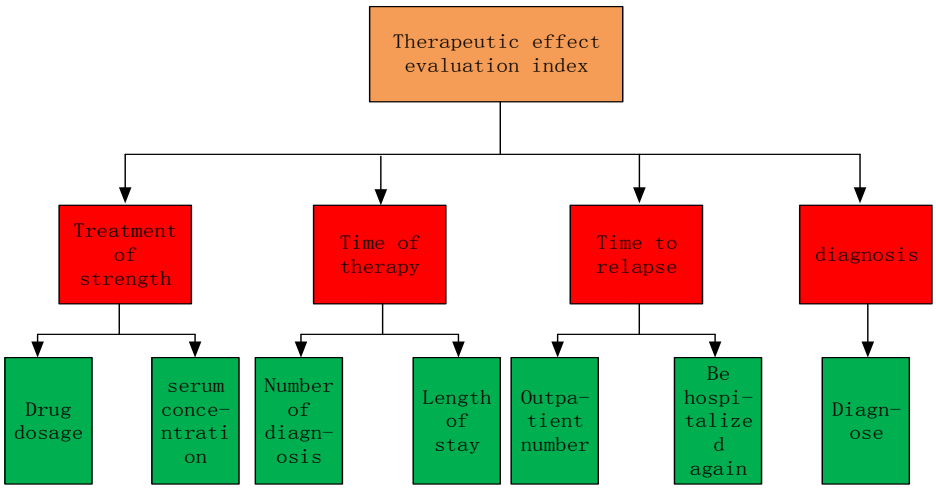

Figure 1 Hierarchical analysis of therapeutic effects

Next, we construct a judgment matrix by comparing the relative importance of pairwise factors. First, we consider the influence degree of the criterion layer on the target layer, and use aij to express the influence ratio of xi and xj on the upper target to determine the relative importance degree of each factor [6-9].

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as the evaluation scale. The following Table 1 lists the meanings of each.

Table 1. Nine scales

Importance scale	meaning
1	Means that both elements are equally important
3	Indicates that the former is slightly more important than the latter
5	Indicates that the former is significantly more important than the latter
7	Indicates that the former is more strongly important than the latter
9	Indicates that the former is more important than the latter
2,4,6,8	Represents the intermediate value between the corresponding scale of 1 and 9
1/k, k=1,..9	Indicates the degree to which the latter is more important than the former

We obtained the influence coefficients of the two indicators on the upper level through the inquiry of patients and doctors and the questionnaire analysis of local residents, which are as follows:

$$a_{1,2} = 1:3, a_{1,3} = 1:4, a_{1,4} = 1:3 \quad (1)$$

$$a_{2,3} = 1:2, a_{2,4} = 1:1, a_{3,4} = 2:1 \quad (2)$$

According to the ratio of these coefficients, we can get the positive and negative matrix:

$$A = \begin{pmatrix} 1 & 1/3 & 1/4 & 1/3 \\ 3 & 1 & 1/2 & 1 \\ 4 & 2 & 1 & 2 \\ 3 & 1 & 1/2 & 1 \end{pmatrix} \quad (3)$$

After that, normalization was carried out to eliminate the differences among indicators, and the weight vector was calculated as follows:

Step1:We normalized each of the columns of A to get $wij = \frac{aij}{\sum_{i=1}^{n} aij}$

Step2:Normalize wi to $wi = \frac{wi}{\sum_{i=1}^{n} wi}$

Step3:Calculate $\lambda = \frac{1}{n}\sum_{i=1}^{n} \frac{(Aw)i}{wi}$

and take it as the approximation of the maximum characteristic root. MATLAB is used to calculate the weight vector:

$$W = (0.0910, 0.3113, 0.4364, 0.3634) \quad (4)$$

Therefore, four criterion layer factor effects on the target layer weights for (0.09110, 0.3113, 0.4364, 0.3634)

3. Establishment of Evaluation Model Based on Ahp

We collected a large number of scoring data on 10 indicators (assuming a full score of 50 points) through questionnaires and calculated the average value of the data to obtain the evaluation result of the treatment effect on patients.

The evaluation fuzzy relation matrix of each factor in the criterion layer is obtained:

$$R_1 = \begin{bmatrix} 0.14 & 0.16 & 0.2 & 0.5 \\ 0.28 & 0.12 & 0.52 & 0.08 \\ 0.2 & 0.22 & 0.48 & 0.1 \end{bmatrix}$$

$$R_2 = \begin{bmatrix} 0.04 & 0.44 & 0.16 & 0.36 \\ 0.06 & 0.04 & 0.30 & 0.60 \end{bmatrix} \quad (5)$$

$$R_3 = \begin{bmatrix} 0.1 & 0.62 & 0.08 & 0.2 \\ 0.56 & 0.02 & 0.18 & 0.24 \end{bmatrix}$$

$$R_4 = \begin{bmatrix} 0 & 0.3 & 0.5 & 0.2 \\ 0.36 & 0.2 & 0.4 & 0.04 \\ 0.66 & 0.06 & 0.02 & 0.36 \end{bmatrix}$$

Then the appropriate fuzzy operator is used to synthesize the factor weight w and the fuzzy matrix R of each evaluated thing, and the fuzzy relation matrix of each criterion layer is obtained:

$$B_1 = W_1 * R_1 = (0.05642, 0.15565, 0.52368, 0.24712)$$

$$B_2 = W_2 * R_2 = (0.00910, 0.14942, 0.20047, 0.38860) \quad (6)$$

$$B_3 = W_3 * R_3 = (0.06006, 0.19923, 0.09006, 0.16000)$$

$$B_4 = W_4 * R_4 = (0.09202, 0.17433, 0.40149, 0.21804)$$

From the sub-matrix of fuzzy relation of each criterion layer, the total matrix of fuzzy relation is obtained:

$$R = (B_1, B_2, B_3, B_4 = \begin{pmatrix} 0.05642 & 0.155650 & 0.52368 & 0.247120 \\ 0.00910 & 0.149424 & 0.20074 & 0.348864 \\ 0.60006 & 0.199232 & 0.09006 & 0.160000 \\ 0.09228 & 0.174328 & 0.40148 & 0.218040 \end{pmatrix} \quad (7)$$

The fuzzy evaluation set Q is obtained by fuzzy transformation of weight vector matrix and evaluation matrix

$$Q = W \times R \quad (8)$$

We selected the optimal algorithm to calculate:

$$Q_k = \min(1, \sum_{j=1}^{m} W_j R_{jk})(k = 1,2 \ldots n) \quad (9)$$

Get the result:

$$Q = W * R = (0.8124, 0.3371, 0.6947, 0.2668) \quad (10)$$

The results can be obtained by bringing in the data affecting various indicators of diabetes.

4. CONCLUSIONS

This paper fully combines the characteristics of the model relation and the fuzzy relation of the influence of the index and the fuzzy property of the index grade to evaluate the therapeutic effect, and USES the fuzzy mathematics knowledge to analyze the index reasonably and accurately. At the same time, in order to make up for the deficiency of the traditional fuzzy comprehensive evaluation model, which is set by human and makes the weight assignment more subjective, we combined the analytic hierarchy process to classify and determine the weight among indicators, so as to eliminate the relationship between different indicators and make the model more able to reflect the actual therapeutic effect.

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A Taxi Airport Pick-Up Plan Based on Virtual Currency Model

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Abstract: Nowadays, taxis have become a hot topic of transportation, In recent years, there have been many studies on the income of taxis in daily travel, However, unlike the ordinary taxi management system, the airport taxi drivers can't choose passengers and refuse to carry them, but allows them to Carrying guests multiple times, Therefore, how to give certain "priority" to airport taxis makes the balance of income of airport taxis important, In this paper, firstly, we collect the latitude and longitude data of the passengers when they get off at the airport, and convert the coordinates of the latitude and longitude into distances, then obtain four types of distance centers by K-means clustering algorithm, and convert them into pick-up time, According to this, the priority of the taxi return is divided into four levels, then introduce the definition of "virtual time currency" ,According to the different levels of priority, then the currency of different quotas is given, the incentive of the taxi driver is improved and the income is balanced, thus provide this perfect plan
Keywords: K-means Clustering Algorithm; Virtual Time Currency; Levels of Priority

1. INTRODUCTION

Nowadays, airport taxi gradually became the airport passenger transportation, because the airport taxi passenger's journey affects the income of the airport taxi driver, so now have a lot of research on regulating the taxi driver earnings, for example by the traditional game model in literature [1-3] improvement to establish a multidimensional game model to study equilibrium pricing of different pricing strategies, so as to improve the yield of the taxi driver. In the literature [3], an optimized taxi charging model is constructed taking into account factors such as passenger travel cost and driver income fluctuation. But these studies are only a taxi pricing strategy is put forward, and this situation the taxi driver has the right to choose the guests, and because the airport system is different from the urban taxi management mode, the airport related provisions of the administration of the taxi can't for the passengers to destination far into the problem, but it can be many passengers, in this case the airport taxi passenger journey is different and the same time the different are most likely to cause the number of passenger taxi and passengers imbalance between supply and demand, thus a bad influence on the passenger and taxi drivers are [4-8].Therefore, in order to make taxi revenue as balanced as possible, this paper proposes a new airport taxi priority arrangement scheme. Research method steps are as follows: first, collecting the space-time characteristics of Beijing international airport passengers get off point distribution [9-13], the longitude and latitude into distance, through the distance after K - means cluster analysis [6], four types of center distance, the distance field into the taxi service time, which, in turn, the taxi home priority can be divided into four levels, to establish a system of "priority" and introducing "virtual currency" model - a reduce the taxi driver waiting time of virtual currency. Finally, combining the virtual time currency and the "priority selection" system, a reasonable airport taxi pickup scheme is given, so as to balance the benefits of airport taxi drivers.

1.1 Transformation of Longitude and Latitude Coordinates

Firstly, the longitude and latitude data of passengers' destination and the geographical position of the airport within one day were collected. Secondly, the interval between passengers' destination and the airport was calculated according to the formula.

D
= arccos((sin north latitude A
× sinnorth latitude B)＋(cos north latitude A
× cos north latitude B
× cosAB north latitude and longitude))
× average radius (Shormin))

Then the obtained distance data were analyzed by k-means clustering, so as to classify the taxi carrying passengers in short distance by using the distance clustering results. Taxi drivers are given different treatment according to different grades.

1.2 K-means Clustering Algorithm Idea

For k-means, we first need to initialize K clustering centers {C1, C2, C3... , Ck}[8], and $1<k\leq n$, Then calculate the Euclidean interval [9] from each object to each clustering center, and the calculation formula is shown as follows:

$$\mathrm{dis}(X_i, C_j)=\sqrt{\sum_{t=1}^{m}(X_{it}-C_{jt})^2}$$

In the above formula, X_i means object i, and$1\leq i\leq n$, the C_j means clustering center j and "$1\leq j\leq k$", the X_{it} means the property t of an object i, and "$1\leq t\leq m$". Then, by comparing the distance between each object and the cluster center, the objects are classified into the nearest cluster center according to the cluster, and then the clusters are formed. Thus, k clusters $\{S_1, S_2, S_3, \ldots, S_k\}$[10]. K-means algorithm defines the prototype of class cluster with the mean value of all objects in each dimension of class cluster, which is the center of class cluster [11-16]. Its calculation formula is as follows:

$$C_t=\frac{\sum_{X_i\in S_l} X_i}{|S_l|}$$

in the formulas, C_l means the first cluster center, $1\leq l\leq k$, $|S_l|$ means the number of first class objects in the cluster, X_i means first class cluster in the case of an object, $1\leq i\leq|S_l|$.

1.3 Algorithm Implementation

The distance between the passenger destination and the airport can be obtained from the above data, and the distance k-means clustering is realized by using matlab [12]. According to the k-means clustering idea, the clustering diagram is obtained as Figure 1 follows:

Meanwhile, the clustering center table in the clustering process is obtained as Table 1 follows:

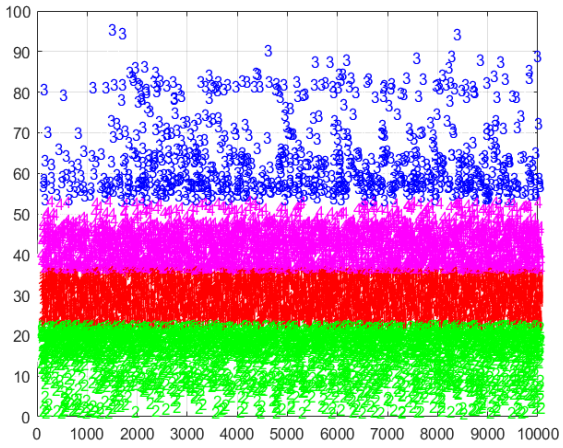

Figure 1. One-dimensional clustering analysis

Table 1. Obtained the clustering center table through Matlab

The clustering center	1	2	3	4
distance /km	16.0535	29.5417	42.5673	64.3417

After the clustering center is obtained, the four distances corresponding to the four clustering centers are used as the radius to draw a circle, so as to divide the passenger journey levels of four taxis. Moreover, Bigemap software is used to visualize the distances corresponding to the four clustering centers on the map [13].

Assuming that all short-distance passenger drivers travel at a uniform speed and the speed is 60km/h, the passenger distance of the four types of taxi is known. The ratio of distance and speed is used to convert the passenger distance of the four types of taxi into four types of time interval. Finally, the four time intervals are obtained as the classification of short-distance passenger drivers. See the Table 2 below.

Table 2. time range corresponding to the priority level

level	1	2	3	4
Time range/min	<20	20-30	30-50	50-60

2. ESTABLISH A PRIORITY SYSTEM

Divided the basis of the level of short-distance passenger driver, if a driver time < 20 minutes, passenger distance is the shortest in the four types of passenger distance, at this point the driver caused by short distance passenger taxi single pass yield at least, but the taxi driver cannot refuse to also can't choose the client, therefore must be based on some unfair taxi driver, and taxi drivers imbalance between yields, easy to cause confusion and even hit a taxi driver's enthusiasm, so to avoid the conflict of the driver for this kind of situation, a priority system is built up according to the level of short-distance passenger driver [14], as shown Figure 2 and Table 3 below:

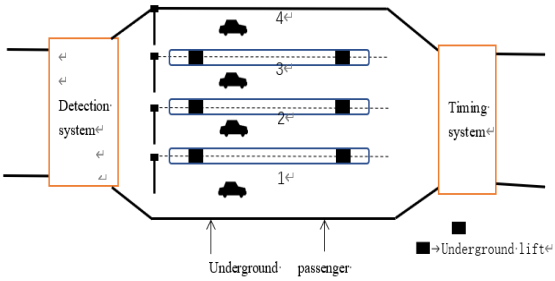

Figure 2. Priority system scenario

The priority system is actually divided into road bayonet detection system, driver pick-up and passenger area and taxi timing system. First of all, the timing of the taxi means that the time of passing taxi will be recorded, and the total time of the next return of the taxi will be recorded. The road bayonet detection system will open different levels of pickup areas for the taxi at different times recorded.

Table 3. Time range of different priorities

level	1	2	3	4
Time range/min	<20	20-30	30-50	50-60
Track grade	1	2	3	4

This system means that the driver service back to the airport after the system according to the record time to determine whether the driver corresponding to what road grade, for level 1, detection system to open 1 orbit, 1 orbit is the distance from the passengers point nearest orbit, considering the driver can't choose the passengers, but passengers can choose to drivers, for passengers, the passengers will choose the nearest taxi as a general transport, so the driver service probability 1 orbit will increase, the orbit of the driver will get more profits, so as to make up for the driver because the previous passenger journey is too low to cause loss of revenue.

Similarly, the second-level short-distance passenger driver enters the second track, the third-level

short-distance passenger driver enters the third track, and the fourth-level short-distance passenger driver enters the fourth track [15]. In order to ensure the safety of passengers, there is an underground passage between the tracks, and passengers can pass through the underground passage when they walk from one track to another. In order to ensure safety and make up for the loss of short distance passenger driver's interests.

3. VIRTUAL TIME CURRENCY MODEL

"Priority" system on the basis of a certain indeed to make up for a taxi driver for a single pass yield loss caused by passenger trip short, but on the other hand, a taxi driver can many passenger, namely if the taxi passenger journey is short, the trip takes less time, in the case of taxi drivers can be increased by the increasing the number of passenger revenue, therefore, considered separately through single trip distance limit taxi passengers take the driveway to choose "priority" is far from enough.

Therefore, virtual time currency is introduced [16]. Virtual time currency is a kind of currency that can affect the taxi waiting time, which can shorten the driver's waiting time and improve the driver's profitability. The specific use scheme is as follows: similarly, according to k-means clustering analysis, the converted time level is divided, and passengers and drivers of different levels can accumulate different time currency.

If the previous passenger driver's level is 1, the time currency can be accumulated for 5 minutes, which can reduce the driver's waiting time for 5 minutes. If it is 2, the time currency can be accumulated for 10 minutes; if the driver's level is 3, it can be accumulated for 15 minutes; if the driver's level is 4, it can be accumulated for 20 minutes.

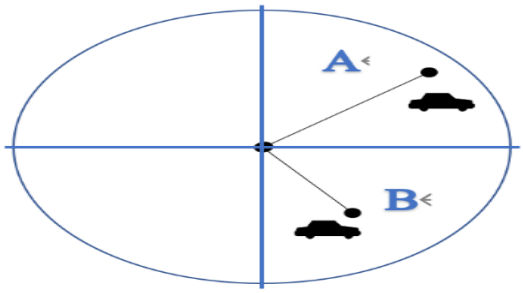

Figure 3. Schematic diagram of virtual time currency

For example, suppose A car driver compared with B car driver for passenger journey far away, in A "priority" system timing system as four grades, so open four grade road detection system, but the B car passenger shorter than A car, car B can because passengers in the same time more and make their own income increased, thus introducing "virtual currency" time model, A car driver accumulated 20 min to currency; Car drivers for level 3 B, total 15 min time currency, then A and B the driver once again return to the airport service, A car drivers are supposed to enter 4 levels track waiting for passengers, however, due to the time of accumulative total of 20 min currency can be offset by 20 min wait time, so A driver eventually into 3 levels orbit, compared with the original "priority" system, are more likely to receive the passengers, as Figure 3.

4. FINAL "PRIORITIZATION" PLAN

According to the classification of the passenger time of the previous short-distance passenger driver, the virtual time currency and the "priority" system are given corresponding preferential policies. Through the mutual coordination of the two, the final priority scheme is as Table 4 follows:

Table 4. "Priority" schemes for balancing drivers' earnings

level	1	2	3	4
Time range/min	<20	20-30	30-50	50-60
Priority-system-track level	1	2	3	4
Accumulated-time currency /min	5min	10min	15min	20min

Through the combination of the above two schemes, it not only solves the problem of income gap caused by the short distance to carry passengers in a single taxi, but also solves the opportunity of multiple times to carry passengers caused by the short distance to carry passengers in a single taxi, resulting in the income gap between the two. Therefore, this scheme is of great help to improve the initiative of airport taxi drivers and balance the benefits between them.

5. CONCLUTION

In this paper, by collecting the capital international airport taxi passengers get off points of latitude and longitude data, and data visualization in shown on the map, and then the data through the K - means cluster formed four grades, use the build four grades were "priority" system and virtual currency model is established, the harmonious combination of the two model is good enough to boost the enthusiasm of the taxi driver and the balance of the proceeds, as the airport taxi is different from daily taxi, a large number of the taxi income research is also a revenue model is established for a taxi, ignores the airport taxi can't for passengers to the destination far into the problem, But can many passenger, in this case the airport taxi passenger journey is different and the same time the different are most likely to cause the number of passenger taxi and passengers imbalance between supply and demand, and a bad influence on the passenger and taxi drivers are related problems, in this paper, based on the virtual currency model airport taxi service plan very good solve the problem, and the virtual currency model easy to cause the freshness and enthusiasm of the taxi driver, has certain significance to promote the taxi revenue.

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Analysis of Taxi Supply and Demand Matching Based on Fuzzy Comprehensive Evaluation Method

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Abstract: With the development of the city and the improvement of people's living standards, taxi travel has gradually become the main mode of travel for most people, but the matching of supply and demand of taxi resources has become a new problem, Based on the fuzzy comprehensive evaluation method, this paper establishes a matching model of supply and demand of taxi resources, and realizes the matching degree of taxi resources in Beijing, Wuhan and Xi'an, and studies the space and time in the morning, middle, night and night, The feasibility of the taxi resource supply and demand matching model was verified
Keywords: Taxi, Fuzzy Comprehensive Evaluation Method, Supply and Demand Matching

1. INTRODUCTION

With the development of society, people's requirements for travel are getting higher and higher, and the way of taking a taxi has become a must-have choice for more and more people with its convenient, fast and comfortable features. However, in recent years, the traffic problems in major cities in China have become increasingly serious, and “difficulty in taxiing” has become a hot issue in society. [1-3] According to incomplete statistics, including the first-tier cities such as Beijing and Shanghai, the idling rate of taxis during the off-peak period is around 30%, while at the peak, people face the problem of not getting cars. At the root of it, there is no good communication between people and taxis, and there is a lack of timely communication platform, which leads to a mismatch between driver and passenger demand information.

Under the background of the Internet era, the city “difficult to take a taxi” has become a hot issue in the society, [2-6] and has promoted various kinds of taxi software to appear on the market. Based on this background, this paper builds a mathematical model based on fuzzy comprehensive evaluation method, and studies how to alleviate the problem of “difficulty in taxiing”. By establishing reasonable indicators, it analyzes the “matching of supply and demand” of different time and space taxi resources. We selected three cities in Beijing, Wuhan and Hangzhou with different degrees of development as research sites; and selected four time periods: morning, afternoon, night and night as research time. Moreover, we determine the taxi demand and actual load as indicators, find the mileage utilization rate, the number of people in possession, etc., and use the algorithm of fuzzy comprehensive evaluation method to analyze the degree of “supply and demand matching” of taxis in different time and space.

2. SELECTION OF TIME AND SPACE

In order to realize the “supply and demand matching” model of taxi resources, we must first select the appropriate time and space, namely time and space.[3-8] A suitable time period can intuitively express the generality of the model. A suitable selection of a city can enhance the model's wide range. Sexuality, so this paper selects the appropriate time and space by three factors: mileage utilization, vehicle full load rate, and taxi ownership.

Mileage utilization refers to the ratio of operating mileage to driving mileage. [4] It is generally based on one vehicle. The formula is: mileage utilization = operating mileage (km) / mileage (km) * 100%.

The vehicle full load rate refers to the average full load of passengers carried by the vehicle. The calculation formula is: full load rate = passenger turnover (person kilometers) / passenger position (capacity).

The number of taxis is used to describe the per capita occupancy of taxis in a certain size city, and is used to evaluate the matching of supply and demand of taxis in the city.[5] The calculation formula is: the number of taxis owned by the taxi = the number of taxis (vehicles) / population size (10,000 people).

2.1 Selection of Cities (Spaces)

As shown in Table 1, each city data table is sorted by the number of people in the taxi (high to low), including the mileage utilization rate selected for the city and the factor of the number of taxis.

Combining these indicators, we further analyze and select Beijing, Wuhan, and Hangzhou as our research cities. The advantages are:

(1) At the same time, as a first-tier city, the economy is relatively developed and there is a large amount of data available for research.

(2) The number of taxis owned by the city is reduced by three cities in Beijing, Wuhan and Hangzhou. It has an overall representative and can be further promoted.

(3) The mileage utilization rate is at a medium level

and is general and can be studied as a representative.

(4) The number of taxis in Beijing is the largest, which can represent a city with a large amount of ownership. Wuhan is a medium-sized city. Hangzhou is a city with a small amount of ownership. The three cities have a strong research.

Table 1. Statistics of taxi related data in each city

Sort by the number of people in the taxi (high to low)								
City	Main urban population	Main city taxi ownership	100 million GDP taxi ownership	Taxi ownership	Taxi monthly turnover (yuan)	Taxi bicycle net monthly turnover (yuan)	Driver's single-shift monthly income (yuan)	Mileage utilization
Dalian	360	12929	1.7	36	22451.1	9557.7	4778.85	65.51%
Shenyang	510	17200	2.7	34	22500	17268	2362.27	57.40%
Beijing	1972	66646	3.4	34	17205	11020.15	4000	68%
Guangzhou	625.33	20300	1.3	32	27350	19500	4500	73.79%
Haerbin	495	14300	2.78	29	22500	10500	4500	84.10%
Xian	484.6	12115	2.48	25	19000	12000	4000	70.00%
Wuhan	660	15637	1.7	24	19000--23000	18900	3200	69.02%
Nanjing	451.49	10732	1.3	23.77	21094.5	9084	5093	65.40%
Chengdu	533.96	14898	1.64	23.5	23610	10225	4601	67.88%
Xiamen	195.87	4462	1.48	22.78	34211.91	14998.79	7499.39	72.00%
Qingdao	458	10018	1.6	22	22943	14478.3	4302.75	64.51%
Ningbo	227.6	4627	0.65	20	26000	12000	6000	68.00%
Hangzhou	455.426	8923	1.1	19.6	29834	14411	5453	69.25%
Jinan	518.9	8043	1.54	15.5	15000	7000	4500	71.70%
Shenzhen	1052.76	11433	0.79	10.86	36636.3	14800.82	7400.41	69.10%

2.2 Selection of Time

For the selection of time, this paper selects four time points: 1:00, 7:00, 13:00, 19:00 for research.

These four time points are widely representative, representing night, early, middle and late, and the four time points are separated by 6 hours, including all time 24 hours a day.

3. TAXI SUPPLY AND DEMAND MATCHING MODEL

The premise of establishing a “supply and demand matching” model for taxi resources is to select appropriate indicators. In order to better reflect the “supply and demand matching”, this paper selects the taxi demand x and the actual load y as indicators for this study.[6]

3.1 Demand Quantity X

The demand, that is, the demand for taxis at this time, can reflect the degree of demand of people at this time. The more the demand, the more taxis are needed, the more difficult it is to meet people's needs, and the less demand is easy to meet. the needs of the people.

3.2 Actual Load y

The actual load refers to the specific number of passengers after the taxi receives the demand, reflecting the degree of satisfaction that people can get.

Determine the indicators used to analyze the degree of supply and demand matching: supply and demand matching

K. Establish a mathematical model as follows:

$$K = \frac{y}{x} \quad (1)$$

Where x is the demand, y is the actual load, and K is the supply and demand match.

Combine the data of the demand and the actual load of the four locations in the three cities found on the intelligent travel platform of Drip, and use Matlab software to calculate the ratio of the actual load to the demand, that is, the matching degree of supply and demand, K 2 as Tabel 2 follows:

Table 2. Supply and Demand Matching Data Table

Time	1:00	7:00	13:00	19:00
Beijing	0.32	0.45	0.34	0.35
Wuhan	0.78	0.87	0.68	0.82
Hangzhou	0.69	0.71	0.66	0.49

Through analysis, this paper selects fuzzy comprehensive evaluation method to analyze the matching degree of taxi supply and demand.[7] Fuzzy comprehensive evaluation method is a comprehensive evaluation method based on fuzzy mathematics. The comprehensive evaluation method transforms qualitative evaluation into quantitative evaluation according to the membership degree theory of fuzzy mathematics, that is, using fuzzy mathematics to make an overall evaluation of things or objects subject to various factors. It has the characteristics of clear results and strong system, which can solve fuzzy and difficult to quantify problems, and is suitable for solving various non-deterministic problems. Organize the data, and use the fuzzy comprehensive evaluation method to divide the supply and demand matching degree F into the following five levels, corresponding to different matching difficulty.

According to the supply and demand matching level, it can be converted into a supply and demand

matching degree level table as shown in Table 3:

Table 3. Supply and demand matching degree scale

Time	1:00	7:00	13:00	19:00
Beijing	Less satisfied	General	Less satisfied	Less satisfied
Wuhan	More satisfied	Satisfaction	More satisfied	Satisfaction
Hangzhou	More satisfied	More satisfied	More satisfied	General

4. ANALYSIS AND INSPECTION OF RESULTS

4.1 Analysis of Spatial Factors Results

When the space (location) is certain, the "supply and demand match" degree of the taxi resources of the three cities is analyzed from different time periods. Overall, 7:00 am and 19:00 pm are better than 13:00 at noon, indicating that it is necessary to increase the arrangement of taxis at noon, or to improve the efficiency of taxis by diverting complicated traffic conditions.

On the other hand, at 1:00 in the evening, it is the lowest satisfaction time of the whole day (24 hours). The matching of supply and demand in the normal time is better, indicating that the city needs to adjust the arrangement of the night taxi, and the satisfaction is low. The reason may be that there are fewer taxi workers at night, the price system is unchanged, and the fatigue at night and the number of passengers are small, resulting in a shortage of supply and low satisfaction.

4.2 Analysis of Time Factor Results

When the time is certain, the taxi supply resources in the three cities will be analyzed from different spaces. Regardless of the early peak or the late peak, Beijing's full-day satisfaction is lower than that of the other two cities. The reason may be that Beijing has a large population and heavy traffic. Even if there are more taxis, it is impossible for crowded traffic. It is a serious problem to get passengers to "ride a car" when they arrive at the passenger's location.

On the other hand, by comparing Wuhan and Hangzhou, Wuhan's satisfaction level is better than that of Hangzhou. Since the total number of taxis in Wuhan is 15,637, which is greater than the 8,923 in Hangzhou, the taxis are sufficient, so passengers can arrive at the passengers conveniently and quickly. Location, it is obvious that Wuhan's satisfaction is greater than Hangzhou is a normal phenomenon.

4.3 Model Evaluation Analysis

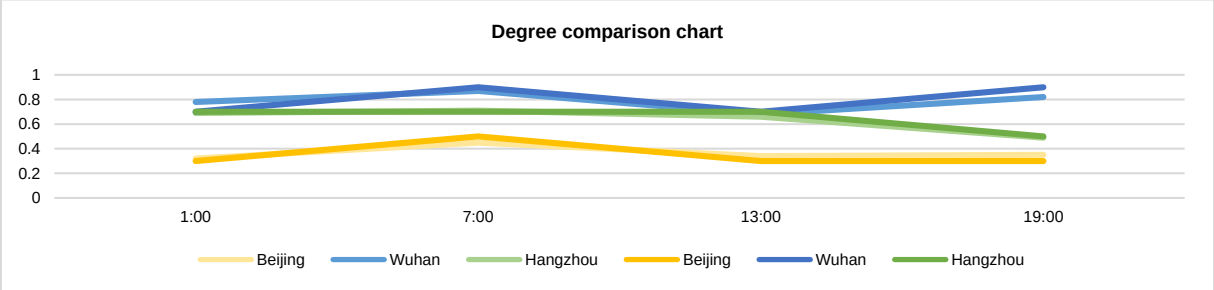

Figure 1. Degree comparison chart

Through the data provided by the fast intelligent travel platform,[8] the average difficulty level of the four cities in three cities is given, which is divided into three levels and recorded as L. Because the difficulty of taxiing reflects the degree of matching between supply and demand, we use L to test the K obtained by the above model, and convert the level of difficulty of K above to the level of difficulty of H. Compare F with H to get Figure 1:

From the above figure, we can find that the K calculated by the model is not much different from the L obtained by the software intelligence, and the trend is basically the same, so the established model is more reasonable.

5. CONCLUSIONS

Based on the fuzzy comprehensive evaluation method, this paper analyzes the matching of supply and demand of taxis in three representative cities. According to the comprehensive analysis, the traffic congestion in first-tier cities like Beijing is not balanced, and the supply and demand of taxis are not balanced. The traffic in other first-tier cities is convenient, but There is a high satisfaction between the supply and demand of cities with a large number of taxis, and the satisfaction of matching the supply and demand of cities with relatively small number of taxis is low. At the same time, the research in this paper has certain limitations. The model is built by using three cities. The data volume is small and not extensive. The predicted results may have large errors, which are inconsistent with the actual situation, and the whole city is the research object. There is a lack of more detailed research on local areas within the city, and it is impossible to portray differences in different areas, such as the situation in the city center and the suburbs. The problem of difficulty in getting a car may still exist locally.

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Multi-Factor Stock Selection Model Based on Shanghai and Shenzhen 300 Shares

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Abstract: Artificial intelligence and big data development have never been more prosperous, In the context of China's financial reforms, quantitative investment in analyzing stock market trading data has become a hot research topic, This paper chose the Shanghai and Shenzhen 300 as the main research object, First, the single factor analysis of the performance of each factor in HS300 is carried out, and the IC value and IR value of the relevant factor are obtained, and the invalid and unstable factors whose IC absolute value is less than 0,05 and the IR value is small are discarded, The SVM algorithm and the BP neural network algorithm are used to predict the stock market respectively, It is found that the prediction accuracy of the SVM algorithm is higher than that of the BP neural network algorithm, Therefore, the SVM algorithm is used for stock selection backtesting, Finally, the strategy is used to obtain 7,42% of annual benefits, and the maximum retracement is 6,16%, Finally, the improved strategy can change the state of the original income loss of 15% to a state of 1,52% of the return, and the maximum retracement is 6,02%

Keywords: Svm; Risk calculation; Stock picking strategy

1. INTRODUCTION

In the context of the increasing effectiveness of today's securities market, how to capture market dynamics and identify the influencing factors of market dynamics requires a more effective and robust model to capture these influencing factors.

For multi-factor stock selection, in 1995 Corinna Cortes and Vapink proposed the SVM model for the first time based on the neural network model. SVM showed great advantages in dealing with nonlinear relations, and it has strong adaptability, and the model is processing. The complex dynamic time series aspect has very good results [1-3]. In 2001, Chapados.N and Benigo.Y used artificial neural network (ANN) to train stock data, and predicted future earnings based on the training results, which greatly saved the time for investors to study stock indicators to obtain relatively good returns. However, the stock data is high-dimensional and contains noise, and it is easy to over-fitting using neural networks [2]. In response to this problem, Breiman proposed a random forest algorithm, which has many advantages in dealing with high-dimensional data, such as fast speed, simple practice, and strong promotion. Therefore, the algorithm has been widely recognized once it is published [3-8]. Li Chunyan used a combination of three-factor model and high-dimensional covariance matrix calculation to predict the stock market portfolio return rate, thus reducing the impact of high-dimensional on the three-factor model prediction results [4]. Based on the research contents of domestic and foreign scholars, this paper combines the neural network to optimize the multi-factor model. Firstly, according to the factor classification of stock data, the factors with the best Sharpe ratio are selected. Therefore, the decision is based on the Shanghai and Shenzhen 300 (HS300). Subjects were studied for factor analysis.

2. FACTOR SCREENING

2.1 Screening Process

According to the financial statements and trading conditions of listed companies, the Digital Dynamic Energy Research Department calculates 12 categories of factors such as basic subject derivative, quality category and income risk category, and 12 major factors are subdivided into more than 500 small factors. There are many stocks and the links between the various stocks are small. If all the research is carried out, the research results will be lack of specificity. Therefore, the Shanghai and Shenzhen 300 (HS300), which includes the best individual stocks in A-share listed companies, is the main research object [5]. First, a single factor analysis was performed on the performance of each factor in HS300, and the IC and IR values of the relevant factors were obtained. Then, the absolute value of the factor IC is sorted. Since the absolute value of the IC is greater than 0.05, it can be considered as an effective factor, so the factor with an IC value of less than 0.05 needs to be discarded. Next, the IR value of the residual factor is counted, and the IR value can reflect the stability of the factor. The more stable the factor, the larger the IR value [6]. Therefore, the weaker factor is eliminated based on the IR value.

$$IR = \frac{\overline{IC}}{IC\text{Volatility}} \tag{1}$$

The final remaining factors are then subjected to strategy research and performance analysis to obtain a single-factor annualized Sharp ratio and abandon the negative Sharp ratio [7]. The final remaining factor is the factor obtained by the screening.

$$S_A = \frac{\frac{1}{n}\sum_{t=1}^{n}\left(R_t - R_f\right)}{\sigma_{REX}}\sqrt{N} \tag{2}$$

In the formula, the annual Sharpe ratio is the product yield series data, which is the market risk-free rate of return, n represents the number of yields determined according to the time frequency, and N represents the annualization factor of different periods. Figure 1 shows:

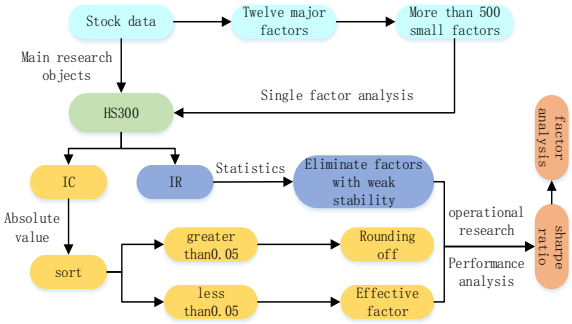

Figure 1 Effective factor screening process

2.2 Performance Analysis

After more than 500 small factors, 20 effective factors such as PE, PS, PB, and ROA are left after single factor analysis (see Appendix 2 for specific factors), and the remaining factors are sequentially tested back and their Sharpe ratios are checked. When the Sharpe ratio is less than 0, the factor is considered to be an invalid factor and is rejected. Table 1 is the partial data obtained when the PB and PE factors are backtested.

Table 1 Partial factor strategy backtest data

Factor name	Sharpe ratio	Calmar ratio	Sortino ratio	Net profit / maximum potential loss	Fee/net profit
PB	0.57	1.42	0.74	0.00	0.13
EnterpriseFCFPS	-0.26	-0.24	-0.33	0.00	-0.69

From the above, it can be seen that the Sharpe ratio of the PB factor is greater than 0, and the EnterpriseFCFPS Sharpe ratio is less than 0. Therefore, when the effective factor is selected according to the Sharpe ratio, the factor "EnterpriseFCFPS" will be deleted.

3. STOCK PICKING STRATEGY FORMULATION

3.1 Composite Factor Construction

First, the data of all effective factor columns is obtained. Since the order of magnitude differs greatly between the data, each column of data is standardized, and the data value is controlled between 0-1.

$$x_{normal} = \frac{x - x_{\min}}{x_{\max} - x_{\min}} \tag{3}$$

Next, all the factor values are added to obtain the mean, and the mean is taken as the value of the composite factor. which is

$$fact_{all} = \frac{\sum_{i=1}^{n} fact_i}{n} \tag{4}$$

3.2 Stock Trend Forecast

3.2.1 Svm prediction model

The SVM model is now very mature in high-dimensional space prediction. The related theory directly uses the inner product function in space, which provides a method to avoid high-dimensional space complexity to solve high-dimensional space decision problems [8]. Prediction using the SVM algorithm is undoubtedly reasonable. SVM is to maximize this interval value, and the point on the dotted line is called the support vector, as shown in Figure 2:

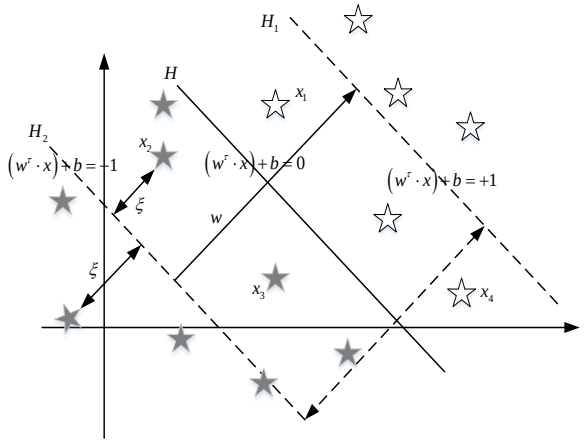

Figure 2 Svm algorithm diagram

In the stock forecasting model, the opening price, the highest price, the lowest price, the closing price, and the composite factor value of the previous day are used as model input values; since the closing price of the day after the stock is complicated and variable, the two-category method is used to The ascending value is used as the model output value, which defines the stock rise as a value of 1, and the decline as a value of 0; since the specific relationship between these data is not clear, the inner product function cannot be directly selected. Therefore, two more common inner product functions are selected: the "sigmoid" function and the "rbf" function, which respectively determine their prediction accuracy, and then determine the inner product function used by the prediction model.

When the Sigmoid function is used as the inner product function, the predicted accurate value and the inaccurate prediction value are almost half of each, and the real value is usually larger than the predicted value. That is, when the sigmoid function is used for prediction, the stock rise is mistaken as the stock decline.

When the rbf function is used as an inner product function, the approximate situation is the same as the sigmoid function, but the error is relatively small.

Therefore, through the above figure, it can be roughly judged that the prediction effect using rbf as the inner product function is better than the sigmoid function, and the accuracy of the model will be verified for the verification conjecture.

$$f(x) = \begin{cases} 1, y_{pre} = y_{rea} \\ 0, y_{pre} \neq y_{rea} \end{cases}$$
$$accuraty = \frac{\sum_{i=0}^{n} f(x)}{n} \quad (5)$$

Combining the predicted results with the real results, the model accuracy is 57.00% when using the sigmoid function, and the model accuracy is 69.57% when using the rbf function. Therefore, the rbf function will be used as an inner product function in the subsequent prediction model.

3.2.2 Bp prediction model

The construction of the BP prediction model is similar to the SVM prediction model construction process. The core algorithm is different and will not be described in detail here.

The BP prediction model is better than the SVM model when the sigmoid function is selected, which is comparable to the SVM model when the rbf function is selected. Nevertheless, it is impossible to judge the pros and cons of the two methods. Therefore, the accuracy of the BP prediction model is also calculated. The accuracy of the BP prediction model is 67.62%, which is 69.57% compared with the SVM model using the "rbf" kernel function. The accuracy rate is small. Therefore, the subsequent stock forecasting model still uses the SVM algorithm.

3.2.3 Svm model predicts stock movements

In 2.2.1, the SVM prediction model has been used to predict the stock market trend in the coming day, using the predicted stock trend, conducting strategic backtesting and stock selection. The specific operation process is as follows:

First, use the model to judge whether the stock trend in the future day is rising or falling, and then formulating a trend to increase the target stock, otherwise the strategy of selling the target stock. Finally, execute the above strategy for a certain period of time to check the profit and loss of the stock. In the process of using the above strategy for backtesting, the stock returns reached 3.65%, the annual return reached 7.42%, and the maximum retracement was only 6.16%, so the strategy is effective.

4. STOCK PICKING MODEL COMBINED WITH STOCK RISK

4.1 Stock Risk Calculation

For the problem of stock risk calculation, the yield of the composite factor is first calculated, and then the stock alpha value is calculated by using the composite factor yield and the closing price. The alpha value describes the non-systemic risk of the security, so the stock is sorted according to the alpha value, and the ten stocks with the lowest alpha value are selected as the target stock purchase. Then repeat the steps in 3.2.3 again.

According to the data, from March 1, 2018 to September 30, 2018, the net value of 300 shares of Shanghai and Shenzhen stocks fell to 0.85, that is, the principal loss reached 15%. However, using the risk-averse investment model, the principal income is 1.52%, avoiding the losses caused by normal investment, and the maximum retracement control is 6.07%, so the improvement is effective.

5. CONCLUSIONS

In this paper, we studied the Shanghai and Shenzhen 300 stocks, and used the single factor analysis method to obtain the IC and IR of each factor and screen out 20 factors such as PB and EnterpriseFCFPS. After the above 20 factors were tested back, the ratio of Sharp was selected. Positive PB, PE and other 15 factors. When selecting the stock selection strategy, the SVM algorithm and the BP neural network algorithm are compared. The accuracy of the prediction model constructed by the SVM algorithm is better than that of the BP neural network algorithm. In the risk assessment, I chose to use the alpha value as the criterion for risk assessment, and finally selected ten target stocks such as Ping an Bank and Vanke A.

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Prediction Model of Forest Fire Based on Large Data Gra-Bp Neural Network

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Abstract: To provide early warning information for national forest fire prevention, prevention and control from the source is the fundamental method to prevent forest fire, Due to the huge amount of national forest fire data and related meteorological data, based on the related big data, this paper first finds the main meteorological factors and precursor meteorological factors from the huge amount of meteorological data by using the gray correlation method and makes a systematic analysis, then carries on the BP artificial neural network to output the quantitative classification index of forest fire, establishes the gra-bp neural network forest fire prediction Measuring model, Using the real data of this model to simulate and predict the forest fire level under certain weather conditions, the overall prediction accuracy is 71,99%, which shows that the model used in this paper can roughly meet the requirements of early warning of forest fire,

Keywords: Big data; Forest fire; Fire prediction; Grey correlation degree; Bp neural network

1. INTRODUCTION

In the era of big data, there are massive, high growth rate and diversified information assets everywhere. Forest fire is a kind of destructive natural disaster. In the past decades, many areas in the world have suffered huge losses in economy, people and other aspects due to forest fire. Using the new processing mode to analyze and extract effective information from the huge amount of forest fire data and find the potential law of fire data can prevent and control the occurrence of forest fire from the source.

Forest fires are often closely related to meteorological information. Fire data and related meteorological data have five characteristics of big data (proposed by IBM) - volume, velocity, variety, low value density and authenticity. In the existing research, most scholars are based on the analysis of fire statistical data, using the traditional statistical methods, summed up the simple laws and trends of fire occurrence such as time and region [1-5]. China is a vast region, because of the different regional environment, the correlation model or correlation equation on a small scale (such as a certain tree species, forest type) has a narrow application. Therefore, it is necessary and practical to do relevant research on a large scale. To find the potential law of fire data, prevention and control from the source is the fundamental method to prevent forest fire. The emergence of big data mining technology provides a new idea for the analysis and prediction of fire.

In this paper, the data analysis method of data mining is used. Firstly, the main meteorological factors and precursory meteorological factors are found from the huge amount of meteorological data by using the gray correlation method and analyzed systematically. Then, the gra-bp neural network forest fire prediction model is established by using the BP artificial neural network and the quantitative classification index of forest fire as the output. Finally, the mature prediction model is used to prevent similar fires in the prediction period in advance..

2. BIG DATA BACKGROUND OF FOREST FIRE

2.1 Survey and Analysis of Big Data of National Forest Fire

The data mainly come from the National Statistical Yearbook and the annual statistical yearbooks of provinces and regions. China is rich in forest resources with vast forest area, and it is also a country with frequent forest fires and more serious disasters. The general situation of forest fires in recent years is shown in Figure 1.

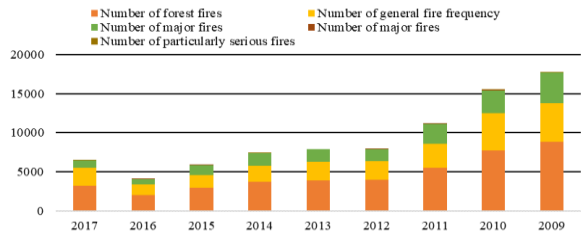

Figure 1. The system block diagram

Note: since 2009, according to the forest fire management regulations, forest fires are classified as “general forest fires, large forest fires, major forest fires and particularly major forest fires”. Statistics are derived from the national statistical yearbook.It can be seen from Figure 1 that from 2009 to 2017, the number of forest fires in China decreased from a relatively obvious trend. However, from 1949 to 2015, there have been 705000 forest fires in China, with an

area of 38.74 million hectares, 33000 people burned, and hundreds of billion yuan of direct economic loss [6-9]. Forest fire can be divided into man-made factors and natural factors because of its leading factors. The fire caused by natural factors also includes lightning strike fire and self ignition of combustibles in the forest. For China, more than 90% of the fires are caused by human factors. However, due to global warming in recent years, the increasing annual average temperature and the uneven distribution of regional precipitation in China, the forest fires caused by natural factors are also frequent. With the frequent occurrence of forest fires, national property, people's property and even people's safety have been seriously threatened. The establishment of a scientific model is of great practical significance to the prediction and prevention of national forest fires.

The data mainly comes from the National Statistical Yearbook and the annual statistical yearbook of provinces and regions. The distribution of the total number of forest fires in 31 provinces of China in 2005-2017 is shown in Figure 2, and the distribution of the total number of serious and major forest fires in 31 provinces of China in 2005-2017 is shown in Figure 3. The frequency of forest fires in China is obviously unbalanced in space. Generally speaking, the frequency of forest fires is more in the east than in the west, more in the South than in the north, and more in the north than in the north, and less in the north.

Figure 2. China's 31 provinces in 2005-2017 distribution of total forest fires

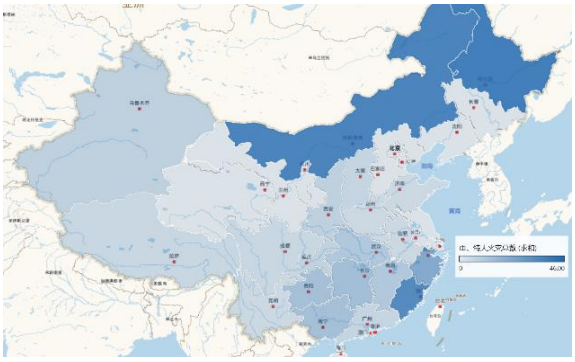

Figure 3. China's 31 provinces in 2005-2017 Distribution Diagram of the Total Number of Serious and Major Fires

It can be seen from Figure 2-3 that in 31 provinces of China, Hunan Province has the largest number of forest fires, followed by Sichuan Province, Zhejiang Province and Guizhou Province, while Heilongjiang Province has the largest number of serious and major forest fires, followed by Inner Mongolia and Fujian Province. When we study the correlation between meteorological factors and forest fires in China, we can use the data of these eight provinces as national representative data for display and analysis.

3. FOREST FIRE PREDICTION FRAMEWORK BASED ON GRA-BP NEURAL NETWORK

In recent years, with the birth of data mining technology, new theoretical models, such as artificial neural network, grey theory and cluster analysis, provide more methods and means for prediction problems, and the combination optimization of existing theoretical models is also commonly used to reduce the disadvantage of each model. In foreign countries, Bates J M [7] et al. First carried out a systematic study on the combined model prediction problem in 1969, which opened up a new area for the prediction problem field. In China, artificial neural network has become a hot topic in the field of prediction in recent years because of its better prediction results. Among them, Liu Su Bing [8] proposed a combined forecasting model tgma (1, 1) based on GM (1, 1), trigonometric model and time series ARMA model, and used the model to predict and analyze energy consumption; Yan Xiuhong [9] proposed an improved combined forecasting model of grey neural network based on data modification, and established multiple models by using the passenger volume time series of Nanchang railway station The results show that the combined optimization model is indeed helpful to improve the prediction accuracy; Jing Guoxun et al. [10] used artificial neural network to modify the residual of GM (1, 1), established the prediction model of urban fire accident, and also confirmed the feasibility of using the combined model to predict the fire accident with high accuracy.

The occurrence of forest fires is related to many factors, including climate change, fuel characteristics, fire prevention policies, and human activities [11]. Among them, meteorological elements are the most difficult to prevent. Forest fire has certain regional, temporal and complex non-linear characteristics. The time series prediction method of BP neural network can better explain the internal correlation between the complex non-linear time series than other prediction methods. Since the input and output of BP neural network model are the key points to be considered, it has strong robustness in autonomous learning. Therefore, grey relation analysis (GRA) can be introduced to modify the randomness and uncertainty in the network. The gra-bp model can achieve high prediction accuracy when the input and output show complex nonlinear characteristics.

2.1 Establishment of Gra-Bp Model

When building the model, first of all, it is necessary to

collect the relevant data of regional forest fire, analyze the data to extract effective feature information and quantify. The change trend of space-time characteristics and the law of meteorological fire risk elements are extracted. The quantitative characteristic information data sequence is regarded as the behavior sequence of grey system, and the absolute correlation degree between the sequences is calculated to form the correlation matrix, and the main meteorological factors and precursory meteorological factors that affect the occurrence of fire are found out. The temporal and spatial characteristics, main meteorological factors and precursory meteorological factors are used as input vectors of BP neural network, and the weights and thresholds of each layer of network nodes are found by training the network. Use the untrained samples to simulate the prediction and view the effect, and the research flow is shown in Figure 4.

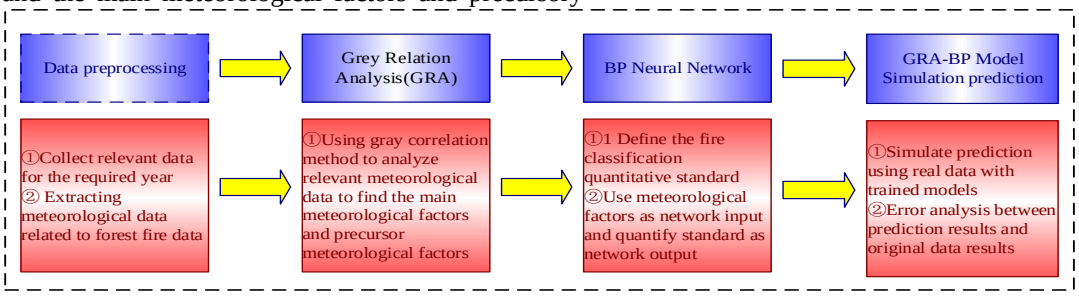

Figure 4. Research flow chart

2.2 Grey Correlation Analysis of Meteorological Factors and Forest Fire

2.2.1 Grey relation analysis (Gra)

For the factors between two systems, the measurement of the magnitude of the correlation that changes with time or different objects is called the correlation degree [12]. Grey system theory defines grey derivative and grey differential equation based on the concepts of correlation space and smooth discrete function, and then establishes dynamic model in the form of differential equation by using discrete data series, that is, grey model is a model in the form of differential equation which is established by using discrete random number to generate a number whose randomness is significantly weakened and whose regularity is relatively regular, so it is convenient to change it Research and description of chemical process [13]. An important part of grey system theory is grey relation analysis. Grey correlation analysis method is a method to measure the correlation degree of factors according to the similarity or dissimilarity degree of the development trend between factors, that is, "grey correlation degree".

Grey correlation analysis is a quantitative comparative analysis of development trend, which is a comparison of geometric shapes between geometric curves. That is to say, the closer the geometric shape is, the closer the development trend is, and the greater the correlation degree is [14].

1) gray correlation difference information space Δ_{GR}

The difference information is $\Delta_{0i}(k)=\left|x_0(k)-x_i(k)\right|$, $i\in I, k\in\{1,2,\cdots,n\}$ that is, the absolute value of the difference between the analysis value and the reference value; the distance space is $\Delta=\left\{\Delta_{0i}(k)\right\}$, that is, the collection of the absolute value of the difference between the analysis value and the reference value; the environment parameter is $\Delta_{0i}(\max)=\max_i\max_k(k)$, $\Delta_{0i}(\min)=\min_i\min_k(k)$. Among them, is the environmental parameter at the two poles of the distance space, and is the environmental parameter at the two poles.

Resolution coefficient: in order to exaggerate the significance of the difference in the correlation coefficient and improve the resolution effect of the correlation degree, the resolution coefficient ξ is derived, and the value is taken at [0, 1]. It has been proved that: in general, it should be greater than 0.4, usually between. In practical application, it is given artificially, usually $\xi=0.5$ [12].

To sum up, we can get the gray difference information space: $\Delta_{GR}=\left(\Delta,\ \xi,\ \Delta_{0i}(\max),\ \Delta_{0i}(\min)\right)$

2) grey correlation coefficient

According to the characteristics of index data, after data preprocessing $x_0(k)$, the comparison sequence is $x_1(k), x_2(k),\cdots, x_i(k)$, as follows:

$$r\left(x_0(k),x_i(k)\right)=\frac{\min_i\min_k\Delta_{0i}(k)+\xi\max_i\max_k\Delta_{0i}(k)}{\Delta_{0i}(k)+\xi\max_i\max_k\Delta_{0i}(k)} \tag{1}$$

3) grey correlation degree

The information of correlation coefficient is scattered, each value of which indicates the correlation degree of two series of a certain index. It shows the correlation degree of the two series in general and the weighted average value of all correlation coefficients The $r(x_0,x_i)$ correlation degree of the pair is absolute x_0 value correlation degree:

$$r(x_0, x_i) = \frac{1}{n}\sum_{i}^{n} r(x_0(k), x_i(k)) \quad (2)$$

Absolute value correlation degree, that is, the average value of each correlation coefficient of the comparison sequence and the reference sequence is used to quantitatively reflect the correlation degree of the two sequences.

2.2.2 Extraction of main meteorological factors and precursory meteorological factors

Meteorological factors are meteorological factors or conditions that affect the development and change of other things, including air temperature, air flow, air humidity, air pressure, etc. [15-16]. The influence of meteorological factors on forest fires caused by non-human factors is very important. The ignition point of various combustibles in the forest depends on the change of various meteorological conditions, such as humidity, temperature, precipitation, wind, etc. It is generally believed that in sunny, high temperature and windy weather, the water content of combustibles in the forest often drops below 40%, which is the most likely to cause forest fire [17].

1) analyze the correlation degree of meteorological factors

After the correlation analysis between the meteorological data collected from the above eight provinces and the fire data, the meteorological factors closely related to the occurrence of forest fires can be obtained as shown in Table 1.

Table 1 Correlation between some meteorological factors and forest fires in major provinces

Meteorological factor / Province	Hunan Province	Sichuan Province	Zhejiang Province	Guizhou Province	Heilongjiang	Inner Mongolia	Fujian Province
Rainfall	0.552	0.607	0.569	0.618	0.575	0.582	0.637
Average Temperature	0.509	0.491	0.537	0.526	0.512	0.627	0.591
Relative Humidity	0.401	0.419	0.449	0.456	0.422	0.438	0.403
Wind speed	0.516	0.464	0.404	0.448	0.382	0.406	0.412
Wind power	0.381	0.348	0.328	0.306	0.354	0.223	0.315
Sunshine duration	0.347	0.382	0.380	0.354	0.348	0.385	0.348

It can be seen from table 1 that for each province, although the correlation degree is different, the ranking of the correlation degree of each meteorological factor is the same. Rainfall is closely related to forest fire, followed by average temperature, relative humidity and wind speed.

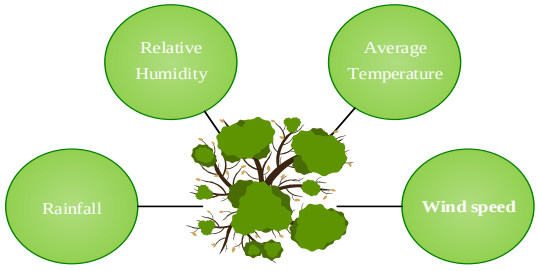

Figure 5 Main meteorological factors

In conclusion, rainfall, average temperature, relative humidity and average wind speed are selected as the main meteorological factors in this study, as shown in Figure 5.

2.3 Optimized Bp Neural Network Framework

BP network is a feedforward network without feedback. The neurons in the network are arranged in layers. The output of neurons in each layer is transmitted to the next layer, and the output is achieved by the connection weight [18]. The working process is divided into two parts: learning training and simulation prediction. The key of calculation is the error back propagation process in learning training, which is completed by minimizing the objective function.

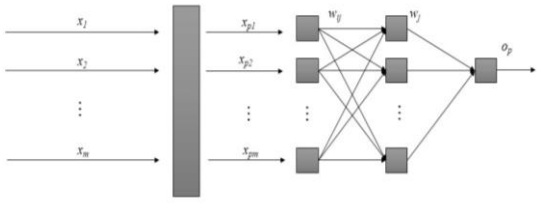

Figure 6 Topological structure of neural network model

An improved three level BP network learning algorithm [19], like Figure 6, first initializes network and learning parameters, gives random values between each connection weight coefficient w_{ij}, w_j and threshold value θ_j, and then θ randomly $\left[-\frac{2}{m}, \frac{2}{m}\right]$, $i = 1, 2\cdots, m, j = 1, 2\cdots, n$ selects one mode $X_P = [x_{p1}, x_{p2}\cdots, x_{pm}]$ pair to d_p provide to the network.

The output of each hidden unit is calculated by using input X_P, connection weight coefficient w_{ij} and threshold value θ_j:

$$o_{pj} = f(net_{pj}) = f\left(\sum_{i=1}^{m} w_{ij} - \theta_j\right) = 1/\left\{1 + \exp\left[-\sum_{i=1}^{m} w_{ij} - \theta_j\right]\right\}, i = 1, 2\cdots, m, j = 1, 2\cdots, n$$

Hidden layer output

$o_p = f(net_p) = \sum_{j=1}^{m} w_j o_{pj} - \theta, j = 1, 2\cdots, n$. The correction error of the output layer d_p is calculated by the expected output of the network and the actual

output o_p of the network

$$\sigma_p = (d_p - o_p) o_p (1 - o_p) \quad (3)$$

w_j, σ_p, o_{pj} calculate the correction error of hidden layer:. $\sigma_{pj} = o_{pj}(1 - o_{pj})\sigma_p w_j$

w_j, σ_p, o_{pj} and θ calculate the new connection weight and output neuron threshold between the next hidden layer and output layer:

$$w_j(t+1) = w_j(t) + \eta(t)\sigma_p o_{pj} + \alpha[w_j(t) - j(t-1)] \quad (4)$$

$$\theta(t+1) = \theta(t) + \eta(t)\sigma_p + \alpha[\theta(t) - \theta(t-1)] \quad (5)$$

$$\eta(t) = \eta_o\left(1 - \frac{t}{T+M}\right) \quad (6)$$

Where, η_O is the initial step size; t is the number of learning; T is the total number of iterations; M is a positive number, $\alpha \in (0,1)$ is the momentum coefficient, generally about 0.9. Then, new connection weights $w_{ij}, \sigma_{pj}, x_{pj}$ and θ hidden neuron thresholds between the next input layer and hidden layer are calculated with and

$$w_{ij}(t+1) = w_{ij}(t) + \eta(t)\sigma_{pj}x_{pj} + \alpha[w_{ij}(t) - w_{ij}(t-1)] \quad (7)$$

$$\theta_j(t+1) = \theta_j(t) + \eta(t)\sigma_{pj} + \alpha[\theta_j(t) - \theta_j(t-1)] \quad (8)$$

Finally, the next learning mode pair needs to be selected randomly, submitted to the neural network again, and then recalculated the hidden layer unit output. All m the mode pairs are trained until they meet the requirements of learning and training.

3. SIMULATION PREDICTION OF THE MODEL

In recent years, the forest fire data and the main meteorological factor data of fire in corresponding years in eight provinces and regions as the representative are collected. Taking Hunan Province as an example. According to the statistics of forest fires in Hunan Province from 2005 to 2015, there are forest fires in all seasons of the year, mainly from October to April of the second year, during which the average temperature is not the highest, the rainfall is less, the relative humidity is lower, and the wind speed is smaller.

Then, the correlation degree of main meteorological factors is taken as the weight proportion standard, the product of main meteorological factor data and weight is taken as the input layer variable of neural network, and the quantitative index of forest fire classification level is shown in Table 2 as the output result of network.

The quantitative index of forest fire classification level locates an interval instead of a number, which can increase the prediction accuracy. Focusing on the practicability of the model, different provinces collect different year data in the modeling process. Subjectively, the data before 2015 is taken as the learning training sample to determine the model parameters, and then some data in 2015 are extracted to test the validity of the model.

Table 2 Quantitative index of forest fire classification level

Classification of forest fire	General fire	Larger fire	Catastrophic fire	Fire disaster
Quantitative index	[1, 5]	[6, 10]	[11, 15]	[16, 20]

After the neural network structure of the above model is established, the training parameters of the model need to be initialized. At the beginning, the initial value of the network weight is set by Xavier function [20], and the bias item is set to 0; the learning rate is set by the exponential decay method, and the initial learning rate is 0.1, and the decay rate is 0.99; then the weather data and fire data of 2005-2014 are brought into the model for learning and training, with a total of 200 models Each time, 500 samples are randomly selected from the training set. When the training accuracy reaches 1.0, as shown in Figure 8, the model training is completed. The software environment in which the model runs is Python + tensor flow in Figure 7.

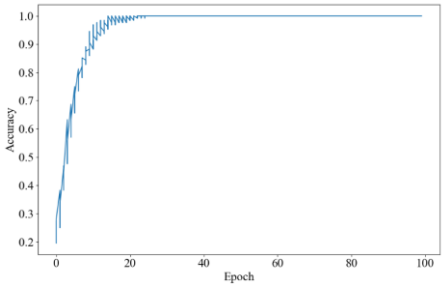

Figure 7 Training accuracy in iteration

Then the simulation test data can be brought in for simulation and comparison, and the comparison diagram of the real value of fire level and the predicted value of fire level can be obtained, as shown in Figure 8.

It is not difficult to see in the figure that when the predicted value is the same as the real value, the red and green coincide, and the part that does not coincide with the real value is the error. Finally, the accuracy of the predicted value is calculated by the classification of the predicted results, and the simulation accuracy of 2015 forest fire data obtained by this model is shown in Table 3.

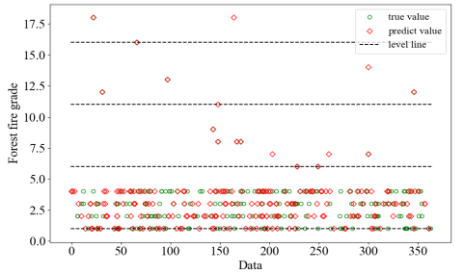

Figure 8 Comparison between the real value of fire

rating and the predicted value of fire rating

Table 3 Prediction accuracy of forest fire classification

Classification of forest fire	General fire	Larger fire	Catastrophic fire	Fire disaster	Classification of forest fire
Average prediction error	72.09%	77.78%	71.42%	66.67%	71.99%

It can be seen from Table 3 that the prediction accuracy of general and large forest fires is greater than that of special and major forest fires. There may be some reasons why the data volume of special and major forest fires is too small, which is also related to the above fire classification and quantification standards. The overall prediction accuracy can reach 71.99%, which shows that the model used in this paper can roughly meet the requirements of early warning of forest fires.

4. CONCLUSION

China has a large forest area, and the importance of forest resources is more and more obvious. In recent years, although the number of forest fires in China has a downward trend, the overall number is slightly higher than that in other developed countries. The loss caused by forest fire is immeasurable. In this paper, the grey correlation method and BP artificial neural network are used to mine the internal relationship between weather data and fire data of eight representative provinces and regions, and the gra-bp neural network forest fire prediction model is established, and the real data is used for simulation.

In addition to the influence of natural factors, various human factors are also very important. This study is limited to natural forest fires. Due to the complexity of large-scale processing of forest fire data and meteorological data, as well as the subjective factors in the determination of forest fire quantitative classification level, there are still some imperfections in this study. For the real forest fire prediction, only suggestions can be provided, and further in-depth mining is needed to improve its accuracy.

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Research on Pressure Control of High Pressure Tubing Based on Genetic Algorithm

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Abstract: Many fuel engines work on the basis of fuel entry and high pressure fuel lines, The intermittent work of this process leads to changes in the pressure inside the high pressure fuel line, In the high-pressure oil pipe, the pressure is stable, how to adjust the opening time of the one-way valve and determine the angular velocity of the cam under the needle control of the injector, this paper analyzes the two processes of discharge decompression and injection supercharging, The relationship between fuel parameters and fuel pressure is determined, and the objective function and constraints are established, The genetic algorithm is used to solve the opening time of the check valve, The relationship between fuel pressure and time in the process of fuel entering and discharging is further determined, The objective function is determined by the least squares method, and the over-determined nonlinear function is finally solved to obtain the cam angular velocity variation

Keywords: Genetic algorithm; Overdetermined; Nonlinear equation; Least squares

1. INTRODUCTION

Just as the intermittent work of the high-pressure fuel system [1] causes the pressure in the high-pressure fuel pipe to change, the amount of fuel injected varies, which affects the efficiency of the engine. This paper studies the actual situation of a high-pressure fuel pipe. The inner cavity has a length of 500mm, an inner diameter of $10mm$, and a small diameter of the oil supply inlet is $1.4mm$. The one-way valve is a switch that controls the length of the oil supply. It is closed for $10ms$ every time it is opened; the injector operates 10 times per second. The injection time is $2.4ms$, and the injection rate of the injector in $2.4ms$ is also known. The high pressure oil pump has a constant pressure of $160PMa$ at the inlet and the initial pressure in the high pressure fuel pipe is $100PMa$. Study on the opening time of the check valve by stabilizing the pressure in the high pressure oil pipe at about 100 MPa;

The fuel for the high pressure fuel line comes from the plunger chamber outlet of the high pressure oil pump, and the fuel injection is controlled by the needle valve of the fuel injector. The pressure oil process of the plunger of the high pressure oil pump is given. It is found that the cam drives the plunger up and down, and the relationship between the cam edge curve and the angle is known. It can be seen that when the plunger moves upward, the fuel in the plunger chamber is compressed. When the pressure in the plunger chamber is greater than the pressure in the high pressure oil pipe, the one-way valve connected to the plunger chamber and the high pressure oil pipe is opened, and the fuel enters the high pressure oil pipe. The inner diameter of the plunger chamber is $5mm$. When the plunger moves to the top dead center position, the residual volume of the plunger chamber is $20mm^3$; when the plunger moves to the bottom dead center, the low pressure fuel will fill the plunger chamber, low pressure fuel The pressure is $0.5MPa$. Understand the structure of the injector. When the lift of the needle valve is 0, the needle valve is closed. When the lift is greater than 0, the needle valve is opened, the fuel flows to the orifice and is sprayed through the orifice; it is known that the needle is injected in one injection cycle. Valve lift versus time. In this paper, the pressure in the high-pressure oil pipe should be controlled at about $100PMa$, and the angular velocity of the cam should be studied.

1.1 Analysis of the Problem

It is required that the pressure in the high pressure oil pipe is stable at about 100 MPa; the flow rate of the pressure and the change in the pressure change and the change in the density of the oil flowing through the high pressure oil pipe are mathematically adjusted to obtain the fuel pressure and volume. The relationship between the relationship, fuel density and time, the whole process is divided into two parts into the pressurization process and the discharge decompression process, then the solution of the two processes is as follows: in the process of discharge decompression, through the in and out The flow rate of the high pressure fuel line determines the expression of the final fuel pressure.

1.2 Solving the Problem

Since the amount of change in pressure of the fuel is proportional to the amount of change in density, the proportionality factor is$\frac{E}{\rho}$ which is:

$$\frac{\Delta P}{\Delta \rho} = \frac{E}{\rho} \quad (1)$$

Where ρ is the density of the fuel, and when the pressure is $100MPa$, the density of the fuel is $0.850\ mg/mm^3$. E is the modulus of elasticity.

It is known that the elastic modulus E has a certain relationship with the pressure. The MATLAB software

can be used to obtain the relationship between the elastic modulus and the pressure after the elastic modulus pressure data is fitted Figure 1:

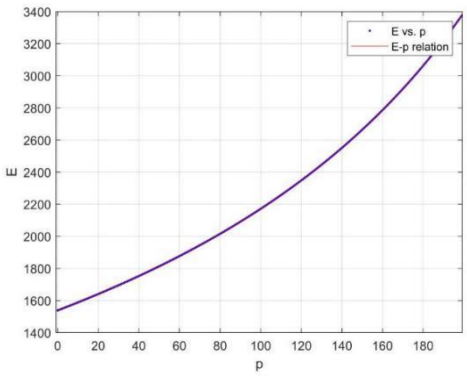

Figure 1 Relationship between elastic modulus and pressure

The final expression of the elastic modulus and pressure function is:

$$\mathrm{E}(P) = 4.064 \times 10^{-12}P^6 - 1.24 \times 10^{-9}P^5 + 10^{-7}P^4 + 9.352 \times 10^{-6}P^3 + 0.01164P^2 + 4.956P + 1538 \quad (2)$$

It is known that the flow rate into and out of the high pressure oil pipe is:

$$\mathrm{Q} = \mathrm{CA}\sqrt{\frac{2\Delta P}{\rho}} \quad (3)$$

Where Q is the amount of fuel flowing through the small holes per unit time; $C = 0.85$ is the flow coefficient; A is the small hole area; ΔP is the pressure difference between the two small holes;

In this paper, the high pressure tubing pressure change [2-4] is divided into two processes, namely, the injection pressurization process and the discharge decompression process. The derivation process is as follows:

2. INJECTION INTO THE PRESSURIZATION PROCESS

The above-mentioned fuel pressure and elastic modulus function, fuel pressure change and density change ratio function can be obtained:

$$\begin{cases} \mathrm{f}(P.E) \\ \dfrac{P_0 - P_1}{\rho_0 - \rho_1} = \dfrac{E}{\rho} \\ P = 100MPa \\ \rho = 0.85\,mg/mm^3 \end{cases} \quad (4)$$

The relationship between fuel density and pressure can be obtained by the simultaneous equations $\mathrm{f}(\rho, P)$

Calculating the flow expression $\mathrm{Q} = \mathrm{CA}\sqrt{\frac{2\Delta P}{\rho}}$ into and out of the high pressure oil pipe

$$\frac{dV}{dt} = CA\sqrt{\frac{2\Delta P}{\rho}} \quad (5)$$

Both sides are multiplied by ρ at the same time, and $\Delta\mathrm{P}$ is $160 - \mathrm{P}$

$$\frac{dm}{dt} = CA\sqrt{2\rho(160 - \mathrm{P})} \quad (6)$$

And because $\mathrm{d}\rho = \frac{dm}{V}$, so

$$\frac{d\rho}{dt} = \frac{CA}{V}\sqrt{2\rho(160 - \mathrm{P})} \quad (7)$$

Again the simultaneous equations:

$$\begin{cases} f(\rho, P) \\ \dfrac{d\rho}{dt} = \dfrac{CA}{V}\sqrt{2\rho\Delta P} \end{cases} \quad (8)$$

The simultaneous result shows the relationship between fuel density and time $\mathrm{f}(\rho, t)$

Simultaneous equations:

$$\begin{cases} f(\rho, P) \\ f(\rho, t) \end{cases} \quad (9)$$

The simultaneous result shows the expression $\mathrm{f}(P, t)$ of the fuel pressure versus time during the injection of the high pressure fuel pipe.

3. SPRAY DECOMPRESSION PROCESS

It is known that the injector operates 10 times per second, each injection time is $2.4ms$, and the relationship between the rate at which the injector B is injected outward and the time during operation:

The fuel injection rate of the injector [3] is divided into three parts: : $0{\sim}0.2\mathrm{ms}, 0.2{\sim}2.2\mathrm{ms}, 2.2{\sim}2.4\mathrm{ms}$, and the flow rate of the high pressure oil pipe entering and exiting each stage is expressed as $\mathrm{Q} = \mathrm{CA}\sqrt{\frac{2\Delta P}{\rho}}$

Multiply Q on both sides of the formula to get:

$$Q^2 = CAQ\sqrt{\frac{2\Delta P}{\rho}} \quad (10)$$

And because A is the area of the small hole, then $\mathrm{V} = \mathrm{AQ}$, then the expressions of each time are:

$$\begin{aligned} Q_1^2 &= CV_1\sqrt{\frac{2(P_0 - P_1)}{\rho}} \\ Q_2^2 &= CV_2\sqrt{\frac{2(P_1 - P_2)}{\rho}} \\ Q_3^2 &= CV_3\sqrt{\frac{2(P_2 - P_3)}{\rho}} \end{aligned} \quad (11)$$

P_0 is the pressure of the high pressure oil pipe at time 0, P_1 is the pressure at $0.2ms, P_2$ is the pressure at $2.2ms, P_3$ is the pressure at $2.4ms$; and $Q^2 = CAQ\sqrt{\frac{2\Delta P}{\rho}}$ is transformed It becomes the function relation of time with respect to pressure. Because of the irregularity of the function, it is divided into three processes, which use $V_1, V_2, V_3, Q_1, Q_2, Q_3$ to represent the volume and fuel injection rate of the three parts.

$$P = P_0 - \frac{\left(\frac{Q^2}{CV}\right)^2 \rho(P_0)}{2} \quad (12)$$

Due to the change in injection volume during the

decompression process [3-7] the relationship between fuel pressure and volume can be divided into the following three segments:

$$\begin{cases} P = P_0 - \dfrac{\left(\frac{Q^2}{CV}\right)^2 \rho(P_0)}{2} \\ Q_1 = 100t \\ V_1 = 50\left(\dfrac{t}{i}\right)^2, 100(i-1) \le t \le 100(i-1) + 0.2 \\ Q_2 = 20 \\ V_2 = 20\left(\dfrac{t}{i} - 0.2\right) + 50\left(\dfrac{t}{i}\right)^2 \\ \quad 100(i-1) + 0.2 \le t \le 100(i-1) + 2.2 \\ Q_3 = -100t + 240 \\ V_3 = 20\left(\dfrac{t}{i} - 0.2\right) + 50\left(\dfrac{t}{i}\right)^2 - 50\left(\dfrac{t}{i} - 2,2\right)^2 \\ 100(i-1) + 2.2 \le t \le 100(i-1) + 2.4 \\ C = 0.84\, mg/mm^3 \\ P_0 = P(t_o) \end{cases} \tag{13}$$

The expression of fuel pressure and time can be obtained by substituting the high-pressure fuel pipe flow and volume in the above expression into the fuel pressure expression. Based on the above formula, the relationship between pressure (fuel pressure) and time, fuel density versus time, and pressure (fuel pressure) versus fuel density can be known.

By arranging the above process, the objective function and constraints for solving the opening time of the check valve can be obtained by calculating the cycle of 1 second:

$$\text{Min}\left(\int_{(t_0+10)(j-1)}^{j(t_0+10)-10} P_u(t)dt - \int_0^{1000} P_d dt\right)^2$$

$$\text{s.t}\begin{cases} P_{0,j} = f(P, j(t_0+10) - 10) \\ P_d = P_0 - \dfrac{\left(\frac{Q^2}{CV}\right)^2 \rho(P_0)}{2} \\ j > 0 \\ C = 0.85\, mg/mm^3 \\ t_0 > 0 \end{cases} \tag{14}$$

This paper uses the genetic algorithm [4] to solve, using the genetic operators of natural genetics to combine, cross and mutate, to produce a population representing the new solution set, this process will lead to the population like the evolution of the natural world, will make the generation of the next generation The previous generation is more adaptable to the new environment. The optimal individual in the last generation population is developed and can be used as the approximate optimal solution of the problem, and the nonlinear function is solved. so when the pressure in the high-pressure oil pipe is stable at about $100MPa$, the duration of the one-way valve opening each time is $0.37ms$;

4. PAIRS OF CAM MODEL ESTABLISHMENT AND SOLUTION

4.1 Problem Analysis

The problem process is also simplified into two parts, namely, the injection pressurization process and the discharge decompression process. For the supercharging process, the formula can be used to derive the relationship between fuel pressure, density, time, elastic coefficient and other fuel parameters. , P is a functional relationship, that is, $P_u(t, \omega)$; for the decompression process, the flow rate formula of the time and the injection rate can be obtained by using the flow formula of the high-pressure oil pipe, that is, $Q(t)$, the same problem One can calculate $P_d(t)$. The time integral of pressure is established and the objective function is obtained by the least squares method. Finally, the genetic algorithm is used to solve the overdetermined nonlinear equation.

4.2 Problem Solving

For the right injector, its working principle [5] is when the needle lift is 0, the needle valve is closed, the injector is not working; when the needle lift is greater than 0, the needle valve is open and the injector is working. From the first question, it is known that the fuel injection period of the injector is$100ms$.

(1) Calculation of the effective area of the injector

Simplify the nozzle of the injector and establish a reasonable coordinate system.

The effective flow area of the injector is: when the needle lift is greater than 0, the difference between the seal seat and the needle at the same height in the vertical direction is equivalent to the area of a ring, namely:

$$S_Z = \pi Z\left(d_a - 0.5Z - sina_f\right)sina_f$$

In the formula, S_Z is the effective area of the injector; a_f is the half angle of the sealing seat; d_a is the diameter of the smallest orifice; Z is the lift of the needle valve;

(2) Flow rate of high pressure oil pipe during the process of decompression

It is known that the flow rate of the high pressure oil pipe is $Q_1 = \text{CA}\sqrt{\frac{2\Delta P}{\rho}}$, and $\rho = 0.84\, mg/mm^3$, $\Delta P = P_0 - P_1$ is substituted:

$$Q_1 = CS_Z\sqrt{\frac{2(P_0 - P_1)}{\rho}} \tag{15}$$

Bring the above-mentioned effective area of the injector into the formula:

$$Q_1 = C\pi Z\left(d_a - 0.5Z - sina_f\right)\sin a_f\sqrt{\frac{2(P_0 - P_1)}{\rho}}$$

In the same way, according to the attached table, the function of the needle lift as a function of time is obtained, and then the needle lift Z is brought into the effective area of the injector to obtain the equation of the injection flow rate with respect to time t.

The fuel at the high pressure oil pipe A comes from the upper port of the plunger of the high pressure oil pump, the oil pump plunger moves to the top dead center, compresses and pressurizes the low pressure fuel, and

after half a cycle, the plunger moves to the bottom dead center, and the low pressure fuel fills the column. The plug cavity is followed by a cyclic cycle. When the oil pressure of the plunger chamber exceeds the pressure of the oil outlet valve spring and the internal pressure of the high pressure oil pipe, the high pressure oil pump supplies oil to the oil pipe, so that the pressure in the high pressure oil is continuously increased. Periodic injection work has also begun [5].

The first step: determine the shape of the cam

It is known that Appendix 1 is the relationship between cam edge curve and angle. According to the known MATLAB, the polar coordinate system is used to draw the cam shape as shown in the following Figure 2:

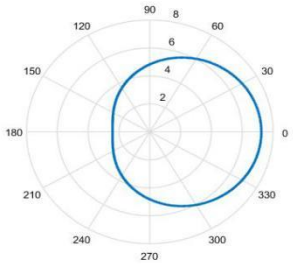

Figure 2. Cam shape diagram

The cam edge curve and angle change can be clearly seen in the above figure.

The Fourier function fitting process is performed on the relationship between the curve and the angle of the known cam edge again.

The relationship between polar and polar angles is obtained by Fourier function fitting:

$$y = 4.826 + 2.413\cos\theta$$

During the pressure oiling process of the plunger of the high-pressure oil pump, the cam drives the plunger to move up and down, and the change of the cam diameter is consistent with the height of the plunger moving up and down, and the expression of the relationship between the polar diameter and the polar angle function is obtained, that is, the plunger The speed of moving up and down:

$$v = -2.314\omega\sin(\omega t) \quad (16)$$

Deriving the rate function expression again, the acceleration of the plunger moving up and down:

$$a = -2.314\omega^2\cos(\omega t) \quad (17)$$

It is known that the residual volume of the plunger chamber is 20 mm^3, and its diameter is 5 mm. The height of the plunger chamber when the plunger reaches the bottom dead center can be determined as follows:

$$h = \frac{V}{\frac{d^2}{2}\pi} \quad (18)$$

The plunger cavity height is $1.0186mm$ when the available plunger reaches the bottom dead center.

The simultaneous equations through the above expression:

$$\begin{cases} m = \rho_0 V \\ V_1 = V - hS \\ S = \left(\frac{d}{2}\right)^2 \end{cases} \quad (19)$$

The simultaneous equations can be used when the high pressure tubing pressure is $100PMa$, and when the check valve is opened, the height of the plunger chamber is $h = 0.0618mm$.

By substituting the height value at this time into the polar diameter and polar angle function expression, the pole diameter of the cam when the check valve is opened is $2.4748mm$..

Considering that each time the fuel enters the oil pipe, it will cause a change in the fuel pressure in the oil pipe. Therefore, each time the fuel pressure changes, the height h of the plunger chamber is different each time the check valve is opened, so this article seeks to refer to $f(w,p,t)$, establish the pressure function of each cam cycle [6], and then use equation (3) to find the pressure increase function of the oil pipe.

According to the concept that the amount of pressure change is proportional to the density, when the initial pressure of the fuel in the high-pressure oil pump is $0.5PMa, \rho = 0.7984\, mg/mm^3$.

$$\begin{cases} h = \Delta y = -2.314\omega\sin(\omega t) * t - 2.431 \\ d\rho = \frac{CA}{V}\sqrt{2\rho(p - p(\rho))}dt \\ \rho(p) = \frac{E(p) * 0.85}{E(p) - p + 100} \\ \rho(h) = \frac{V_0 * \rho_0}{V_0 - h} \\ C = 0.85, \rho_0 = 0.7984, V_0 = 20 \\ A = (\frac{1.4}{2})^2\pi \\ V = (\frac{10}{2})^2\pi * 500 \end{cases} \quad (20)$$

Therefore, it is easy to obtain the functional relationship of $f(w,p,t)$, and the finishing can be obtained $p(w,t)$.

Similar to the problem 1, the optimal function is established by using the pressure increment of the fuel high-pressure fuel pipe and the integral of the fuel and the reduction of the high-pressure fuel pipe pressure and the least squares method, and the genetic algorithm is used to solve the optimal solution [7]. The genetic algorithm is realized by MATLAB programming. As the number of iterations increases, the result is closer to the optimal solution, and the objective function obtains the most stable and reliable solution. At this time, the angular velocity of the cam is $\omega = 27.5\,rad/s$, and the pressure in the high-pressure oil pipe is as stable as possible at about $100MPa$

5. CONCLUSIONS

By solving the high pressure oil pipe pressure is stable at about $100MPa$; the fuel system is divided into the injection pressurization process and the discharge decompression process, respectively analyzing the two

processes to determine the fuel pressure and Time-varying relationship, finally using the relationship to establish the objective function and constraints of the opening time of the one-way valve, using the genetic algorithm to solve the one-way valve opening $0.37ms$ high pressure tubing pressure maintained at $100MPa$; It can be concluded that the one-way valve opening time is closely related to the pressure in the high-pressure fuel pipe during the solution process. Combined with the working principle of the high-pressure oil pump and the injector, the angular velocity of the cam is determined, and the pressure in the high-pressure fuel pipe is stabilized at about $100MPa$; the fuel system is also divided into a supercharging and decompression process, and the fuel in each of the two processes is first derived. The function expression between the parameters obtains the relationship between the fuel pressure and the time in the two processes. The objective function is obtained by the least squares method. The genetic algorithm is used to solve the overdetermined nonlinear function when $\omega = 27.4\,rad/s$. The pressure inside the high pressure oil pipe is stable. In this process, analyze the working principle of the injector and understand the law of cam rotation.

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Smart Introduction Talent Program Based on Grey Prediction and Fuzzy Comprehensive Evaluation

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Abstract: How to give full play to the ability of all types of talents in the society is a major problem in today's society, This paper uses gray prediction to determine the changes in China's employment situation and market talent demand in the next three years, Based on this result, fuzzy comprehensive evaluation is adopted, Based on the analysis and based on the analysis results, some reasonable talents and talents introduction programs such as reducing the proportion of political personnel are obtained
Keywords: Talent introduction; Grey prediction; Fuzzy comprehensive evaluation

1. INTRODUCTION

In the 21st century, talent competition has become more intense. General Secretary Xi Jinping of our country has repeatedly mentioned the issue of "talent" in the report of the 19th National Congress and has emphasized its importance several times [1]. Talent is the driving force behind the city's innovation and development, and it is the main driving factor for urban innovation and diffusion. In the past few years, attracting talent has been one of the highlights of many cities because they can learn better skills, make better products and master better management methods in a short period of time. In today's cities, in addition to market recruitment, talents are also conducted through open recruitment activities such as the Internet and campus recruitment fairs.

How to optimize talent utilization so that it can fully realize its potential has become a key factor in the talent strategy. For such problems, many domestic and foreign research scholars have conducted research and discussion on it. TongFeng [2] proposed that Chinese universities should strengthen their distinctive awareness in research and stimulate the innovation factors of talents and talent teams in their creation to enhance their creative initiative. From the perspective of talent innovation, Chinese universities should learn the talent strategy of other countries in the world and eliminate the mechanization of talent use. In view of the blindness of talent investment, Chinese research universities should increase their own investment awareness, increase investment precision, and reduce the waste of funds while ensuring sufficient academic funds. MoQian [3] combined with the three-dimensional policy tools, the government should increase the talent market and reduce the uncertain factors in the talent market by introducing talents and controlling the talent market. HuWenjing [4-6] studied the impact of the introduction of large-scale talents in the western region based on the impulse process, and proved that the introduction of talents in the western region is conducive to the development of the local economy but affects local employment issues and income issues. There are uncertainties in the follow-up of the persistence and stability of large-scale talent introduction.

This paper will use the grey forecasting model to derive the trend of employment and combine it with the fuzzy comprehensive evaluation model to obtain a better talent wisdom introduction program.

2. ESTABLISHMENT AND SOLUTION OF GREY PREDICTION MODEL

2.1 Establishment of Grey Prediction Model

Establish a first-order linear differential equation for $x^{(\mathrm{t})}$

$$\frac{dx^{(1)}}{dt} + \mathrm{a}x^{(1)} = \mathrm{u}$$

Where a is the development coefficient and u is the gray action amount, and remembers $\hat{\alpha}=\begin{pmatrix} a \\ u \end{pmatrix}$.

The mean generated B and the constant vector Y_n are generated for the accumulated data.

$$\mathrm{B}=\begin{bmatrix} 0.5(x^{(1)}(1)+x^{(1)}(2)) \\ 0.5\left(x^{(1)}(2)+x^{(1)}(3)\right) \\ \cdot \\ \cdot \\ 0.5(x^{(1)}(\mathrm{n}-1)+x^{(1)}(\mathrm{n})) \end{bmatrix} \quad (1)$$

$$Y_n = (x^{(0)}(2), x^{(0)}(3), \ldots, (x^{(0)}(\mathrm{n}))^T \quad (2)$$

Solving the grey parameter $\hat{\alpha}$ by least square method

$$\hat{\alpha} = \begin{pmatrix} a \\ u \end{pmatrix} = (B^T B)^{-1} B^T Y_n \quad (3)$$

Substituting the gray parameter $\hat{\alpha}$ into (2), solve it and get:

$$\hat{x}^{(1)}(\mathrm{t}+1) = \left(x^{(0)}(1) - \frac{u}{a}\right) e^{-\mathrm{at}} + \frac{u}{a} \quad (4)$$

The function expressions $\hat{x}^{(1)}(\mathrm{t}+1)$ and $\hat{x}^{(1)}(\mathrm{t})$ are discretized, and the difference between the two is used to restore the $x^{(0)}$ original sequence, and the approximate data sequence $\hat{x}^{(0)}(\mathrm{t}+1)$ is obtained as follows:

$$\hat{x}^{(0)}(\mathrm{t}+1) = \hat{x}^{(1)}(\mathrm{t}+1) - \hat{x}^{(1)}(\mathrm{t}) \quad (5)$$

2.2 Solution of Grey Prediction Model

According to the National Bureau of Statistics's 2008-2017 Chinese students' employment status [5-7], as shown in Table 1 and Figure 1, the Matlab software is used to predict the employment situation of Chinese students in the next three years.

Table 1. Employment rate of chinese students in 2008-2017

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
employment rate	0.855	0.866	0.896	0.902	0.909	0.914	0.921	0.917	0.916	0.919

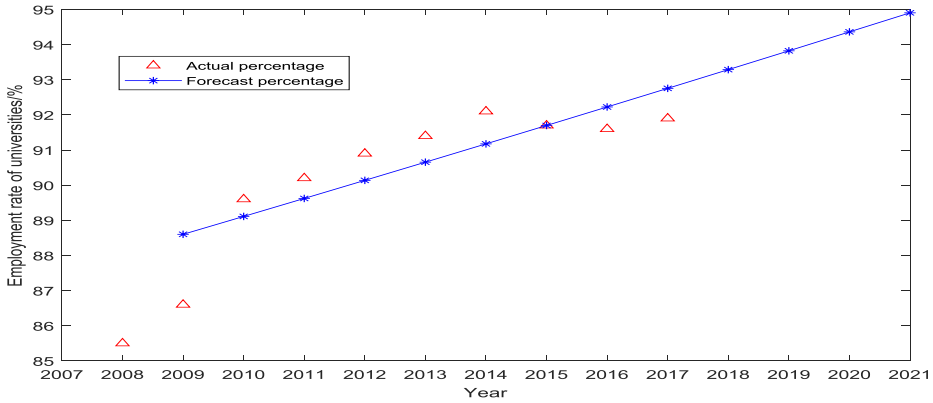

Figure 1. Trends in employment rate of chinese students in the next three years

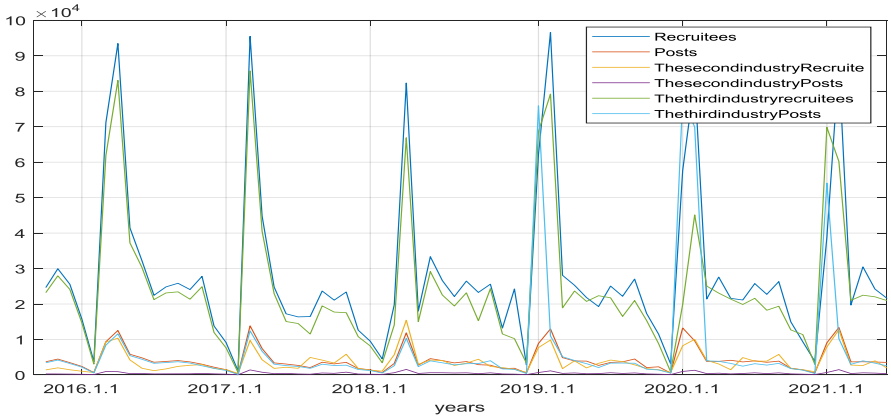

Figure 2. Trends in market talent demand in the next three years

It can be obtained from the combination of Figure 1 and Figure 2 that the employment rate of Chinese college students in the next three years is on the rise.

3. PHENOMENON ANALYSIS BASED ON FUZZY COMPREHENSIVE EVALUATION MODEL

We selected Hebei Province for analysis, and now Hebei Province is about three lines [1], modeling and quantifying the employment situation of college students in Hebei under the new employment model.

3.1 Model Establishment

Let the judgment object be P: its factor set U = $\{u_1, u_2, \ldots, u_m\}$, and judge the level set V = $\{v_1, v_2, \ldots, v_m\}$. The evaluation matrix is obtained by fuzzy evaluation of each factor in U according to the grade index of the evaluation set [6]:

$$R = \begin{bmatrix} r_{11} & \cdots & r_{1m} \\ \vdots & \ddots & \vdots \\ r_{n1} & \cdots & r_{nm} \end{bmatrix} \quad (6)$$

Where r_{ij} represents the degree of membership of U_i with respect to V_j. (U, V, R) constitutes a fuzzy comprehensive evaluation model. After determining the importance indicators (weights) of each factor, it is recorded as $A = \{a_1, a_2, \ldots, a_n\}$, which satisfies $\sum_{i=1}^{n} a_i = 1$

synthesis:

$$\bar{B} = A \times R = \left(\overline{b_1}, \overline{b_2}, \ldots, \overline{b_m}\right) \quad (7)$$

3.2 Model Solving

Evaluation factors: employment growth, new employment methods, traditional secondary industry employment, traditional tertiary industry employment. Evaluation factor value: employment growth rate Emerging mode employment success rate Traditional industry employment growth rate.

It can be seen from the above Table 2 that the overall employment rate is rising, the employment rate of the secondary industry is slightly declining, and the tertiary industry has a larger auxiliary increase.

Table 2. Employment rate of various industries in recent years

Year	2015	2016	2017	2018	2019	2020
The Whole	14.30%	14.71%	14.79%	13.79%	16.31%	16.08%

The Second	16.07%	15.11%	14.66%	14.95%	14.42%	14.29%
The Third	14.97%	15.69%	15.22%	24.04%	36.80%	39.78%

It can be concluded that the emerging employment mode has increased the employment rate. With great contributions, we can understand that the emerging employment channels are all aspects of the service industry, and further demonstrate our exploration of the overall employment rate for emerging employment. Through the exploration of data in Hebei Province [7], it can be learned that 13.68% of graduates tend to start a business, 16.38% of graduates will choose to apply for civil servants and university village officials, but the success rate of these two jobs is extremely low. According to the data that can be queried in previous years, it can be estimated that the percentage is about 4.65%. At the same time, the difficulty of starting a business can be estimated, and the probability is roughly 7.54%, so that the ratio is solved. The ratio between traditional and emerging is $\frac{87.81}{12.19}$. Finally, for all employment methods to be evaluated by fuzzy mathematics, we can give the following strategies: Colleges and universities should appropriately encourage college students to start their own businesses, develop their talents, and conduct relevant education during their school years. For the phenomenon of applying for civil servants and village officials, schools should conduct appropriate ideological education.

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The Influence of Automatic Driving on Traffic Volume

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Abstract: Many parts of the United States face the problem of blocked traffic flow due to the number of roads, It is now necessary to analyze the impact of using autonomous driving on traffic flow, The first part is to establish a traffic volume model, The data is processed by the traffic flow theory, and the traffic volume Q is obtained according to the linear relationship between the speed-density and the data in the question, Then, the possible influencing factors, such as the number of lanes, the average traffic flow and the traffic volume, are analyzed to determine the influencing factors influenceing the traffic volume, and the traffic volume model is initially established, The second part is to establish a one-way single lane traffic volume model, Consider the proportion of autonomous vehicles, improve the traffic volume model, and analyze the impact of the proportion of autonomous vehicles from 10% to 50% to 90% on traffic volume, When the proportion of self-driving vehicles obtained is 40%, the effect on traffic volume becomes obvious, and when it reaches 70%, the effect is the most significant, Considering the cost of dedicated lanes, it is concluded that when the proportion of autonomous vehicles reaches 70%, the establishment of dedicated lanes is more conducive to traffic volume, Finally, according to the establishment process of the model, the feasible opinions and Suggestions are put forward to the traffic management department, which can improve the utilization rate of the traffic road more reasonably

Keywords: Correlation analysis; Simulation; Automatic driving

1. INTRODUCTION

Due to the limited number of roads, many places in the United States face traffic disruptions. The governor of Washington allows the use of autonomous driving and cooperative vehicle systems to improve traffic flow. Because the impact of these policies on traffic is unclear, detailed analysis is required. This paper selects roads 5, 90, 405 and 520 on four continents of T, P, K, s as research objects. The work flow chart is shown in Figure 1.

In the data processing, the traffic volume Q, the number of lanes, the peak value, the average traffic flow, the correlation between the four factors of the road type and the traffic volume Q, and the four-factor traffic flow model are established. Considering the proportion of autonomous driving and the relationship between autonomous driving and non-automatic driving, especially the effect of autonomous driving on traffic volume from 10% to 50% to 90%, the model has been improved. Finally, identify possible balance points and turning points for major performance changes, discuss the need for dedicated lanes, and propose better strategies.

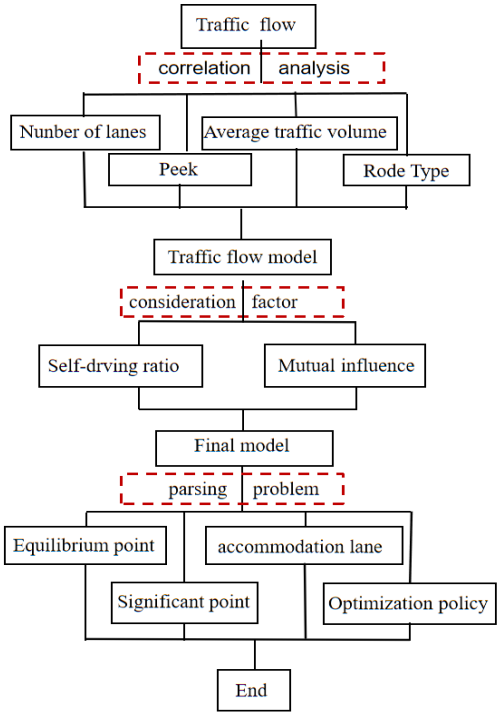

Figure 1. Flowchart of ideas

2. ASSUMPTIONS

Assume that all drivers follow the traffic rules.

Assume that the vehicles on the road are of the same type and have the same length of vehicle.

Assume that only one car can be allowed to pass in each lane.

3. MODEL ESTABLISHMENT AND SOLUTION

3.1 Demand for Traffic

Traffic flow [1] is represented by three parameters: traffic volume Q, traffic density K and driving speed V. It is known from traffic flow theory.

$$Q = K * V \quad (1)$$

When the traffic volume Q of a certain section increases gradually, the road starts to be crowded until

Q / C = 1. At this time, the traffic density is the maximum density, where C is the road capacity, and the unit is vehicle / hour.

The U. S. defines road capacity as "the maximum sustainable flow rate of a point or even section of a lane or road that a vehicle or person can reasonably cross within a specific time period under given road, geometric, traffic, environmental and control conditions; usually expressed as vehicle per hour, passenger car per hour or person per hour"[2]

According to the US Road Capacity Manual (HCM2000), the calculation formula for the capacity of a road group in an intersection is

$$C_i = N_0 \frac{\ell_i}{C} \quad (2)$$

among them:

C_iFor a road group capacity, the unit is (veh/h);

N_0The saturation flow rate for a road resistance, the unit is (veh/h);

$\frac{\ell_i}{C}$The ratio of the effective traffic light time to the length of the cycle for a road group;

C is the period of time

The longer the total red length, the smaller the traffic capacity.

Saturated traffic flow rate $S_i = \frac{3600}{\bar{s}}$, where $\bar{s}$ the average headway distance $\bar{s} = \frac{24 \cdot 60 \cdot 60}{M}$can be used to determine the capacity of each road.

When the road vehicles continue to increase and eventually lead to traffic congestion, the driving speed is 0, the road traffic density is the road blocking density Kmax, and the traffic volume at this time is 0.

According to the linear relationship of speed-density

$$V(K) = V\frac{V_{max}}{K_{max}K_{max}} \quad (3)$$

Among them, Vmax is the driving speed when driving freely. In this question, the nominal speed limit of all these roads is 60 mph, so Vmax is 60.

Where $K = \frac{M}{L}$, M is the daily traffic volume in the data table and L is the driving distance.

Known by the above formula

$$Q(K) = V\frac{V_{max}}{K_{max}K^2_{max}} \quad (4)$$

In order to take the maximum value, K = 1/2Kmax, the traffic flow can be obtained from the formula and the additional data of this question.

3.2 Correlation Analysis between Influencing Factors and Traffic Volume

On Route 5, Routes 405 and 90 are mostly IS, while a small portion of Routes 520 and 90 belong to RS. In order to determine whether the type of expressway is related to traffic flow, first select two factors for correlation analysis [3-6], and the relevant analysis results are shown in Table 1.

As can be seen from Table 1, the Pearson coefficient between road type and traffic flow is -. 468, ie | r | = 0. 468, indicating that traffic flow is negatively correlated with road type and that the two variables are significantly correlated. In addition, the two-way test value between the two is 0. 000, the correlation coefficient of the double star mark in the figure is lower than the significance level 0.01, and the correlation coefficient is considered to be significant, verifying the significant between the two. Correlation. Similarly, the correlation between the number of lanes, peaks, average traffic flow and traffic flow was analyzed. The results are shown in Table 2.

Table 1. Correlation analysis results

		Road type	Traffic capacity
Road type	Pearson correlation	1	-. 468**
	Significance (double tail)		. 000
Traffic capacity	Pearson correlation	-. 468**	1
	Significance (double tail)	. 000	

* *. At 0. 01 level (double - tailed), the correlation is significant.

Table 2. Correlation analysis

		traffic flow
Number of lanes	Pearson correlation	. 100
	Significant (bilateral)	. 135
	N	224
peak value	Pearson correlation	. 351**
	Significant (bilateral)	. 000
	N	224
Average Traffic volume	Pearson correlation	. 351**
	Significant (bilateral)	. 000
	N	224

It can be seen from Table 2 that the Pearson coefficient between the number of lanes, peak value, average traffic flow and traffic volume is 0. 757, that is, the number of lanes, peak value, average traffic flow and traffic volume are positively correlated. The bilateral test value between them is 0. The correlation coefficient of binary number mark in the graph is 0. 01 or lower significance level, and the correlation coefficient is considered significant, and the correlation between the two is verified. To sum up, the number of lanes, peak, average traffic flow, road types are all related to traffic volume.

3.3 Establishment of Traffic Volume

the capacity of a certain road be N0, and you can get

$$N_0 = \frac{3600}{t_i} = \frac{3600}{I\frac{3.6}{v_{min}}\frac{1000v}{I_{min}}} \quad (5)$$

No- possible capacity (per vehicle/hour); The average headway of ti continuous vehicles; V - average speed (km/h); Imin-minimum workshop distance (m); The formula for calculating the minimum headway is as follows:

$$I\frac{v}{3.6_1}\frac{v^2}{254\mu_{3_{4_{min}}}} \quad (6)$$

t1 is the driver's reaction time, generally between 0. 3 and 1. 0 s, where 0. 8s is taken. μis the coefficient of friction, generally between 0. 3 and 0. 8, here 0. 6;I 3 is the safe distance, 6 m I 4 is the average length of the vehicle, and 5 m here. Then, the resulting

expression is

$$N_0 = \frac{1000}{\frac{t_1}{3.6}+\frac{v}{254\mu}+\frac{l_3+l_4}{v}} \quad (7)$$

While

$$N_0 = \frac{1000}{\frac{1}{6}+\frac{v}{152.4}+\frac{11}{v}} \quad (8)$$

According to the data, there is a gap between the capacity of the interstate highway and the national highway due to the lack of funds and technical support for the construction of the interstate highway. Therefore, its capacity will be lower than that of the US National Highway. Therefore, we introduced a method to balance the gap between the interstate and the national road and then generalize the capacity[4].

$$N_0 = \lambda \frac{1000}{\frac{1}{6}+\frac{v}{152.4}+\frac{11}{v}} (9)$$

If the road type is a national road, the value is 1; when the road type is intercontinental, the value is 0. 8.

3.4 Establishment and Solution of One-Way Single-Lane Traffic Volume Model

If the proportion of self-driving vehicles is η, then the proportion of non-autonomous vehicles is 1-η, bringing the proportion of self-driving vehicles into the model.

$N_0 = \lambda \frac{1000}{\frac{1}{6}(1-\eta)+\frac{v_1\eta+v_2(1-\eta)}{152.4}+\frac{11}{v_1\eta+v_2(1-\eta)}}$ Where v1 represents the speed of the automatic driving of the vehicle, v2 represents the speed of the non-automatic driving of the vehicle, and both speeds are less than 60 mph. The relationship between the traffic volume and the proportion of autonomous vehicles is obtained by Matlab simulation[5], as shown in Figure 2.

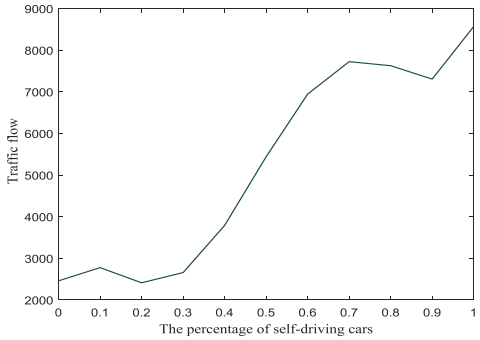

Figure 2. Proportion - traffic volume diagram

In the figure, the proportion of autonomous driving is between 0% and 30%, which has little effect on traffic; the ratio is between 30% and 70%, the flow rate continues to increase rapidly, and the proportion of traffic impact increases from 70% to 90%. %. As the ratio increases, the flow will increase until it reaches 100 and reaches the maximum flow. As far as the development of autonomous vehicles is concerned, it is impossible to reach 100 vehicles in a short period of time. Therefore, we ignore the impact of this ratio. It can be concluded that the effect is obvious when the self-driving ratio is 40, and the maximum impact is 70.

3.5 Establishment of Special Lane Model

According to figure 2, the factors that increase the flow from 70% to 90% are analyzed. Since the proportion of self driving vehicles has reached a certain level, but the proportion of non motor vehicles still has a certain proportion [6], it is necessary to reconsider the modification of the model, and then through simulation, compare the setting of special lane without special lane. In this case, an automatic lane is assumed. If n, the number of non self driving lanes is N-N. $N_0 = \lambda \cdot \frac{1000}{\frac{1}{6}+\frac{v_2}{152.4}+\frac{11}{v_2}} \times (N-n) + \lambda \frac{1000}{\frac{v_1}{152.4}+\frac{11}{v_1}} \times n$ After Matlab simulation, the relationship between the proportion of self-driving vehicles and the traffic volume is obtained under the condition of setting up special lanes, as shown in Figure 3.

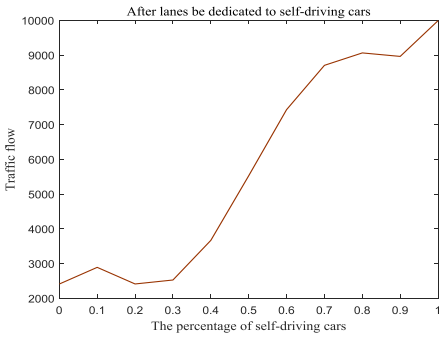

Figure 3. Proportion - traffic volume diagram

It can be seen from the figure that when a dedicated lane is established to function more than 70% of the auto-driving vehicle, it is chosen to automatically assume that the vehicle ratio is between 60% and 70% to set up a special lane and will have a greater effect on the traffic volume.

To sum up, the establishment of special lanes has a great impact on the improvement of traffic.

4. SUMMARY

Through the analysis of the model established in this paper, when the number of automatic vehicles reaches 70%, building a special lane for automatic vehicles will improve the traffic speed and relieve the traffic pressure.

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Analysis on the Operation Capacity of Yibin Wuliangye Co., Ltd

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Abstract: Based on the financial statements issued by Yibin Wuliangye Co,, Ltd, in the past five years, this paper focuses on the analysis of the operating capacity of the enterprise through comparative methods, The operating capacity mainly refers to the efficiency and efficiency of the operating assets of the enterprise, The analysis of the operating capacity is an important prerequisite for the analysis of the financial capacity and the improvement of financial management of the listed company
Keywords: Dupont analysis; Operating capacity; Total asset turnover rate; Inventory turnover rate

1. INTRODUCTION

China is a big country of liquor consumption, liquor has become an indispensable consumer goods in the life of our people. After years of development after reform and opening up, the liquor industry in China is more and more mature. Yibin Wuliangye Co., Ltd. belongs to the liquor manufacturing industry, which is a myth in the liquor manufacturing industry. In recent years, its operation status has been very good [1-5]. This paper analyzes the operation capacity of Yibin Wuliangye Co., Ltd. in 2014-2018, and puts forward reasonable suggestions for its development.

2. COMPANY PROFILE

Yibin Wuliangye Co., Ltd. is located in Yibin City, Sichuan Province, established on August 19, 1997. The main business scope is alcohol and beverage wine manufacturing industry, and the industry type is: Food and beverage > beverage manufacturing industry > wine manufacturing. On April 27, 1998, the company was listed on the main board of Shenzhen Stock Exchange. By the end of 2018, its total assets had reached 86.094 billion yuan.

3. OPERATIONAL CAPACITY ANALYSIS

According to the annual report data of Yibin Wuliangye Co., Ltd. from 2014 to 2018, combined with the calculation method of financial analysis indicators, various data reflecting the operation capacity of the enterprise are obtained as shown in Table 1.

Table 1 Operation capacity index of yibin wuliangye Co., Ltd. in 2014-2018

a particular year	2014	2015	2016	2017	2018
Business cycle(days/time)	468.00	454.00	443.00	423.00	384.00
Inventory turnover rate (second)	0.77	0.79	0.81	0.85	0.94
Days of inventory turnover (day/ time)	467.11	453.06	441.99	422.14	383.71
Turnover rate of accounts receivable (second)	211.79	188.42	228.68	277.87	337.95
Days of accounts receivable turnover (days / times)	1.70	1.91	1.57	1.30	1.07
Turnover rate of accounts payable (second)	9.38	7.83	4.53	3.18	3.33
Accounts payable turnover days (days / times)	38.39	46.01	79.48	113.10	107.97
Turnover rate of current assets (times)	0.56	0.52	0.50	0.51	0.57
Turnover rate of fixed assets (times)	0.56	0.52	0.54	0.60	0.69
Total assets turnover (times).	0.46	0.44	0.43	0.45	0.51

3.1 Analysis of Turnover Speed of Accounts Receivable

The turnover rate of accounts receivable refers to the ratio of net credit sales income to the average balance of accounts receivable in a certain period of time, which reflects the collection speed of accounts receivable and is generally expressed by the number of turnover[1]. The formula is:

$$\text{Turnover rate of accounts receivable} = \frac{\text{Sales revenue}}{\text{Average balance of accounts receivable}} \quad (1)$$

The turnover rate of accounts receivable shows the average number of times that accounts receivable are converted into cash in the year, which reflects the realization speed of accounts receivable and the collection efficiency of enterprises[2]. The turnover rate of accounts receivable of Wuliangye in Yibin from 2014 to 2018 is shown in Figure 1.

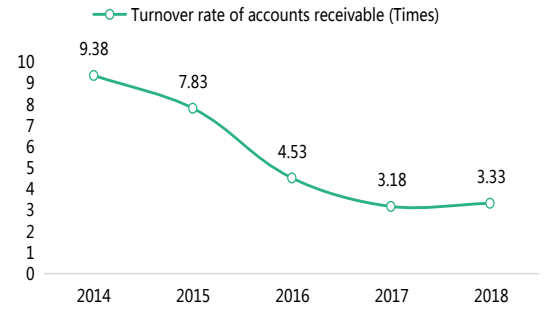

Figure 1. Turnover rate of accounts receivable in yibin wuliangye from 2014 to 2018

From figure 1, the turnover rate of accounts receivable in the enterprise decreases at first and then rises, and the turnover rate of accounts receivable is much higher than the average level of the industry. This phenomenon shows that the credit policy of the enterprise is too strict and the credit conditions and credit standards are too high, which will affect the sales scale of the enterprise, have a negative impact on the market share of the product, and thus affect the profitability.

3.2 Analysis of Inventory Turnover Speed

The speed of inventory turnover is usually expressed by the ratio of sales revenue to the average cost of inventory[3], and the formula is

$$\text{Inventory turnover} = \frac{\text{Sales revenue}}{\text{Average inventory balance}} \quad (2)$$

Inventory turnover rate is a comprehensive index to measure the sales capacity and inventory management level of enterprises. The inventory turnover rate of Yibin Wuliangye 2014 / 2018 is shown in Figure 2.

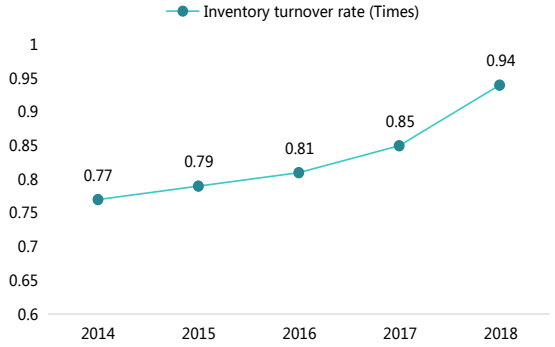

Figure. 2 Inventory turnover rate of yibin wuliangye 2014 / 2018

As can be seen from FIG.2, the inventory turnover rate of the five-grain liquid in the past five years is increasing year by year, and the growth rate in 2018 is close to 10%, indicating that the inventory of the enterprise is gradually decreasing, the liquidity is enhanced, and the speed of the inventory conversion to the cash or the accounts receivable is increasing.

3.3 Analysis of the Turnover Speed of Current Assets

The achievement of enterprise management results mainly depends on the transformation of current assets [4-5]. The analysis of the operating capacity of current assets is the most important part of the analysis of the operational capacity of an enterprise, and its formula is as follows:

$$\text{Turnover rate of current assets} = \frac{\text{Sales revenue}}{\text{Average balance of current assets}} \quad (3)$$

The turnover rate of current assets calculated by using the index of operating income not only reflects the pure turnover speed of current assets but also the effect of utilization of current assets. The turnover rate of current assets of Yibin Wuliangye in 20142018 is shown in Figure 3.

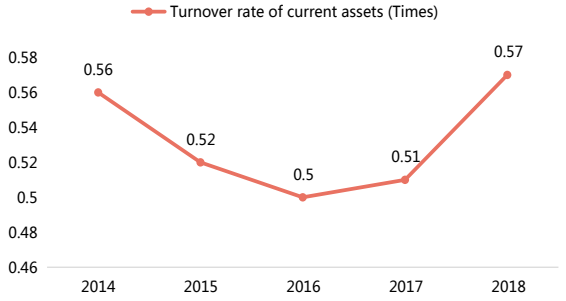

Figure. 3 Turnover rate of current assets in yibin wuliangye from 2014 to 2018

As can be seen from Figure 3, the turnover rate of Wuliangye's current assets is relatively low, with the highest value of 0.57 and the lowest value of 0.50, showing a trend of first decreasing and then rising, with a relatively stable development trend, but lower than the industry average. It shows that the enterprises do not make full use of the current assets of the enterprises, and the remaining large amount of idle funds form a waste of funds[6-7].

There are two reasons that affect the speed of turnover of current assets, one is the turnover efficiency of advances, the other is the cost income rate of enterprises. The turnover of the advance can reflect the specific turnover efficiency of the current assets of the enterprise in a specific period of time, and the income rate of the cost can also reflect the relationship between the income and the cost of the enterprise. When the ratio is larger than 1, it indicates that the economic efficiency of the enterprise is relatively good. The higher the efficiency of the advance, the better the operation ability of the enterprise.

3.4 Analysis of Turnover Rate of Total Assets

The turnover rate of total assets reflects the utilization efficiency of total assets in terms of asset liquidity[8]. Its formula is:

$$\text{Turnover rate of total assets} = \frac{\text{Sales revenue}}{\text{Average total assets}} \quad (4)$$

The turnover rate of total assets reflects the operation ability of the whole assets of an enterprise. Generally speaking, the more turnover times of assets, the faster turnover speed, the stronger operation ability. The turnover rate of Wuliangye's total assets in 2014-2018

is shown in Figure 4.

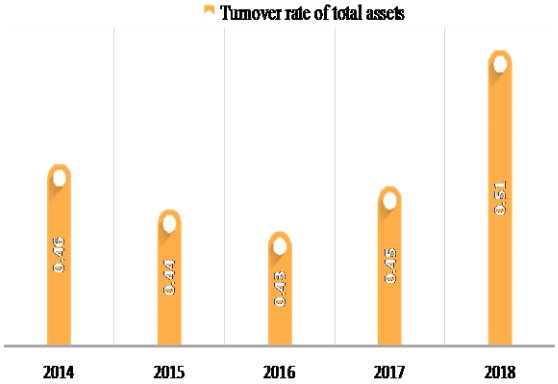

Figure 4 Turnover rate of total assets of wuliangye, yibin, 2014-2018

As can be seen from Figure 4, Wuliangye's total assets turnover rate in the past five years was the highest in 2018, with 0.51 times. The development was relatively stable and the growth rate was not obvious. There are four ways to improve the turnover rate of total assets:

On the premise of high profitability, by properly reducing the price of products, increasing the sales volume, accelerating the speed of capital turnover, so as to improve the turnover rate of total assets and the profitability of enterprises[7-9].

Under the condition of constant asset scale and production efficiency, the turnover rate of total assets of an enterprise can be improved by increasing the sales price and sales revenue.

By disposing idle fixed assets and reducing the scale of assets, enterprises will also improve the turnover rate of total assets.

When the asset scale of an enterprise remains unchanged, the purpose of improving the turnover rate of the total assets of an enterprise can be achieved by improving the production efficiency and the utilization rate of production capacity.

4. SUGGESTIONS FOR THE DEVELOPMENT OF WULIANGYE GROUP

With the development of economy, all walks of life need to increase the research and development of scientific and technological products, meet the needs of different consumers, and improve their own return on net assets. Only in the liquor industry can it develop for a long time, increase the research and development of scientific and technological products, and narrow the gap with listed companies in the same industry. As the government has issued some corresponding policies, the sales revenue of high-end liquor has been affected to some extent. Wuliangye can adopt a new sales strategy, adjust the price accordingly, and ensure the normal sales volume. The enterprise should appropriately expand the debt scale, do not act too fast, control the financial leverage, make the company reduce the financial risk as much as possible, use the funds to expand the sales channel, reduce the production cost, and improve the net profit.

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Research on Tangshan Old-Age Service System Based on Grey Prediction and Smoothing Index Method

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Abstract: With the increasing elderly problem in our country, the problem of providing for the elderly has attracted the attention of national government, This paper makes an analysis of the basic situation of the development of the endowment cause in Tangshan from four aspects: policy system, community endowment service, social security system, endowment institutions and beds, This paper uses the grey prediction theory to analyze and forecast the population of the old-age pension in Tangshan in the next 20-30 years, Taking age as independent variable, total population and elderly population as dependent variables, the grey model was established, By using MATLAB to process and calculate the data, it is found that in 2048, the elderly population accounted for 83,94% of the total population in China, Based on the related data of the development of the pension service industry in Tangshan from 2010 to 2017, the contribution of the pension service industry in Tangshan to the regional GDP in the next 20-30 years is estimated by using the quadratic exponential smoothing method, and the economic growth effect of the pension service industry is evaluated

Keywords: Development of Old-Age Care; Grey Prediction; Quadratic Index Smoothing Method

1. INTRODUCTION

With the increasing aging problem in our country, the problem of providing for the aged has attracted the attention of the national government [1]. In the Thirteenth Five-Year Plan for the Development of the National Aging Cause and the Construction of the Pension System, the State Council pointed out that we should actively carry out actions to deal with the aging of the population and promote the overall, coordinated and sustainable development of the cause of aging. However, at present, the uneven development of urban-rural and regional ageing undertakings and the construction of the old-age pension system are prominent. Therefore, it is of great practical significance to study a more perfect pension service system [2].

Yu Huan [3] used the grey prediction model to calculate the total number of the elderly disabled population in Shenyang in the next 20 years, and budgeted the scale of demand for home-based pension services. Gu Jing [4] uses descriptive statistics and mathematical models to forecast the development trend of supply and demand for home-based pension in the future, and puts forward countermeasures and suggestions to realize the balance between supply and demand. Li Suoping [5] used the quadratic exponential smoothing prediction method and panel model to analyze the economic growth and industrial structure effect of the pension service industry in Hebei Province. In this paper, the grey prediction theory is used to analyze and forecast the number of the elderly population in Tangshan in the next 20-30 years. Based on the related data of the development of the pension service industry in Tangshan from 2010 to 2017, the contribution of the pension service industry in Tangshan to the regional GDP in the next 20-30 years is estimated by using the quadratic exponential smoothing method.

2. ANALYSIS OF DEVELOPMENT OF OLD AGE CAREER IN TANGSHAN CITY

The policy system has gradually improved. On July 3, 2015, the Tangshan Municipal People's Government issued the Opinions on the Implementation of Speeding up the Development of the Old-age Service Industry, proposing that "by 2020, a comprehensive old-age service system based on home, community, institution and information, with perfect functions, excellent services and covering urban and rural areas will be established." On February 10, 2017, the General Office of the Tangshan Municipal People's Government issued the Notice on the Establishment of the Joint Conference System for the Old-age Service in Tangshan City. It was decided to establish the Joint Conference System for the Old-age Service in Tangshan City to promote the related aspects of the Old-age Service, such as medical rehabilitation, cultural education, sports, fitness, leisure tourism and financial services. Domain interaction development.

The social security system is gradually improving. In order to more accurately grasp the coverage level of pension insurance in Tangshan City and the annual per capita pension level, based on the analysis of relevant literature, relevant reports of Tangshan Municipal Government and documents and information of Tangshan Municipal Government, this paper draws the pension insurance participation situation of urban and

rural residents in Tangshan City from 2009 to 2016 as shown in Figure 1.

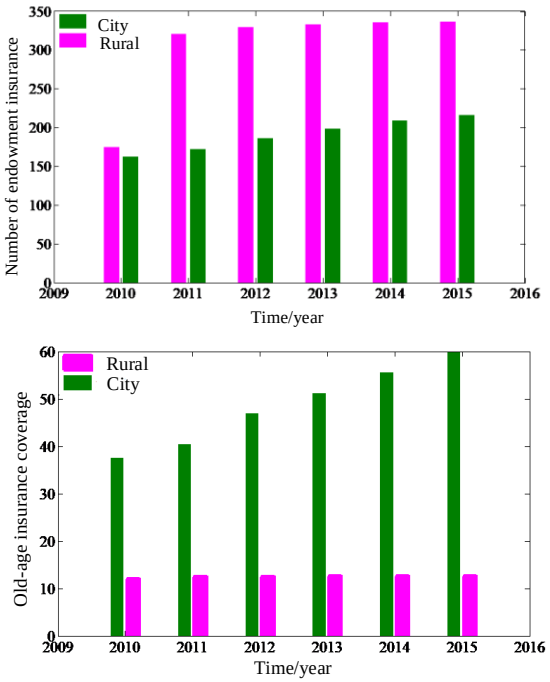

Figure 1. The participation of urban and rural residents in old-age insurance

The number and coverage of urban residents'pension insurance increased year by year from 2010 to 2015. The number of urban residents increased from 1619,000 in 2010 to 2162,000 in 2015. The coverage increased from 37.49% in 2010 to 59.77% in 2015. The growth trend showed a certain regularity. However, the number and coverage of rural old-age insurance is not growing rapidly, from 1749,000 people in 2010 to 33,665,000 people in 2015, and the coverage rate is from 12.00% in 2010 to 12.61% in 2015. During these six years, the number and coverage of rural old-age insurance almost all stabilized at the level of 3.3 million people and 12% without substantial changes.

Of course, there are also problems in pension institutions in Tangshan. Tangshan pension institutions lack professional medical facilities and nursing workers. Few people enter the post after professional training. The poor medical level and the low level of medical staff are the problems of most pension institutions.

3. OUTPUT VALUE OF THE ELDERLY SERVICE INDUSTRY BASED ON GREY PREDICTION

According to the data of the elderly population over 60 years old in Tangshan from 2013 to 2017, the proportion of the elderly population is calculated, as shown in Table 1.

Taking age as independent variable, total population and elderly population as dependent variables, estabilish the GM (1,1) grey model. The original non-negative time series is set as follows:

$$X^{(0)} = \left\{ X^{(0)}_{(1)}, X^{(0)}_{(2)}, X^{(0)}_{(3)}, \cdots, X^{(0)}_{(n)}, \right\} (1)$$

A sequence is generated by first-order accumulation:

$$X^{(1)} = \left\{ X^{(1)}_{(1)}, X^{(1)}_{(2)}, X^{(1)}_{(3)}, \cdots, X^{(1)}_{(n)}, \right\} (2)$$

$$X^{(1)}(i) = \sum_{k=1}^{i} X^{(0)}(k), i = 1, 2, \cdots, n \, (3)$$

Table 1. Statistics of the general population and the elderly population in tangshan from 2013 to 2017

Year	Population (million)	elderly population (million)	Proportion of elderly population	rate of natural increase(‰)
2013	7.48	1.35	18.06%	7.13
2014	7.53	1.43	18.99%	8.06
2015	7.55	1.56	20.62%	3.44
2016	7.60	1.64	21.56%	4.15
2017	7.55	1.64	21.7%	5.33

The $X^{(1)}$ sequence satisfies the first order linear differential equation:

$$dX^{(1)} + aX^{(1)} = u \, (4)$$

In this equation, a represents the development parameters of the model, reflecting the development trend of $X^{(1)}$ and the original sequence $X^{(1)}$; u represents the coordination coefficient of the model, and reflects the changing relationship between data.

According to Least Square Method,

According to the least square method, $A = (a, u)^{(T)}$ can be obtained. The solution of the a and u substitution formula (3) is $X^{(1)}(k+1) = [X^{(0)}(1) - u/a]e^{-ak} + u/a$. The grey prediction model of the original sequence $X^{(0)}$ can be obtained by reducing and reducing the formula.

$$X^{(0)}(k+1) = X^{(1)}(k+1) - X^{(1)}(k), k = 1, 2, 3, \mathrm{L} \, (5)$$

Based on the related data of the development of the pension service industry in Tangshan from 2010 to 2017, the contribution of the pension service industry in Tangshan to the regional GDP in the next 20-30 years is estimated by using the quadratic exponential smoothing method, and the economic growth effect of the pension service industry is evaluated.

Smooth recurrence formula:

$$S_t^{(1)} = \alpha Y_t + (1-\alpha) S_{t-1}^{(1)} \, (6)$$

Where, $S_t^{(1)}$ is the first smoothing value, $S_t^{(2)}$ is the second smoothing value, α is the smoothing coefficient $(0 < \alpha < 1)$, Y_t is the actual value of the index, $\hat{Y}_t = S_t^{(1)}$ is the predicted value of the index.

When using primary and secondary exponential smoothing values to calculate the predicted values of secondary exponential smoothing, two parameters a_t and b_t are also calculated. The calculation methods

are as follows:

$$a_t = 2S_t^{(1)} - S_t^{(2)} \quad (7)$$

$$b_t = \frac{\alpha}{1-\alpha}\left(S_t^{(1)} - S_t^{(2)}\right) \quad (8)$$

Therefore, the predicted value $\hat{Y}_{t+N}$ of Phase $(t+N)$ is calculated based on the results of the above formulas, as follows:

$$\hat{Y}_{t+N} = a_t + b_t N \quad (9)$$

4. FORECAST OF THE OUTPUT VALUE OF ELDERLY SERVICES IN TANGSHAN

Using MATLAB to process and calculate the data, the data of the population over 60 years old in the future are predicted as Table 2 follows:

Table 2. The results of the total population and the elderly population in tangshan in the next 20-30 years predicted by grey model

Year	Population (million)	Elderly population (million)	Proportion of elderly population
2039	7.83	4.46	56.96%
2040	7.84	4.66	59.46%
2041	7.86	4.87	62.08%
2042	7.87	5.09	64.82%
2043	7.88	5.33	67.67%
2044	7.90	5.58	70.65%
2045	7.90	5.83	73.76%
2046	7.92	6.10	77.01%
2047	7.93	6.38	80.40%
2048	7.94	6.67	83.94%

The results of grey prediction model simulation, residuals and relative errors of the total elderly population in Tangshan City are as follows: Table 3:

Table 3. Calculations of simulated values, residuals and relative errors of the elderly population

$X^{(0)}(n)$ /(million)	$X^{(0)}(n)$ /(million)	$\varepsilon^{(0)}(n)$	(Δ)
1.43	1.46	-32734.4	0.023038
1.56	1.53	27548.45	-0.0177
1.64	1.60	38387.87	-0.02344
1.64	1.67	-32355	0.019733

(1) The average simulation error, i.e. the average relative error is:

$$\overline{\Delta} = \frac{1}{n}\sum_{k=1}^{n}\Delta_K = \frac{1}{n}\sum_{k=1}^{n}\left|\frac{\varepsilon(k)}{x^{(0)}(k)}\right| = 0.000408 \quad (10)$$

(2) Posterior difference ratio

The mean and variance of $X^{(0)}(n)$ were calculated:

$$\overline{x} = \frac{1}{n}\sum_{k=1}^{n}X^{(0)}(k) S_1^{\,2} = \frac{1}{n}\sum_{k=1}^{n}\left[X^{(0)}(k) - \overline{x}\right]^2 \quad (11)$$

Posterior difference ratio

$$C = S_2 / S_1 = 0.385974$$

(3) Small error probability

$$p = P\left(\left|\varepsilon\left(k - \overline{\varepsilon}\right)\right| < 0.6745 S_1\right) = 1 \quad (12)$$

Based on the time series data of Tangshan from 2013 to 2017, Y_t represents the level of economic development, GDP expressed by expenditure accounting method, output value of pension service industry expressed by OG, calculated by the above method, and according to the availability of Yearbook data, the number of elderly population in Tangshan is over 60 years old. The output value of the pension service industry in Tangshan City is calculated based on the original data and the indicators. The results are shown in Table 4.

Table 4. Primary data for variables from 2013 to 2017

Year	GDP (billion)	Consumption (billion)	Proportion of the old(%)	Output value of old-age services (billion)
2013	6121.21	2387.56	18.03%	519.93
2014	6225.30	2506.70	18.98%	5521.10
2015	6103.06	2637.16	20.62%	627.07
2016	6354.87	2907.23	21.56%	709.23
2017	6530.15	3193.07	21.70%	791.65

On the determination of exponential smoothing coefficient. Generally speaking, the newer the value of smoothing coefficient α, the bigger the data weight, the smaller the old data weight, which reflects the ability of the prediction model to smooth the error between the predicted value and the actual observation value. When the time series presents a stable horizontal trend, a smaller smoothing coefficient α should be selected, generally in the range of (0.05, 0.20); when the time series shows an obvious upward or downward trend, in order to make the prediction model more sensitive, the smoothing coefficient should be taken a larger value, generally in the range of (0.6, 1). After determining the range in the calculation process, several alpha values are selected for trial operation, and the minimum average error α is selected.

From the calculation process, we can know that with the gradual increase of α, the average error percentage shows a downward trend. It can be seen that with the increase of the α, the error between the predicted value and the observed value decreases gradually, the accuracy of the smoothing prediction results shows an upward trend, and the predicted value is closer to the observed value, so the second exponential smoothing α=0.9 is chosen. The coefficients are further calculated. Formula 1-5 is used to calculate the final forecast value of Tangshan GDP and the output value of pension service industry after 20-30 years. The result is shown in Figure 2 below.

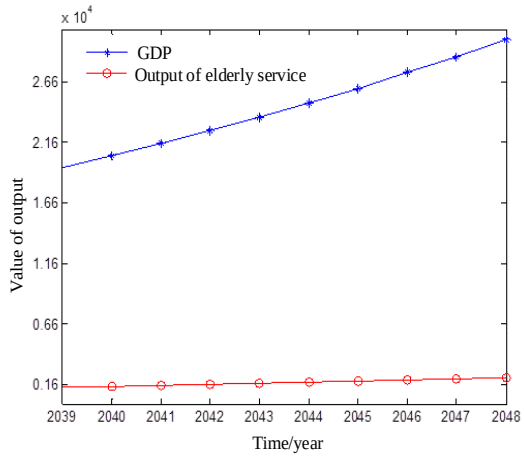

Figure 2. Projection table of the output value of the pension service industry in tangshan city in the next 20-30 years

As can be seen from Figure 2, the output value of the pension service industry in Tangshan increased year by year from 2039 to 2048. By 2048, the output value of the pension service industry in Tangshan will reach 211.039.64 billion yuan. It can be seen that the old-age service industry is a "sunrise industry" in economic development and has great potential for development.

5. RESULTS

With the aggravation of elderly in our country, the pension problem has been paid attention by the government. The pension policy system of Tangshan Municipal Government has been gradually improved; the community pension service facilities have been improved day by day, making the elderly have medical care and support; and the coverage rate of pension insurance is also on the rise. At the same time, there are also some problems in pension undertakings, such as insufficient funds for pension institutions, lack of professional medical facilities and nursing workers, and lack of special venues such as entertainment facilities. For the future 20-30 years, the elderly population is increasing year by year. Through the grey prediction model, we predict that the number of the elderly population will reach 446.0944 in 2039, and how much the elderly population will increase. Therefore, the various pension needs = the percentage of the total demand of the elderly population, we select three more important items for the elderly to predict, through comparison. By 2048, the demand for daily care services for the elderly has reached 29.5524.74 million people, the demand for spiritual comfort services has reached 2.3193.25 million people, and the demand for preventive health services has reached 5.3317.81 million people. By predicting the number of the elderly population and the proportion of employees to the elderly, it is predicted that by 2039, 40,000 nursing staff will be needed for self-care elderly people, 70,000 nursing staff will be needed for assisting the elderly, and 140,000 nursing staff will be needed for the elderly. From this, it can be seen that with the advent of elderly in China, the market economy for the elderly will develop rapidly.

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Optimization of Deoxidation Alloying Batching Scheme for Molten Steel

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Abstract: Steel is closely related to people's lives, Its role is mainly reflected in the construction, The quality of steel directly determines the building's ability to resist disasters, In order to smelt high-quality steel, it is necessary to use deoxidation method to add elements (such as C, Mn, S, P, Si) which are stronger than oxygen before the tapping or during the tapping and pouring process, so as to make oxygen in the metal, The amount reaches the standard, and in order to improve the various physical properties and chemical properties of the steel, it is necessary to add an alloying additive to the steel to adjust the composition to a prescribed range to achieve the desired performance, However, smelting high-quality steel means increasing costs, so how to smelt high-quality steel at a certain cost is an urgent problem to be solved, This paper mainly discusses the two elements of C and Mn which have the greatest factors affecting the deoxidation alloying of steel, Through a large amount of historical data and relevant data, the mathematical results are used to obtain the historical yield of C and Mn, The multiple linear regression is performed by SPSS, The main factors affecting the yield of the alloy are: silicon aluminum alloy FeAl30Si25, ferrosilicon (qualified block), According to the historical yields of the two elements C and Mn, the gray model was used to predict the yield of C and Mn, It was found that the predicted values were highly consistent with the true values, Combining the prediction results of different alloy materials' price, content and alloy yield, a constrained cost optimization model is established to obtain the optimal alloying scheme

Keywords: Data analysis; Gray model; Cost optimization model; Multiple linear regression

1. INTRODUCTION

In the process of smelting steel, the metal will contain a certain amount of oxygen when it reaches the end of refining. If the oxygen content exceeds a certain value, the oxygen remaining inside will accelerate the aging of the steel and affect the quality of the steel. In order to ensure the quality of the steel, it is necessary to reduce the oxygen content below the standard value. Different steel grades need to add different amounts and different kinds of alloys in the smelting process to make various elements meet the standards. The prices of different alloys are different, and the content of various elements is also different. Which alloy is selected for deoxidation alloying The key link. With the continuous development of the steel industry, the competitive pressure of various steel companies is also increasing. How to reduce the production cost of alloy steel is an important means for steel enterprises to improve their competitiveness while ensuring the quality of steel.

In today's society, people's demand for housing is constantly improving, and the building's ability to withstand pressure has become an important consideration. The compressive capacity of a house depends on the strength of the foundation and concrete on the one hand and the quality of the steel on the other hand. How to improve steel quality in the process of iron and steel smelting has become a key issue that the steel industry needs to solve.

Deoxidation alloying is an important part of steel [1] in the smelting process, which directly affects the quality of finished steel. In the process of deoxidation alloying [2], which alloy is added, how much each alloy is added, whether the elements in the alloy are fully utilized, and how the type and quantity of the alloy are added to deoxidize the alloy. The lowest cost. According to the research direction of this paper, a large number of literatures have been found, similar to the thermodynamic problems of deoxidation balance of Al and Ti in high temperature molten steel studied by Wang Tianlong Master of Northeastern University [3] and the master of Yi Xiaomin of Tianjin University of Technology. The carbon temperature prediction and control model of the converter steelmaking end point [4], the development and application of the final deoxidized alloy material for steelmaking in China in recent years [5-8], so this paper aims to calculate the C and Mn elements by adjusting the historical data. The alloy yield, a new model is established to predict the yield and how to formulate the ingredients to minimize the cost of steel.

2. ESTABLISHMENT OF MULTIPLE LINEAR REGRESSION MODEL

(1)Data collection

By consulting a large amount of historical data and literature, this paper obtains the main influencing factors of the yield of different types of steel alloys - silicon aluminum alloy FeAl30Si25, ferrosilicon (qualified block), ferrosilicon FeSi75-B, petroleum coke carbonization Agent, silicon calcium carbon deoxidizer, ferrovanadium (FeV50-A), ferrovanadium (FeV50-B), silicon aluminum manganese alloy ball, ferrosilicon (qualified block), silicon carbide (55%).

(2) Data analysis

The factors affecting the yield of C and Mn are analyzed. In this model, based on the obtained historical yields of C and Mn, SPSS software is used to perform multiple linear regression [6] to analyze the factors affecting the yield of C and Mn elements.

(3)Model establishment

First, based on a large number of data and the method given by the problem, the historical yield of C and Mn is obtained.

θ、λ =Weight of alloying elements C and Mn absorbed by molten steel during deoxidation alloying / total weight of added elements

Table 1. Historical Yield of C and Mn Elements with Steel Number Hrb400b

Stove number	θ	λ
7206063	93.18%	89.03%
7A06082	91.79%	87.44%
7A06090	89.95%	91.51%
7A06516	87.81%	89.50%
7A06108	91.47%	86.84%
7A06130	90.25%	84.41%
7A06207	89.73%	93.32%
7A06238	85.36%	93.54%
7A06257	83.91%	91.54%
7A06716	92.80%	90.34%
average value	89.74%	88.29%

Table 2. Historical Yield of C and Mn Elements with Steel Number Hrb400d

Stove number	θ	λ
7A06291	97.62%	94.54%
7A06346	85.72%	85.25%
7A06561	94.51%	92.18%
7A06585	89.71%	89.38%
7A06659	93.29%	88.62%
7A06661	91.87%	91.54%
7A06669	80.95%	87.54%
7A06672	91.78%	89.73%
7A06681	79.09%	87.88%
7A06724	85.59%	91.42%
average value	90.75%	88.36%

Table 3. Historical Yield of C and Mn Elements with Steel Number Hrb500b

Stove number	θ	λ
7A05312	92.64%	97.93%
7A05313	91.03%	95.01%
7A06480	84.71%	98.81%
7A06483	85.55%	96.52%
7A06484	91.74%	92.76%
7A06497	95.13%	91.80%
7A06488	91.64%	90.26%
7A06508	88.24%	92.41%
7A06487	85.96%	92.35%
7A06508	88.24%	92.45%
average value	88.04	94.03%

Table 4. Historical Yield of C and Mn Elements with Steel Number Hrb500d

Stove number	θ	λ
7A06469	84.39%	91.07%
7A06473	84.70%	93.86%
7A06489	90.41%	94.34%
7A06496	88.13%	93.89%
7A06492	90.02%	86.33%
7A06626	85.49%	91.96%
7A06622	91.24%	92.25%
7A06633	87.14%	89.58%
7A06622	90.60%	89.58%
7A06626	95.06%	90.54%
average value	88.88%	92.43%

According to the above table, the historical yield relationship of C and Mn elements of four different steel grades can be obtained. The average yield of C and Mn is about 90%, as Table1-4.

(4)Solution of multiple linear regression equation model for predicting C and Mn yield

Firstly, this paper analyzes the factors affecting the yield of C. When sig>0.05, it indicates that the alloy has a relationship with the yield of elements, as Table 5-7.

Table 5. Model Summary

Model	R	R^2	adjustR^2	Error of estimation
Of	.277a	.077	.060	.064

Table 6. Anovaa(Dependent Variable: C Yield Rate)

Model	Sum of squares		Mean square	F	Sig
regression	0.233	12	0.019	4.688	.000b
residual	2.802	677	0.004		
Total	3.035	689			

By comparing sig with 0.05, the factors influencing the yield of C are ferro-vanadium (FeV50-A), ferro-vanadium (FeV50-B), silicon-aluminum alloy FeAl30Si25, silicon-aluminum-manganese alloy ball, ferrosilicon (qualified). Block), ferrosilicon FeSi75-B, petroleum coke recarburizer, silicon carbide (55%).

The same method was used to analyze the influencing factors of the yield of Mn.

By comparing sig with 0.05, the factors affecting the yield of Mn are silicon aluminum alloy FeAl30Si25, ferrosilicon (qualified block), ferrosilicon FeSi75-B, petroleum coke recarburizer, silicon carbide (55%), Silicon calcium carbon deoxidizer.

Using the multiple linear regression relations in SPSS software, the influencing factors obtained above are

used as independent variables, and the yields of C and Mn elements are used as the dependent variables. By drawing the histogram and the normal probability map, the detailed and intuitive fitting of the following figure is obtained. relationship.

Table 7. C Yield Coefficient

Model	Standard coefficient	T	Sig
(constant)		31.621	0
Ferrovanadium (FeV50-A)	-0.033	-0.863	0.389
Ferrovanadium (FeV50-B)	0.115	2.267	0.024
Silicon aluminum alloy FeAl30Si25	0.032	0.596	0.552
Silicon aluminum manganese alloy ball	0.018	0.457	0.648
Silicon manganese surface (silicon manganese slag)	-0.213	-4.448	0
Ferrosilicon (qualified block)	0.026	0.671	0.502
Ferrosilicon FeSi75-B	-0.077	-1.33	0.184
Petroleum coke recarburizer	0.019	0.382	0.703
Manganese silicon alloy FeMn64Si27 (qualified block)	-0.218	-3.455	0.001
Manganese silicon alloy FeMn68Si18 (qualified block)	-0.369	-5.254	0
Silicon carbide (55%)	-0.081	-1.341	0.189
Silicon calcium carbon deoxidizer	-0.16	-3.584	0

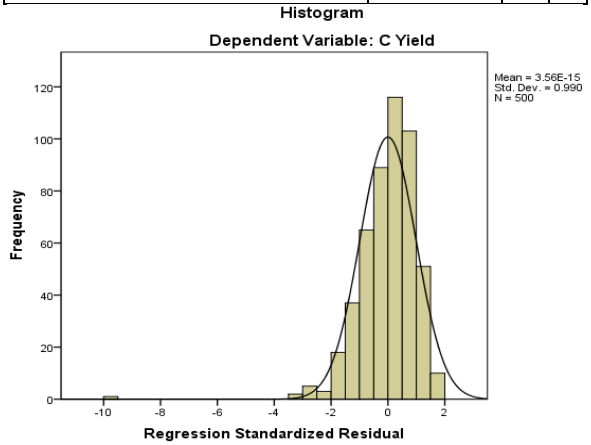

Figure 1. Histogram of C Yield Rate under the Influence of Multiple Factors

It can be found from Figure 1 and Figure 2 that the expected probability of the yield of C and Mn is roughly proportional to the cumulative observation probability, so several influencing factors affecting the yield of the element are determined.

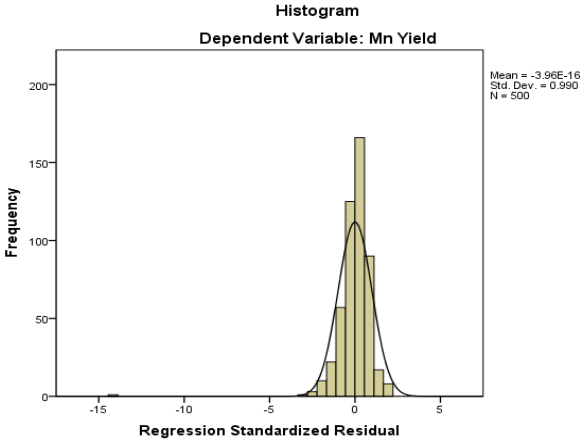

Figure 2. Histogram of Mn Yield Rate under the Influence of Multiple Factors

3. ESTABLISHMENT OF A GREY MODEL

(1)Data processing

In the process of deoxidation alloying, the heat energy of the alloy steel is added to maintain the balance, and the temperature of the molten steel is always maintained at the temperature at the end of the converter.

All required materials are fully stocked and there is no shortage of goods.

The added alloys are all insoluble in molten steel, and the quality of the molten steel remains unchanged during the deoxidation alloying process.

There is no accident in the process of deoxidation alloying, such as furnace aging, factory power failure, etc., the model requires all the smooth in the deoxidation alloying process.

The price of the alloy required during the calculation is always constant, and there is no sudden increase or decrease in the price of one or more alloy materials.

In the process of analyzing a large amount of data, this paper excludes some abnormal data, such as C, Mn yield exceeds 100% or is negative. The remaining data is taken as the analysis object of this article.

(2)Data analysis

It is necessary to predict the yield of C and Mn. According to the historical yield obtained in the previous paper, the MATLAB software is used to establish the gray mathematical model [7]-GM(1.1) model, which is for C, The sequence of Mn historical yield is subjected to the process of accumulation and subtraction, and the predicted result is obtained.

(3)Model solution

1).In order to ensure the feasibility of the GM (1.1) modeling method, it is necessary to perform necessary verification on the known data. The original data is listed as $x^{(0)} = (x^0(1), x^0(2), ..., x^0(n))$, and the ratio of the series is calculated:

$$\lambda(k) = \frac{x^{(0)}(k-1)}{x^{(0)}(k)}, k = 2,3,...,n \quad (1)$$

If all the gradations fall within the allowable coverage interval $x \in (e^{\frac{-2}{n+1}}, e^{\frac{2}{n+1}})$, the sequence X(0) can

construct the GM (1.1) model and can be gray predicted.

$$\lambda_1(k)=\frac{x^{(0)}(89.74\%)}{x^{(0)}(88.29\%)}=1.009\ \lambda_2(k)=\frac{x^{(0)}(90.75\%)}{x^{(0)}(88.36\%)}=1.027$$

$$\lambda_3(k)=\frac{x^{(0)}(88.04\%)}{x^{(0)}(98.57\%)}=0.9362\ \lambda_4(k)=\frac{x^{(0)}(88.88\%)}{x^{(0)}(92.43\%)}=0.9615$$

The results are: $x\in[0.9,1.1]$

Otherwise, do the appropriate transformation processing on the data, such as translation transformation:

$$y^{(0)}(k)=x^{(0)}(k)+c,k=1,2,3,...,n \tag{2}$$

Taking C makes the level ratio of the data columns fall within the tolerance. The data generation is performed by means of cumulative generation (AGO), and the process is as follows:

Set the original number to

$x^{(0)}=(x^{(0)}(1),x^{(0)}(2),.....x^{(0)}(n))$ make

$$x^{(1)}(k)=\sum_{i=1}^{k}x^{(1)}(i),k=1,2,.....n \tag{3}$$

$$x^{(1)}=(x^{1}(1),x^{1}(2),.....x^{1}(n)) \tag{4}$$

The obtained new sequence is called the one-time accumulation generation sequence of the sequence X(0). Similar

$$x^{(r)}(k)=\sum_{i=1}^{k}x^{(r-1)}(i),k=1,2,.....n,r\geqslant 1 \tag{5}$$

Substituting data

$$x^{(r)}(k)=\sum_{i=1}^{k}x^{(r-1)}(i),k=1,2,3,4$$

get $x^{(r)}(k)=90.6325$

The r-time accumulation called X(0) generates a sequence.

2).Establish GM (1.1) model

Let's set $x^{(0)}=(x^{(0)}(1),x^{(0)}(2),.....x^{(0)}(n))$ to meet the above requirements, and use it to build a GM (1.1) model for the data column.

$$x^{(0)}(k)+\alpha z^{(1)}(k)=b \tag{6}$$

The regression analysis is used to obtain the estimated values of a and b, so the corresponding whitening model is:

$$\frac{dx^{(1)}(t)}{dt}+ax^{(1)}(t)=b \tag{7}$$

Solution

$$x^{(1)}(t)=(x^{(0)}(1)-\frac{b}{a})e^{-a(t-1)}+\frac{b}{a} \tag{8}$$

Then get the predicted value

$$\hat{x}^{(1)}(k+1)=(x^{(0)}(1)-\frac{b}{a})e^{-a(k)}+\frac{b}{a},k=1,2,...,n-1 \tag{9}$$

Substituting data into $\hat{x}^{(1)}(k+1)=89.3525$

Obtaining the predicted value accordingly

$$\hat{x}^{(0)}(k+1)=\hat{x}^{(1)}(k+1)+\hat{x}^{(1)}(k),k=1,2,...,n-1 \tag{10}$$

Substituting data into $\hat{x}^{(0)}(k+1)=91.9125$

3).Test predictive value

Residual test: Calculate relative residuals

$$\varepsilon(k)=\frac{x^{(0)}(k)-\hat{x}^{(0)}(k)}{x^{(0)}(k)},k=1,2,...,n \tag{11}$$

Level deviation value test: calculation

$$\rho(k)=1-\frac{1-0.5a}{1+0.5a}\lambda(k) \tag{12}$$

Substituting data $\varepsilon(k)=\frac{91.9125-89.3525}{90.6325}=0.0282<0.1$

If for all $|\varepsilon(k)|<0.1$, it is considered that a higher requirement is reached; otherwise, if it is for all $|\varepsilon(k)|<0.2$, it is considered to meet the general requirement.

4).For the accumulated generated data, the mean B is generated and the constant term vector Y_n is solved, and the gray parameter a is solved by the least squares method.

$$a=(B^TB)^{-1}B^TY_n \tag{13}$$

$$\frac{dx^{(1)}}{dt}+ax^{(1)}=u$$

Bring a into

Solve

$$\hat{x}(t+1)=(\hat{x}(1)-\frac{u}{a})e^{-at}+\frac{u}{a} \tag{14}$$

Where a = 0.0023 and u = 0.8981.

The above results are cumulatively restored to obtain predicted values.

Using the above-mentioned collection of C and Mn element yields in recent years, combined with the established gray prediction model, using MATLAB to obtain the actual change trend of C and Mn element yields in the next few years and the comparison of model prediction changes, As shown in Figure 3-4:

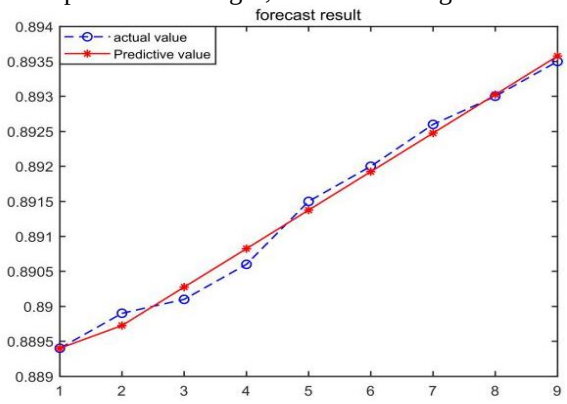

Figure 3. Prediction Results of C Element Yield

4. ESTABLISHMENT OF CONSTRAINED COST OPTIMIZATION MODEL

(1)Model preparation

In the given alloy, the idea of this paper is to replace the costly alloy with a low-cost alloy containing the same element, so that the yield of C and Mn does not change during deoxidation alloying, and deoxidation The cost reduction of alloying is a cost-optimized model with constraints [8].

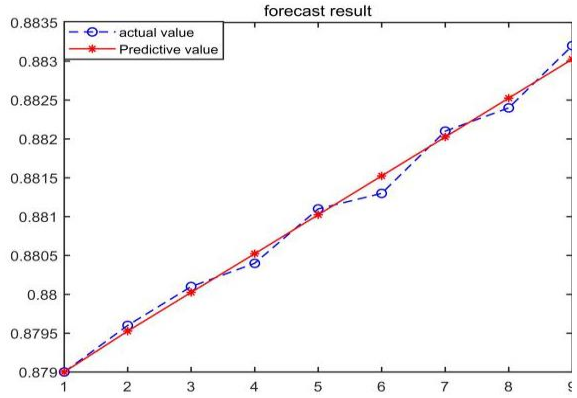

Figure 4. Prediction Results of Mn Element Yield

Table 8. C, Mn Content and Price of Alloy Ingredients

Alloying ingredients	C content	Mn content	Price (yuan/ton)
Ferrovanadium (FeV50-A)	0.0031	0	205000
Ferrovanadium (FeV50-B)	0.0031	0	205000
Silicon aluminum alloy FeAl30Si25	0.00374	0	1000
Silicon-aluminum-manganese alloy ball	0	0.3	8500
Silicon-manganese surface (silicon-manganese slag)	0.017	0.664	7600
Ferrosilicon (qualified block)	0.0006	0	6000
Ferrosilicon FeSi75-B	0.0006	0	6000
Petroleum coke recarburizer	0.96	0	4600
Manganese silicon alloy FeMn64Si27 (qualified block)	0.017	0.664	8150
Manganese silicon alloy FeMn68Si18 (qualified block)	0.017	0.664	8150
Silicon carbide (55%)	0.3	0	6100
Silicon calcium carbon deoxidizer	0.225692308		4000

From the above Table 8, it can be found that some ingredients with high C and Mn content are cheaper than other ingredients with the same or even lower content, such as petroleum coke recarburizer, but this ingredient does not contain Mn element, so comprehensive considerations, The application of the equivalent substitution method can greatly reduce the cost of the ingredients without affecting the yield of C and Mn.

(2)Model establishment and solution

First calculate the cost calculated according to the original method of adding ingredients.

W=[vanadium iron (FeV50-A)+vanadium iron (FeV50-B)]*205+ silicon aluminum alloy FeAl30Si25*1+ silicon aluminum manganese alloy ball*8.5+silicon manganese surface (silicon manganese slag)*7.6+[silicon Iron (qualified block) + ferrosilicon FeSi75-B]*6+ petroleum coke recarburizer*4.6+[manganese silicon alloy FeMn64Si27 (qualified block) + manganese silicon alloy FeMn68Si18 (qualified block)] *8.15+ silicon carbide (55%)*6.1+ Silicon Calcium Carbon Deoxidizer*4

The average value obtained is 16605.38 yuan

The mathematical model is used to represent the constraint optimization model.

$$w = f(x), x = (x_1, x_2 ... x_n)$$

x belongs to a feasible domain, and the minimum ratio of w is obtained without changing the ratio of the alloys in different constraints and the yield, as Table 9.

Table 9. Symbol Description

symbol	Symbol meaning
A	Ferrovanadium (FeV50-A)
B	Ferrovanadium (FeV50-B)
C	Silicon aluminum alloy FeAl30Si25
D	Silicon manganese surface
E	Ferrosilicon (qualified block)
F	Ferrosilicon FeSi75-B
G	Petroleum coke recarburizer
H	Manganese silicon alloy FeMn64Si27 (qualified block)
I	Manganese silicon alloy FeMn68Si18 (qualified block)
J	Silicon carbide (55%)
K	Silicon calcium carbon deoxidizer
L	Silicon aluminum manganese alloy ball
θ	C alloy yield
λ	Mn alloy yield
W	Adding cost of deoxidation alloying of different alloying ingredients

First option

The ferrosilicon (FeV50-B) and vanadium iron (FeV50-A) were replaced by silicon aluminum alloy FeAl30Si25, and the other alloys remained unchanged.

Q={[vanadium iron (FeV50-A)+vanadium iron (FeV50-B)]*0.0031+ silicon aluminum alloy FeAl30Si25*0.00374}/0.00374

W = silicon aluminum manganese alloy ball * 8.5 + silicon manganese surface (silicon manganese slag) * 7.6 + [silicon iron (qualified block) + ferrosilicon FeSi75-B] * 6 + petroleum coke recarburizer * 4.6 + [manganese silicon alloy FeMn64Si27 (Qualified Block) + Manganese Silicon Alloy FeMn68Si18 (Qualified Block)] *8.15+ Silicon Carbide (55%)*6.1+ Silicon Calcium Carbon Deoxidizer*4+Q

$$Q = \left[(A+B)*0.031 + C*0.00374 \right] / 0.00374$$

$$W = L*8.5 + D*7.6 + (E+F)*6 + G*4.6 + (H+I)*8.15 + J*6.1 + K*4 + Q$$

The calculated cost average is 13453.12 yuan

Second option

The manganese-silicon alloy FeMn64Si27 (qualified block) and the manganese-silicon alloy FeMn68Si18 (qualified block) were replaced by a silicon-manganese surface, and the contents of other alloys remained unchanged.

X={[manganese silicon alloy FeMn64Si27 (qualified block) + manganese silicon alloy FeMn68Si18 (qualified block)] * 0.0017 + silicomanganese surface (silicon manganese slag) * 0.0017} / 0.0017

W=[vanadium iron (FeV50-A)+vanadium iron (FeV50-B)]*205+ silicon aluminum alloy FeAl30Si25*1+ silicon aluminum manganese alloy ball*8.5+silicon manganese surface (silicon manganese slag)*7.6+[silicon Iron (qualified block) + ferrosilicon FeSi75-B]*6+ petroleum coke recarburizer *4.6+ silicon carbide (55%)*6.1+ silicon calcium carbon deoxidizer *4+X

$$X = \left[(H + I) * 0.0017 + D * 0.017 \right] / 0.017$$

$$W = (A + B) * 205 + C * 1 + L * 8.5 + D * 7.6 + (E + F) * 6 + G * 4.6 + J * 6.1 + K * 4 + X$$

The calculated cost average is 12635.27 yuan

Third option

Silicon carbide (55%) was used instead of ferrosilicon (qualified block), ferrosilicon FeSi75-B, and other alloy contents remained unchanged.

Y={[ferrosilicon (qualified block) + ferrosilicon FeSi75-B]*0.0006+silicon carbide (55%)*0.3}/0.3

W=[vanadium iron (FeV50-A)+vanadium iron (FeV50-B)]*205+ silicon aluminum alloy FeAl30Si25*1+ silicon aluminum manganese alloy ball*8.5+silicon manganese surface (silicon manganese slag)*7.6+ petroleum coke Recarburizer*4.6+[Manganese Silicon Alloy FeMn64Si27 (Qualified Block) + Manganese Silica FeMn68Si18 (Qualified Block)]*8.15 + Silicon Calcium Carbon Deoxidizer*4+Y

$$Y = \left[(E + F) * 0.0006 + J * 0.3 \right] / 3$$

$$W = (A + B) * 205 + C * 1 + L * 8.5 + D * 7.6 + G * 4.6 + (H + I) * 8.15 + K * 4 + Y$$

Calculated to obtain the average cost of 18801.91 yuan

Fourth option

Replace silicon iron (qualified block), ferrosilicon FeSi75-B with silicon carbide (55%), substitute manganese silicon germanium FeMn64Si27 (qualified block), manganese silicon alloy FeMn68Si18 (qualified block) with silicon manganese surface, replace with silicon aluminum alloy FeAl30Si25 Ferrovanadium (FeV50-B), ferrovanadium (FeV50-A), other alloy contents remain unchanged.

W = silicon aluminum manganese alloy ball * 8.5 + petroleum coke recarburizer * 4.6 + silicon calcium carbon deoxidizer * 4 + A + B + C

$$W = L * 8.5 + G * 4.6 + K * 4 + Q + X + Y$$

The calculated cost average is 12531.63 yuan

In view of its four appeals, we have the fourth option to minimize the cost of deoxidation alloying in the case of higher alloy yields.

The composition of silicon manganese surface, silicon carbide (55%), silicon aluminum alloy FeAl30Si25, silicon calcium carbon deoxidizer accounted for 60%, 20%, 15%, 5%, respectively.

5. CONCLUSION

In this paper, the deoxidation alloying process in the iron and steel smelting process was studied to reduce the oxygen content in steel and to make other elements meet the content standards. Therefore, this paper compares and analyzes the alloys provided, and gives the formulation scheme with lower alloy cost in the case of higher yield in the deoxidation alloying process.

Firstly, this paper establishes a multivariate linear regression model based on a large number of historical yields. Regression analysis can accurately measure the degree of correlation between each factor and the degree of regression fit, making this study consistent with the actual situation.

Then the gray model GM (1.1) is established to predict the factors affecting the yield. The sample distribution for the model does not need to be regular, which is consistent with the situation given by the problem. The results can be directly obtained by MATLAB. The large amount of data used is accurate. Compared with the book purchasing system based on the grey system theory [7], the forecasting premise of this paper is large and more universal. After further development and improvement, the relevant data statistics are further improved. Refinement and improvement [8].

Finally, a constrained cost optimization model is established. Based on the control variable method and the equivalent substitution idea, four deoxidation alloying schemes are proposed. The original deoxidation alloying schemes are compared to obtain the optimal cost scheme. Finally, the optimal batching scheme is as follows: the compound silicon manganese surface, silicon carbide (55%), silicon aluminum alloy FeAl30Si25, and silicon calcium carbon deoxidizer account for 60%, 20%, 15%, and 5%, respectively. The calculated costs are averaged, the given ingredients are more complete, and a more accurate formula is obtained after the relevant data is improved.

The values given in this paper are based on a large amount of data, and the development and application of the final deoxidized alloy materials for steelmaking in China [5].

Compared with this, this paper is more accurate, real-time, and feasible, and can be put into the actual converter steelmaking. In addition to reducing costs in the deoxidation alloying process, it is also possible to reduce costs from other links, such as improving the production process, implementing one can to the end, reducing the number of intermediate cans, which can effectively reduce the consumption of steel materials, thereby achieving the purpose of reducing costs; Improve the efficiency of resource and energy utilization, such as the secondary utilization of various waste slag and waste gas generated in the process of deoxidation alloying, saving energy and creating considerable economic benefits.

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Analysis of Securities Investment Based on Fuzzy Mathematics

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Abstract: At present, the securities investment market is not yet fully mature, and the limited analysis method can't evaluate and forecast the trend of trading securities, based on the fuzzy comprehensive evaluation model of AHP, the comprehensive evaluation results of fuzzy mathematics in securities investment and the overall trend of the market are established, The fuzzy comprehensive evaluation model based on AHP is constructed by the four kinds of analytical methods, By analyzing the four kinds of analytical methods and determining the weight, the fuzzy comprehensive evaluation model based on the analytic hierarchy process is constructed, and the comprehensive evaluation results of the fuzzy mathematics in the securities investment and the overall trend of the market are determined, Provide new operational basis and decision when dealing
Keywords: Stock Investment, Analytic Hierarchy Process, Fuzzy Comprehensive Evaluation, Market Prediction

1. SECURITIES INVESTMENT ANALYSIS METHOD

1.1 Fundamental Analysis

In the analysis of securities investment, combined with the economics, finance, accounting and investment and other basic value of the principle of analysis, to provide investors with an effective basis for investment and a reasonable operating system. Among them, the fundamental analysis is a more comprehensive and comprehensive analysis method, mainly for the industry and the company micro-factors analysis.

1.2 Technical Analysis

Securities technology analysis method is a short-term point of view, the use of charts, morphology, logic and mathematics methods, through the study of the typical changes in the law to predict the trend of changes in the securities market technical methods.

1.3 Policy Analysis

Policy analysis mainly from the national development and industry point of view, through the establishment of macroeconomic analysis index system to predict and the securities market in the national policy trend. Among them, the important macro indicators are: GDP, market interest rates, market exchange rates, currency rates, fiscal policy and monetary policy. Using the method of policy analysis, the indicators of quantitative classification for investors to seek a lower risk system of investment.

1.4 Classical Theoretical Analysis

The classical investment theory analysis[1] is the investor planning and guiding their investment behavior, the complex mathematical algorithm in classical theory can make rational and balanced decision-making for investors. The so-called classic must be the practice of the past and summed up the general law of nature in order to provide future generations to learn and apply. Among them, the more important theory of securities investment: K-line theory of the primary, wave theory, Gann theory, Dow theory and the stock market psychological game.

The fuzzy comprehensive evaluation method can evaluate the risk and benefit of the securities and provide some guidance for the investors to choose the securities.

2. FUZZY COMPREHENSIVE EVALUATION

In this paper, the fuzzy comprehensive evaluation[2] model is applied to the securities investment analysis. Through the refinement and quantification of the basic indicators and the determination of the weight of the indicators, the investors' securities are evaluated as a whole.

2.1 Fuzzy Comprehensive Evaluation of the Characteristics

According to the established criteria, things are evaluated on a single factor, that is a single judgment; the evaluation of things by multiple factors, that is comprehensive evaluation. Which is a kind of decision-making process, used in the evaluation of the pros and cons of things [3].

2.2 Construction of Fuzzy Evaluation Model

2.2.1 Determine the weight using analytic hierarchy process

By combining the experience of experts[4-6] and comparing the importance of each layer, the judgment matrix is constructed. The basic algorithm steps are:

a.Regularize each column of the comprehensive evaluation matrix:

$$\overline{b_{ij}} = \frac{b_{ij}}{\sum_{i=1}^{n} b_{ij}} (i, j = 1, \cdots n), \begin{pmatrix} b_{11} & \cdots & b_{1n} \\ b_{n1} & \cdots & b_{nn} \end{pmatrix} \quad (1)$$

b. Summarize the judgment matrix after each column is normalized:

$$\overline{W_1} = \sum_{j=1}^{n} \overline{b_{ij}}, \begin{pmatrix} \overline{b_{11}} & \cdots & \overline{b_{1n}} \\ \overline{b_{n1}} & \cdots & \overline{b_{nn}} \end{pmatrix} \quad (2)$$

c. formalization of $W = (W_1, W_2, \cdots, W_n)^r$:

$$W_i = \frac{\overline{W_i}}{\sum_{j=1}^{n} \overline{W_j}}, (i = 1, 2 \cdots, n) \quad (3)$$

d. Calculate the maximum eigenvalue of the comprehensive judgment matrixλ_{max}.

$$\lambda \sum_{j=1}^{n} \frac{\sum_{i=1}^{n} b_{1n} \times W_n}{n} (n = 1, 2, \cdots, n)_{max} \quad (4)$$

e. Consistency test

$$CI = \frac{\lambda - n}{n-1}, CR = \frac{CI}{RI} \quad (5)$$

The values are shown in the Table 1 below:

Table 1. Ri Values Table

Order	1	2	3	4	5	6	7	8	9	10	11	12
RI	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.52	1.54

When the comprehensive evaluation[5] matrix satisfies: $CR = \frac{CI}{RI}$ <0.1, It is considered that the consistency of the comparison matrix is better, and the calculated eigenvalues and eigenvectors can be applied. Otherwise, it means that the constructed judgment matrix error is larger than the maximum allowable range and needs to be adjusted. The basic operation flow is shown in Figure 2.

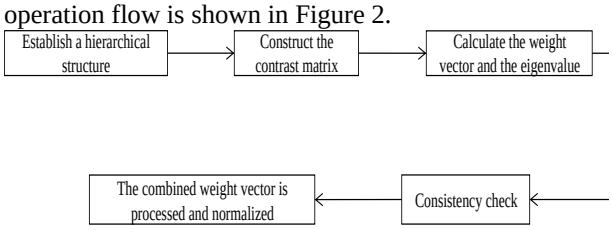

Figure 2 Analytical Flow Chart

2.2.2 Fuzzy comprehensive evaluation based on analytic hierarchy process

The securities analysis[6] expert evaluates the weight matrix of the indicators at all levels and the factor evaluation matrix based on the sub-factor level and the evaluation level.Which is divided into four grades according to the influence degree of the index, the degree of success is A> B> C> D, the scores are recorded as 4, 3, 2, 1, the corresponding membership degrees are 1, 0.8, 0.4. Which can be based on the aggregate elements of the indicators of fuzzy comprehensive analysis.

$$B_i = A_i \cdot R_i = [A_{i1} \quad A_{i2} \quad \cdots \quad A_{ij}] \cdot \begin{bmatrix} r_{i11} & r_{i12} & \cdots & r_{i1k} \\ r_{i21} & r_{i22} & \cdots & r_{i2k} \\ \vdots & \vdots & & \vdots \\ r_{ij1} & r_{ij1} & \cdots & r_{ijk} \end{bmatrix} = [B_{i1} \quad B_{i2} \quad \cdots \quad B_{ik}] \quad (6)$$

$B_i$is normalized to the data processing and combined, the resulting 4×4 matrix columns are added and normalized:

$$B = [B_1 \quad B_2 \quad \cdots \quad B_k] = [0.268 \quad 0.314 \quad 0.258 \quad 0.160] \quad (7)$$

The score of the fuzzy comprehensive evaluation can be obtained by multiplying the B matrix by the fractional fraction:

$$F = [0.268 \quad 0.314 \quad 0.258 \quad 0.160] \cdot \begin{bmatrix} 4 \\ 3 \\ 2 \\ 1 \end{bmatrix} = 2.69 \quad (8).$$

3. CONCLUSION

In the context of the rapid development of today's market economy, securities trading has a certain risk.The use of existing securities investment analysis method is still unable to accurately predict the trend of securities, which can only control the results within a limited range and blurred.By constructing the fuzzy comprehensive evaluation model based on the analytic hierarchy process (AHP), the four effective methods are used to evaluate the securities market in the existing market, which provides a new way for the investors to provide a market trend, New methods to promote the success rate of securities investment.

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Research on the Best Decision-Making Recommendation Model for Airport Taxi

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Abstract: As people's demand for travel speed is higher and higher, airplane has gradually become the most frequently used way of travel for medium and long distance travel, thus forming a prosperous airport taxi market, How to efficiently arrange taxi drivers to receive passengers has become the focus of attention of passengers and drivers, Decision tree algorithm is good predict behavior of tree structure, finding out the influence taxi decision the number of passengers, the passengers to the destination, the competition number of vehicles, weather conditions, such as four factors, multiple iterations, it is concluded that each iteration when choose information gain the biggest impact factors as a root node, and further through the analysis of decision diagram intuitive taxi decision-making plan, The premise of constructing a decision tree is that there are a large number of samples to learn from, Since we only need a more accurate and reasonable method of selecting attributes, we only need to use ID3 algorithm, Python is used to calculate the information Gain value of each node, then the next node is determined, and finally the whole decision tree is obtained,To achieve the convenience of taxi drivers to determine the best choice decision

Keywords: Optimal decision; Decision tree; Information entropy; Id3 algorithm; Information gain

1. INTRODUCTION

This question is about taxis at domestic airports. Taxis are one of the main means of transportation for most passengers who leave the plane for their destination. For domestic airports, most airports separate the passenger seeing off channel from the passenger receiving channel, which makes taxi drivers who see off passengers to the airport face two choices : a. go to the arrival area (reception channel) and wait in line to pick up passengers back to the city.b. return to the city directly to solicit customers.

Both of these situations will lead to the loss of revenue for taxi drivers with different costs.In general, the choice of taxi drivers is related to their personal experience judgment. For example, the number of passengers required [1-5] for a flight to arrive at the airport is significantly increased, the number of passengers at night is significantly lower than the number of passengers during the day, and the number of passengers is seasonal. However, in practical problems, there are still many determinations and uncertainties that affect the decision-making of taxi drivers, which are related to each other in different ways and have different effects.

2. THE TAXI DRIVER SELECTS THE DECISION TREE MODEL

2.1 Data Acquisition and Model Building

In the analysis of problem 1, this paper proposes to use decision tree to make risky decisions, and the general decision model [2] will contain three basic factors: natural state, strategy and profit and loss value.Therefore, through consulting relevant literature [3-6] and intra-group discussion and analysis of factors beyond the control of decision makers, this paper concludes that four factors influencing taxi decision-making, namely the number of passengers, the distance to the destination of passengers, the number of competing vehicles and the weather, are also known as the four natural states that may be affected, and they are classified as a state set S:

$$S = \{S_1, S_2, S_3, S_4\}$$

As for the selection strategies of taxi drivers, they can be divided into two types: going to the arrival area (reception channel), waiting in line for passengers to return to the urban area, and directly emptying and returning to the urban area to solicit passengers. The two schemes are classified as strategy set D:

$D = \{d_1, d_2\}$-

Regarding the profit and loss value, in this question, the taxi driver chooses the profit or profit value of different strategies in different situations. The profit and loss value is a function of strategy and natural state. It is assumed that the probability of occurrence of each natural state Sj is Pj, When adopting a certain strategy di, the corresponding expected profit and loss value E is calculated as follows:

$$E(d_i) = \sum_{j=1}^{n} \alpha_{ij} p_{ij} \qquad (i = 1, 2, \cdots m) \text{-(1)}$$

Among them, α_{ij} is the profit and loss value of strategy$d_i$under the occurrence of Sj in the natural state.

In order to better calculate the profit and loss values of taxi drivers in different situations, this paper uses the ID3 algorithm in the decision tree model. We need to obtain the probability value that each natural state may obtain. And uncertainty. After consulting relevant data, Shannon proposed information entropy to measure the uncertainty[4] of the random variable. The calculation formula is as follows:

$$H(S_i) = -\sum_{i=1}^{n} p_i \, log_2(p_i) \quad (2)$$

According to reference 4, information entropy has the following two properties: the higher the sample set purity, the smaller the entropy value; the more complex the components, the lower the purity, and the larger the entropy value. Therefore, the difference information gain of the information entropy before and after the division can be used to measure the effectiveness of the current feature on the partitioning of the sample set S:

$$\text{Gain}(Y,S) = H(Y) - \tilde{H}_1(Y) \quad (3)$$

The difference formula of entropy before and after dividing the data set by a feature:

$$Gain(Y,S) = H(Y) - H(Y|S) \quad (4)$$

H (Y) is the information entropy before division, and H (Y | S) is the conditional entropy according to feature S:

$$H(Y|S) = \sum_{i=1}^{n} p(x_i)\, H(Y|S = x_i) \quad (5)$$

In the decision tree ID3 algorithm, the information gain Gain (Y, S) is used as a measurement index for selecting the nodes of the decision tree. In this way, a relatively short tree can be established, which can accurately classify and obtain the decision result as soon as possible. In the process of establishing a decision tree, the larger the information gain Gain (Y, S) of a feature, the stronger the ability of the feature to reduce the entropy of the sample. That is to say, this feature makes the data from uncertainty to deterministic. The stronger the ability.

2.2 Analysis and Results of Decision Tree Model

In order to obtain the most real data of taxi driver's wishes and make the model more accurate, a questionnaire was issued to taxi drivers near the airport to obtain 868 results. Due to space limitations, 14 data were randomly selected for display, as shown in Table 1:

Table 1. The 14 Samples Drawn Randomly

Number of passengers	Number of competing vehicles	Destination	The weather	Whether to wait
High	Low	Near	Good	Y
Moderate	Moderate	Near	Good	Y
Moderate	High	Near	Bad	Y
High	High	Far	Bad	Y
Low	High	Near	Bad	Y
Moderate	Moderate	Near	Bad	Y
Low	Moderate	Far	Bad	Y
High	Moderate	Far	Good	Y
High	Low	Near	Bad	Y
Low	Low	Near	Good	N
Low	Low	Far	Good	N
Moderate	High	Far	Bad	N
Low	Moderate	Near	Good	N
Moderate	Moderate	Far	Good	N

The establishment of the root node:

Two events X, Y are independent of each other and p represents the probability that they may occur:

$$p(x,y) = p(x) \cdot p(y) \quad (6)$$

That is, $log(xy) = log(x) + log(y)$ (7)

Information entropy before classification: $H(S) = -\frac{558}{868} \times log\frac{558}{868} - \frac{310}{868} \times log\frac{310}{868} = 0.94$

Classified by distance, there are two types of eigenvalues (Far and Near).

$$H(S|\text{Destination} = \text{Far}) = -\frac{372}{496} \times log\frac{372}{496} - \frac{124}{496} \times log\frac{124}{496} = 0.811$$

$$H(S|\text{Destination} = \text{Near}) = -\frac{186}{372} \times log\frac{186}{372} - \frac{168}{372} \times log\frac{186}{372} = 1$$

The conditional entropy under the feature destination Far or Near is:

$$H(S|\text{Destination}) = \frac{496}{868} \times H(S|\text{Destination} = \text{Far}) + \frac{372}{868} H(S|\text{Destination} = \text{Near}) = 0.892$$

Therefore, according to the destination Far or Near classification, the information gain is:

$$\text{Gain}(S|\text{Destination}) = H(S) - H(S|\text{Destination}) = 0.048$$

Similarly, get the information gain value of other natural states:

$$\text{Gain}(S|\text{Weather}) = 0.151$$
$$\text{Gain}(S|\text{Vehicles}) = 0.029$$
$$\text{Gain}(S|\text{Passengers}) = 0.247$$

Since the first iteration has the largest information gain Y, the number of passengers is used as the root node; at this time, the tree is divided into three categories (low, moderate, high) according to the number of passengers, and then we follow each feature of the number of passengers Reclassify[5].For low wage increases, the initial entropy of the second iteration is:

$$H(S) = -\frac{2}{5} \times log\frac{2}{5} - \frac{3}{5} \times log\frac{3}{5} = 0.971$$

Calculate the entropy of the distance feature:

$$H(S|\text{Destination} = \text{Near}) = -\frac{2}{3} \times log\frac{2}{3} - \frac{1}{3} \times log\frac{1}{3} = 0.918$$

$$H(S|\text{Destination} = \text{Far}) = -\frac{1}{2} \times log\frac{1}{2} - \frac{1}{2} \times log\frac{1}{2} = 1$$

$$H(S|\text{Detination}) = \frac{3}{5} \times H(S|\text{Near}) + \frac{2}{5} \times H(S|\text{Far}) = 0.9508$$

Calculate the information gain:

$$\text{Gain}(S|\text{Destination}) = H(S) - H(S|\text{Destination}) = 0.0202$$

Similarly we can get:

$$\text{Gain}(S|\text{Weather}) = 0.971$$
$$\text{Gain}(S|\text{Vehicles}) = 0.771$$

Due to Gain(S|Weather)>Gain(S|Vehicles)>Gain(S|Destination),So the weather is a sub-tree of the passenger

destination Far or Near.The third iteration continues to classify each feature of the weather.In the end, we get the tree diagram[6] as as shown in Figure 1:

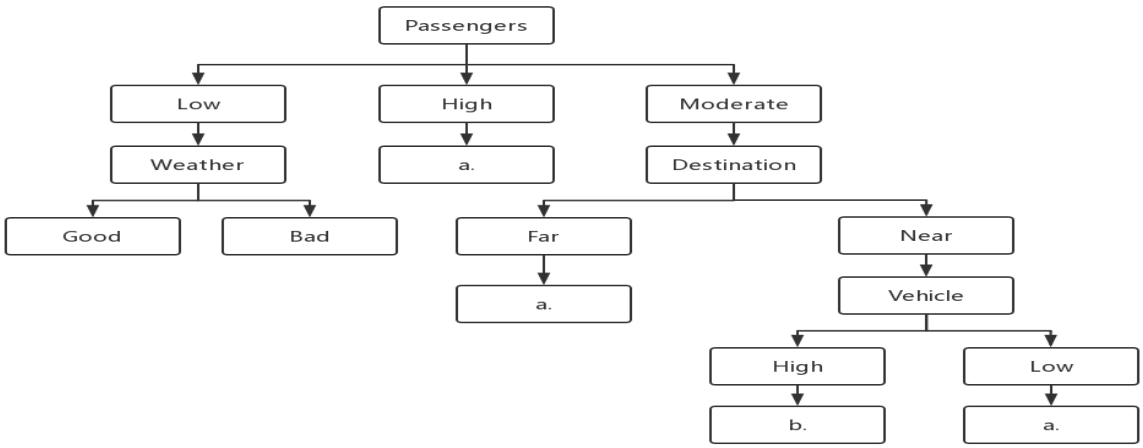

Figure 1 Decision Tree Model Results

3. CONCLUSION

The decision tree model established in this article is easy to understand and can be visualized. For the choice of driver scheme, it is reasonable to establish a decision tree model for the decision model. The computational complexity is not high, and it can solve single-stage problems as well as high-stage problems. The model built is closely related to real life, and it is more universal to solve the problems raised in combination with the actual situation. Determine the taxi-related data of a specific airport and the city where the airport is located. Based on the established decision plan, the taxi selection plan for the airport is given, and the rationality of the model and the dependence on relevant factors are analyzed.

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Block Chain Voting System Based on Cee and Blind Signature Algorithm

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Abstract: With the development of artificial intelligence network era, the application field of block chain is more and more extensive, How to apply block chain technology to elections that need to process a large amount of voting information, the correct application of block chain technology has become the focus of the whole society, To solve the first problem, we need to deal with the election problem that contains a large amount of voting information, First, voters generate their own private keys, which ensure the security of voters' personal information, Public keys refer to users' voting information, and private keys are used for transaction signatures during voting, Then a blind signature algorithm is applied to introduce a random value that can conceal the exchanged data, After a round of information transmission, the voters passed the voting information to the manager and marked their votes, thus ensuring the accuracy of the voting information, The security of the voting system needs to be ensured, The consensus algorithm is applied to predict the probability that the voting system will be breached, which once again proves the security of the voting system in theory

Keywords: Block chain; Elliptic cryptography; Blind signature; Consensus algorithm; Fragmentation technology

1. INTRODUCTION

At present, there are many software that can vote in China. Some related software, such as Weibo and WeChat, have voting-related functions. However, there is a risk that these intermediary software will be tampered with and the voting process will not be transparent.

To prevent the loss of all kinds of election records and ballot papers, to ensure that the ballot papers will not be tampered with and there will be no improper ballot papers. Because the block chain is open and transparent, the real information of voters is monitored by everyone, and the elected people are also monitored by everyone, thus ensuring the authenticity of the vote[1-3].

2. EXPERIMENTAL

2.1 Study Area

The voting system model[2]is built by using block chain technology. Based on elliptic curve discrete high-efficiency cryptosystem, the blind signature algorithm of elliptic curve cryptosystem is used. The algorithm can realize the same security level of cryptographic services as RSA and discrete logarithm system DL with fewer operands, and improves the efficiency on the premise of ensuring the security of the whole voting system. The voting information received within a certain period of time is encapsulated into a data block with a timestamp, and a block is selected through a consensus algorithm and linked to the current longest block chain. This process involves hash algorithm, Merkle tree, timestamp, asymmetric encryption and other technical elements, ensuring the integrity and traceability of block data.

2.2 Method

Public key encryption refers to an encryption algorithm consisting of a public key and a private key. The public key and the private key are the only matching keys. The public key is open to the public, which is equivalent to a bank account in traditional transactions and is used to store bitcoin. Bitcoin here is a virtual currency. This model refers to the voting information of users, which can be seen by managers and voters. The private key is only visible and used by voters, and is used for signing transactions during voting to prove ownership. No one else has the right to change it, Figure 1.

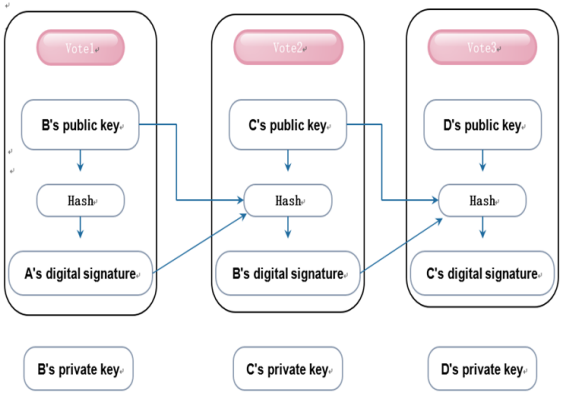

Figure 1 Public Key and Private Key in Zone Chain

The private key is decided and managed by voters. The public key is generated by an irreversible encryption function, namely elliptic operation. Different private keys are calculated by algorithms to obtain different public keys. This uniqueness ensures the security of the system. Then a bitcoin address is

generated by hash function using the public key. Bitcoin address is a string of numbers and letters that can be shared with other managers.

Elliptic curve cryptosystem is used to control the generation of public key and private key. Elliptic curve is used in algebra and geometry It has been studied for more than 150 years and has rich and profound theoretical accumulation and strong practical application. The elliptic curves mentioned here are not ellipses, they are called elliptic curves because they are expressed by cubic equations [3-6]. Its general form is:

$y^2 + axy + by = x^3 + cx^2 + dx + e$ (1)

In a real number system, an elliptic curve is a set of all points (x,y) that satisfy the equation E:$y^2 = x^3 + ax + b$. If $4a^3 + 27b^2 \neq 0$, E: $y^2 = x^3 + ax + b$ can become a group[4]. In the curve equation, all the coefficients come from a finite field GFξ, which is commonly expressed as E:

$$y^2 = x^3 + ax + b(\text{mod } p) \neq 0 \quad (2)$$

There are only a limited number of points (x,y) on the curve, including a special point o, called infinity point. The construction of elliptic groups is used in the generation process of calculation keys. The following is the generation process of the construction of elliptic groups Ep(a,b):

(1)$x = 0,1,\ldots,p-1$,meter $x^3 + ax + b(\text{mod } p)$

(2)For each calculation result, it is determined whether it has the square root of modulus p. If not, then Ep(a,b) There is no point in x coordinate corresponding to the result; If there is, if two square roots are y and p-y, then points (x,y) and (x,p-y) are all points of Ep(a,b). In this way, elliptic groups are built and these basic models are applied to generate keys.

Select elliptic curve E: $y^2 = x^3 + ax + b \ (\text{mod } p)$,Construct an Elliptic Group $Ep(a,b)$. Let $P = (x_1, y_1) \in Ep, Q = (x_2, y_2) \in Ep, P \neq -Q$,so $P + Q = R = (x_3, y_3) \in Ep$

$x_3 = \lambda^2 - x_1 - x_2$ (3)

$y_3 = \lambda(x_1 - x_3) - y_1$ (4)

$$\lambda = \begin{cases} \frac{y_2 - y_1}{x_2 - x_1} \\ \frac{3x_1^2 + a}{2y_1} \end{cases} \quad (5)$$

In $Ep(a,b)$, the generating element point g is selected so that the smallest satisfying $n \cdot G = 0$ is a very large prime number, and an integer x less than n is selected as the private key to generate the public key $Y = x \cdot G$.

Using elliptic curve cryptosystem, we can accurately determine the unique correspondence between public key and private key, thus ensuring the security of the whole system.

a)blind signature

Blind signature algorithm includes two roles: the user and the signer. The purpose of using this algorithm is to enable the user to complete voting without disclosing his information content to the signer. Therefore, blind signature technology is widely used in anonymous voting scenarios to protect users' privacy and improve the security factor of the entire voting system[5].

3. MODEL OPTIMIZATION AND IMPROVEMENT

3.1 Algorithm for Updating Private Key

If an attacker successfully invades and controls a node, the attacker can successfully transfer the attack target to another node in the system. This attack is called a mobile attack. Block chain nodes automatically save system information and transmit information through interconnection. If one node is successfully invaded, other nodes will have great risks. Therefore, in order to avoid mobile attacks, node private keys must be updated regularly to ensure the security of participating nodes.

In addition, the update of the private key makes it impossible for the attacker to obtain the private key information other than that even if he obtains the information of a certain node within T time period, thus avoiding the possibility of the attacker tampering with the signature information and ensuring the forward security of the signature information[6]. To solve the above problems, we adopt the following algorithm.

If the update period of the node private key is T, the update algorithm is as follows:

$NodeQ_i$ machine selects an integer toM_i^T the initial conditionM_i^T.$NodeQ_i$calculates update factor:

$X_{ij}^T = M_i^T p \ mod \ a_j$ (6)

Node Q_i calculates verification information and verification formula

$A_i^T = h^{M_i^T} mod \ q$ (7)

$B_{ij}^T = M_i^T p - X_{ij}^T$ (8)

$C_{ij}^T = h^{B_{ij}^T} mod \ q$ (9)

$NodeQ_i$ received the information X_{ij}^T and broadcast information A_i^T, B_{ij}^T and C_{ij}^T sent by Q_i. The correctness of the update factor was verified by the following two equations:

$(h^{M_i^T})^p mod \ q = A_i^T$ (10)

$((h^{M_i^T} \text{ mod q})(C_{ij}^T) a_j \ mod \ q) mod \ q$ (11)

If the verification equation holds, the private key for T period is calculated:

$N_j^T = N_j^{T-1} + \sum_{i=1}^{n} X_{ij}^T \ mod \ d_j$ (12)

3.2 Fragmentation Technique

Sharding technology is a chain expansion scheme that divides the network into fragments, but

fragmentation is not a new concept in the database field.Sharding technology divides large databases into smaller, faster, and more manageable parts called data fragments. The advantage is decentralized and effective expansion on a secure chain. If utilized effectively, the system will be distributed, secure, and linearly scalable.Using network fragmentation technology, assuming 10,000 nodes, through the workload proof process, they will be randomly

divided into 10 groups, each group being called a slice. Each node stores only a subset of the information they have processed themselves, and each slice processes a different set of data and arrives at a consensus answer within the group. The shards then submit a summary report of the data to a shard called the Directory Services Committee, which aggregates the data summaries for the different shards and combines them to form a larger data set called Final Block, the data of the final block will be returned to all fragments, as Figure 2.

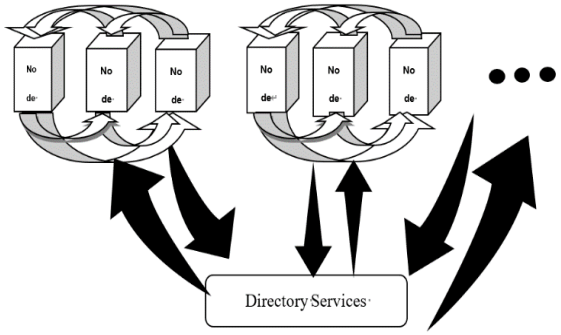

Figure 2. Schematic Diagram of Slicing Technology

4. CONCLUSIONS

The model is based on elliptic cryptosystem and blind signature algorithm. The private key managed by voters ensures the security of user information, i.e. voters only pass the information of candidates they cast to managers. A block chain model is established based on the elliptic password system and blind signature algorithm, and a voting system for processing large-scale voting information is constructed, which solves the election problem requiring large-scale voting information.

The consensus algorithm is applied to predict the probability that the voting system will be breached, which once again proves the security of the voting system in theory.

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Research on Population Structure Based on Second Child Policy

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Abstract: Population structure has become one of the restrictive factors affecting China's long-term development, In response to this, the state has proposed a new policy of "full two children" to improve the status quo, Based on the impact of the second child policy on the number and structure of the population, relevant mathematical models were established for analysis and prediction, Using the birth rate and the total fertility rate as indicators, the data was subjected to polynomial fitting, Compared with the actual data, it was found that after the two-child policy was released (ie, 16 and 17 years), the fitted data was significantly different from the actual data, The relevant policies have already achieved preliminary results, The Leslie matrix population prediction model method was used to simulate the age structure of the population every five years in the future, Based on an in-depth analysis of changes in China's population, it was found that China's population will reach about 1,386676 billion in 2035, and the degree of aging will further deepen, All age structures tend to be stable, In addition, a BP neural network model was established to make a reasonable prediction of the proportion of men and women and the proportion of urban and rural population from 2019 to 2035, It was found that affected by the second child policy, the proportion of men and women will decline in the future and fluctuate between 1,04 and 1,045, The proportion of urban and rural population will continue It rises and fluctuates between 2,2 and 2,4, but the changes of both within the upper and lower limits show a potential law approaching a constant

Keywords: Two-Child Policy Polynomial Fitting, Leslie Matrix Model; Bp Neural Network

1. INTRODUCTION

Population structure issues will play an important role in China's future development. Nowadays, changes in the proportion of urban and rural population, increasing aging problems, imbalance between male and female ratios, and declining fertility in the new situation have affected China's future development to varying degrees Sustainability and optimizing the quality of China's population development is a very important research topic and a hot issue that people are currently paying attention to.

Question 1: Based on the current data on population issues, use the model to analyze whether the new policy of "two children in a comprehensive way" has produced preliminary results in the past few years in terms of increasing the number of new children and adjusting the structure of the population.

Question 2: Based on the current development situation, a prediction model is established to predict how China's population and population structure will be by 2035 or 2050, and analyze how this result will affect our national economy.

2. EFFECT OF SECOND CHILD POLICY IMPLEMENTATION

2.1 Indicator Anaysis

According to the China Statistical Yearbook data, the four index data from 2000 to 2017 are arranged as Figure 1 shown below[1-3]:

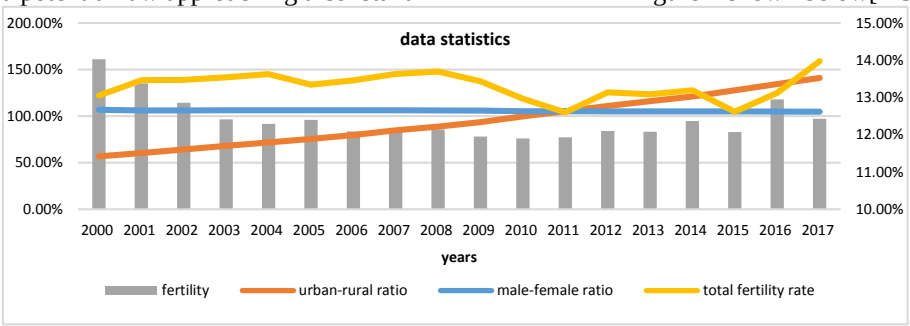

Figure 1 Statistics of 2000-2017 Statistical Yearbook

It can be seen from the above figure that after the implementation of the "two-child policy" in 2015, the birth rate and total fertility rate have changed significantly. The performance of the two can accurately reflect the changes in China's population. Therefore, we mainly choose the birth rate and total fertility rate as the The indicators are fitted to analyze whether the policy has been effective.

2.2 Variable Analysis

Draw a scatter plot to determine the degree of the fitted polynomial. Use SPSS software to draw a scatter plot of historical data, as shown in Figure 2, in order to observe the growth trend of the data and determine the number of fits.

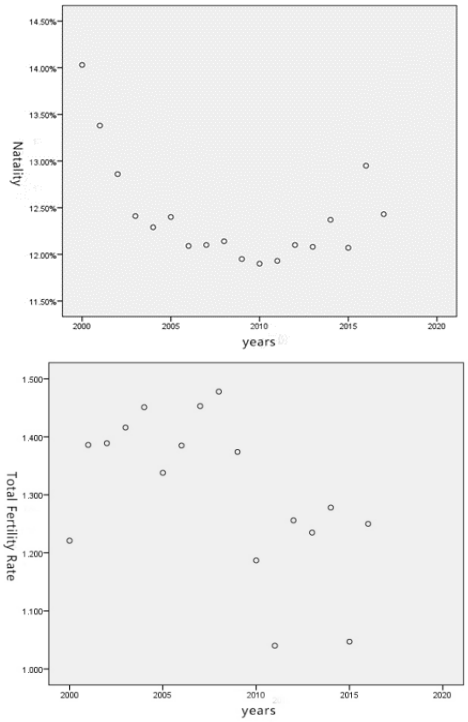

Figure 2. Scatter Plot of Birth Rate and Fertility Rate

Observed from the figure, the data shows a growth trend similar to the cubic function. Therefore, with the help of MATLAB software, a cubic fit was performed on the data.

2.3 Problem Solving

Curve fitting. The polynomial fitting method [2-6] is adopted.the data of the birth rate and the total fertility rate from 2000 to 2017 are fitted with a third-degree polynomialy $= a_3x^3 + a_2x^2 + a_1x + a_0$.

The birth rate fitting function results are:

y=-1.73983223746577e-05x3+0.104966830674973x2 -211.093381736160x+141506.158987699

The fertility fitting function results in:

y=4.63E-06x3-0.027893002x2+56.05812115x-37554.09223

MATLAB draws the fitted curve and scatter distribution separately, and the results are shown in the following Figure 3-4.

Fit effect test. Therefore, no matter from the graph or the data, you can find that the fitting effect is better.

Result analysis. Since the implementation of the second child policy, the birth rate and fertility rate have been affected, and the initial effects have been shown [4-8].

3. LESLIE MATRIX MODEL

3.1 Model Processing

Assume that the mortality rate of infants aged 0-4 years is ignored, and the population is divided into 20 age groups at equal intervals according to age, that is, every five years old is an age group (Note: All people over 95 years old are classified as 95+ years old) Within the paragraph), using the population of each age in the initial period as a column vector, construct a Leslie matrix of fertility and mortality at each age, and at the same time discretize the same interval, t = 0,1,2, ..., and then calculate Projected population structure for each year.

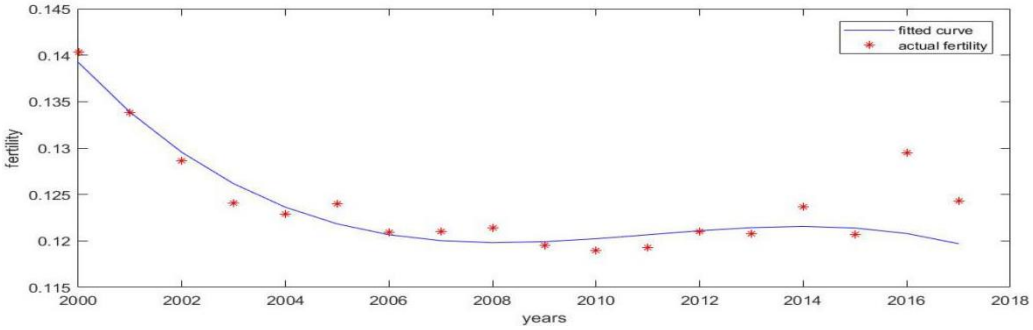

Figure 3. Fitting Curve of Birth Rate from 2000 to 2017

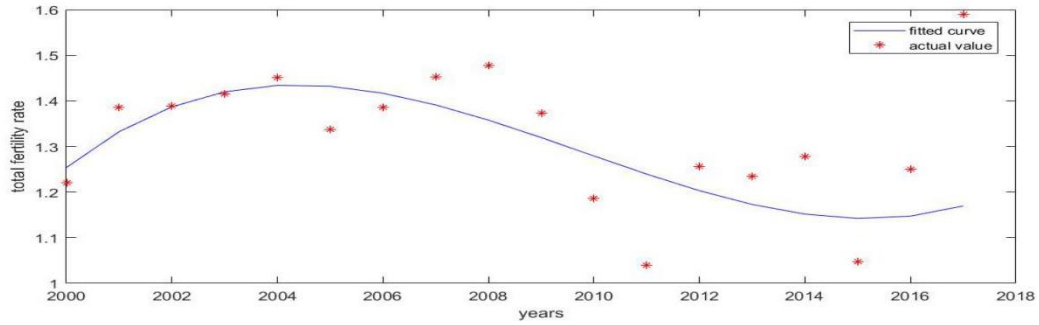

Figure 4. Fitting Curve of Fertility Rate from 2000 to 2017

(Note: The red dot indicates the actual data; the blue curve indicates the fitting result)

Let the population of the i-th age group in year t be $n_i(t)$ i=1,2, ..., 20, and the definition vector $n_i(t)$=[$n_1(t), n_2(t),\ldots,n_{20}(t)$]T;

Let the population fertility rate of the i-th age group be b_i, where b_i is the average number of daughters per female in the i-th age group per unit time;

Let the death rate be d_i, that is, d_i is the ratio of the death to the total number in the i-th age group per unit time, then the survival rate $s_i = 1 - d_i$;

Assume that b_i and s_i do not change with time t. According to the definition of b_i, s_i, and $n_i(t)$, write out that $n_i(t)$ and $n_{i+1}(t+l)$ should satisfy the relationship:

$$\begin{cases} n_i(t+1) = \sum_{i=1}^{20} b_i n_i(t) \\ n_{i+1}(t+l) = s_i n_i(t), i = 1, \ldots, 20 \end{cases}$$

Let the Leslie matrix L be: $\begin{bmatrix} b_1 & b_2 & \cdots & b_{19} & b_{20} \\ s_1 & 0 & \cdots & 0 & 0 \\ 0 & s_2 & \cdots & 0 & 0 \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ 0 & 0 & \cdots & s_{19} & 0 \end{bmatrix}$

Therefore, as long as we find the Leslie matrix L and according to the initial vector $n(0)$ of the population distribution, we can find the population distribution vector $n(t)$ at time t.

Here, 2015 is used as the initial year to predict the age structure of the population in the following years, and the population is grouped at 5-year intervals.

3.2 Model Solving

3.2.1 Initial solution data

(1)Calculate the total number of people in the i (i=1,2, ...,20) age group in 2015.[5-10]

According to the statistical results of the China Statistical Yearbook, the calculation results are as Table 1 follows:

(2)Calculate female fertility in the i (i=1,2,…, 20) age group in 2015

With reference to traditional demographic methods, women of childbearing age are targeted at the age of 15-49, so only the number of females in the 4-10th group can be considered, as Table 2.

Table 1. Proportion of Each Age Group in 2015

generation	0-4	5-9	10-14	15-19	20-24	25-29	30-34	25-39	40-44	45-49
proportion(%)	5.96	5.53	5.30	5.17	6.39	8.79	7.77	7.21	7.66	9.21
generation	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95+
proportion(%)	8.45	5.22	5.94	4.50	2.85	1.97	1.28	0.58	0.17	0.04

Table 2. Fertility Rates by Age in 2015

Generation	15-19	20-24	25-29	30-34	35-39	40-44	45-49
fertility rate(%)	0.78%	13.91%	30.76%	17.74%	7.22%	3.08%	2.09%

(3)Calculate the survival rate s_i(i = 1,2, ...,20) of the i-th age group

First calculate the total mortality rate of the population in the i-th age group, and then calculate the survival rate of each age group according to the formulas$s_i = 1 - d_i$. The results are as Table 3 follows:

Table 3. Mortality and Survival Rate of All Ages in 2015

generation	0-4	5-9	10-14	15-19	20-24	25-29	30-34	25-39	40-44	45-49
mortality rate(%)	0.00	0.23	0.16	0.23	0.15	0.29	0.29	0.38	0.71	1.10
Survival rate(%)	100.0	99.77	99.84	99.77	99.85	99.71	99.71	99.62	99.29	98.90
generation	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95+
mortality rate(%)	1.76	2.74	3.97	6.29	12.4	19.42	30.47	44.87	58.45	68.45
Survival rate(%)	98.24	97.26	96.03	93.71	97.6	80.58	69.53	55.13	41.55	31.55

(Note: 0--4 ages infant mortality ignored)

3.2.2 Solving future age structure predictions

The Leslie matrix population model infers the age distribution of the next period from the distribution of age groups. Because the data of five years is selected, the population and population distribution can only be predicted by using five years as a period.The age structure of which predictions for 2035 are Table 4:

Table 4. Predicted Value of the Proportion of Each Age Group in 2035

generation	0-4	5-9	10-14	15-19	20-24	25-29	30-34	25-39	40-44	45-49
proportion(%)	4.23	4.50	5.20	5.94	5.93	5.50	5.26	5.13	6.30	8.59
generation	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95+
proportion(%)	7.49	6.78	6.97	7.94	6.49	3.32	2.74	1.22	0.37	0.10

3.2.3 Forecasting population development in 2035

China's population development situation is complex. The current low fertility level is facing severe challenges. The following sections analyze and predict the development of China's population after the implementation of the policies.[6]

(1)Population

According to the distribution of each age group in each year, the total population of that year can be calculated. With the Leslie matrix and the 2015 initial data, first calculate the population of each age group according to the formula. $P_{i+1}^t = P_i^t \times (1 - D_i)$ where P_i^t is the population of the i-th age group in year t Number; Di is the mortality rate for the i-th age group. Then by summing the number of people in each age group, that is,$P^t = \sum_{i=1}^{20} P_i^t$ (i = 1,2, ...,20),The predicted value of the total population in the future years can be obtained. Based on the results, the following line chart is Figure 5:

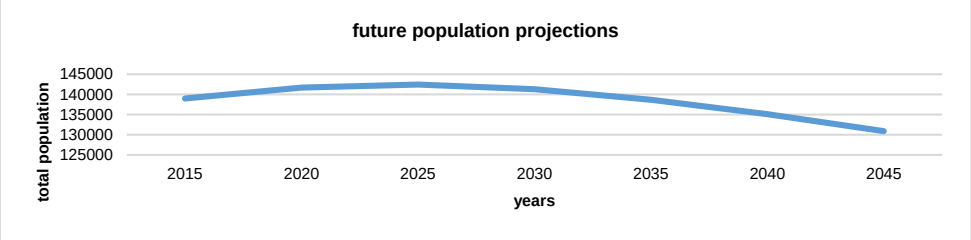

Figure 5. Forecast of Future Total Population

From the graph change trend, we can see that if the comprehensive two-child policy has been implemented, the total population of our country will experience a period of continuous growth, and there will be a population peak around 2025. The total population will reach 14.264 billion people, and the population growth rate will Slowing down gradually, the total population gradually showed a downward trend. Among them, the total population forecast in 2035 is 1.386676 billion people.

(2)Aging population

The population is divided into three stages according to age, that is, children are 0-14 years old; adults are 15-64 years old; elderly are 65 years old or older. The calculation results of the model can be used to obtain the population of these three stages. The results are shown in the appendix. The figure shows the proportion of the elderly and the change in the number of people. As shown in the figure, we analyze the problem of aging.

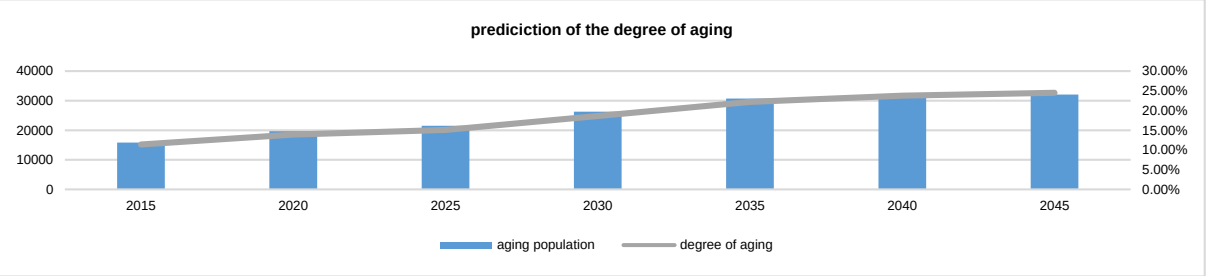

Figure 6. Number of Elderly Population and Degree of Aging

From the Figure 6, it can be intuitively shown that the elderly population in China is on the rise and the degree of aging is also increasing, indicating that the process of aging in China is accelerating. By 2035, the population of people over 65 years of age will increase to about 36321 million people, a proportion of 22.18%, which is almost double that of 2015. Therefore, we can see that the problem of population aging will be more serious[7-12].

4. BP NEURAL NETWORK ANALYSIS

4.1 Model Processing

Establish a model of urban and rural population ratio and gender ratio. According to the algorithm of the BP network model, the network topology must be determined first. In this paper, a three-layer structure is used. The training results of the two structures are obtained with the help of MATLAB software, as shown in Figures 7 and Figures 8. As shown. The excitation function of the hidden layer is an S-type activation function. In the forward propagation process, the input data information is processed layer by layer from the input layer through the hidden layer and passed to the output layer. If the result of the output layer is obtained, If it is less than the expected value, return and modify the weights of the neurons in each layer. This process is continued until the error of the network output is reduced to an acceptable level. A screenshot of the neural network structure obtained by MATLAB is as follows:

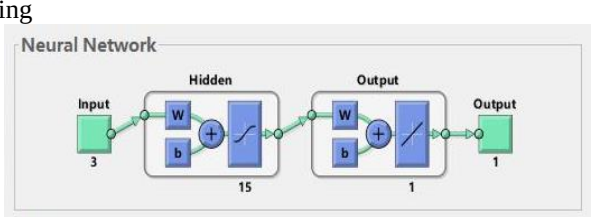

Figure 7. Structure of Urban-Rural Proportional Neural Network

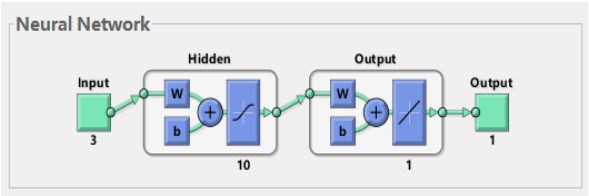

Figure 8. Structure of Sex Ratio Neural Network

BP algorithm specific implementation steps:

(1)Randomly give initial weights of hidden and input neurons:

Incentive function: $g(x) = \frac{1}{1+e^{-x}}$

(2)Calculating the output of the hidden layer:

$$H_{j=}g\left(\sum_{i=1}^{n}\psi_{ij}x_i + a_j\right)$$

(3)Output of the output layer:

$$O_k = \sum_{j=1}^{l} H_j\psi_{jk} + b_k$$

(4)Calculate network output error:

$$\Delta = \frac{1}{2}\sum_{k=1}^{m}(Y_k - O_k)^2$$

(5)Adjust the weight of each layer:

$$\begin{cases} \psi_{ij} = \psi_{ij} + \eta H_j(1 - H_j)x_i \sum_{k=1}^{m} \psi_{jkek} \; ek = Y_k - O_k \\ \psi_{jk} = \psi_{jk} + \eta H_{jek} \end{cases}$$

(6)Paranoid Update:

$$\begin{cases} a_j = a_j + \eta H_j(1 - H_j)x_i \sum_{k=1}^{m} \psi_{jkek} \\ b_k = b_k + \eta e_k \end{cases}$$

4.2 Model Solving

Table 5 Urban and Rural, Male and Female Training Parameters

(Urban and rural) training parameters	1.04640
1.06740	1.06016
1.06058	1.06186
1.06271	1.06313
1.06271	1.06186
1.06058	1.05931
1.05212	1.05170
1.05128	1.05086
1.05044	1.05002
1.04960	1.04792

Matrix the data from 2000 to 2018, and get the training parameters as Tabel 5 shown in the table above. From the neural network training result graph, it can be seen that in the urban-rural scale model, the data was executed 41 times. The precision bar of the performance value shows the mean square error is 1.00e-07, and the progress bar of the gradient shows 1.00e + 10. Generalization The ability check value is 6; in the gender ratio model, the data was executed 12 times. The accuracy bar of the performance value shows a mean square error of 1.00e-07, the gradient progress bar shows 1.00e + 10, and the generalization ability check The value is 6.[8]

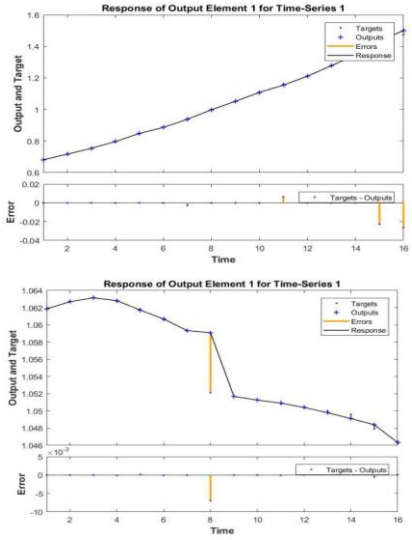

Figure 9 Changes in Output Elements of Two Neural Network Models over Time

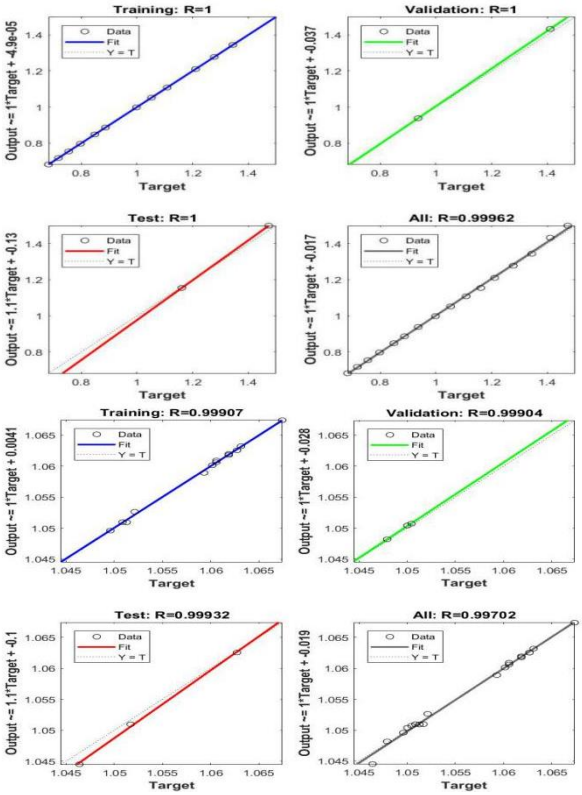

Figure 10. Regression Analysis of the Neural Network Model on the Proportion of Urban and Rural Population and the Proportion of Male and Female

The training fitting degree of the two model models during neural network processing, model confirmation, model verification, and all data fitting conditions are given. The analysis can obtain the fitting effect better, as Figure 10.

In the end, the forecast results of urban and rural population and sex ratios were obtained, as Figure 11 follows:

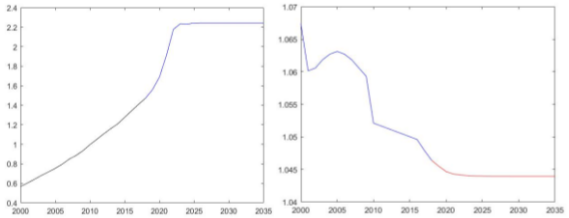

Figure 11. Prediction Chart of Urban and Rural Population Ratio and Sex Ratio

(Note: The left picture shows the proportion of urban and rural population, and the right picture shows the proportion of sex)

It can be seen from the forecast result graph that the proportion of urban and rural population will first show an upward trend in the years after the implementation of the policy, especially in 2020-2025, it will nearly rise linearly, and then it will stabilize. 2.23. As far as the sex ratio is concerned, it will first experience a relatively rapid decline, and it will also eventually stabilize. By 2035, the ratio of men and women will decline significantly, about 1.044. Therefore, we can

conclude that the implementation of the comprehensive two-child policy does have a regulating effect on the population structure, and the effect is also significant.

5. NATIONAL ECONOMIC IMPACT

Will stimulate long-term economic development space and potential[9].Nowadays, the phenomenon and trend of population aging are becoming more and more obvious, and the number of talents in the high-end industry is relatively small, which is bound to affect the sustainable development of the country. However, after the implementation of the "Comprehensive Two-Child" policy, first of all, it will bring huge development space to the mother and infant market, and medical, education, and housing industries will also be significantly affected. Potential development opportunities. According to the data, in the performance report of Jinfa Rabbi in 2019: a year-on-year increase of 15.92%. Therefore, the second-child concept stock has become a large potential share in the Chinese stock market in contemporary times, which can further expand the space for economic development.

Helps ease employment pressure. The liberalization of the policy will inevitably increase the willingness of some women to give birth, and gradually return to the family, the severe situation of labor market employment will be eased. On the other hand, [10] developments in areas such as the mother and child market and prenatal education will provide society with more jobs and opportunities, and the demand for labor will increase, which will ease social employment pressure.

In the medium and long term, the second child policy will help ease the pressure on pension income and expenditure. Due to the serious aging, China's old-age insurance has been unable to keep up with the growth rate of aging. [11, 12]Not only has the government introduced a delayed retirement reform plan, but the liberalization of the two-child policy has also helped the income and expenditure of pension insurance tend to be balanced. On the other hand, the change in the proportion of its urban and rural population shows that in the future, China's urbanization rate will reach a height of nearly 70%, which will inject a large amount of labor into the city, bring more development opportunities, and the urbanization rate will further promote economic development.

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Discussion on the Application of Stratified Evaluation in Middle School Football Teaching and Training

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Abstract: The evaluation of education in the training process is important for students, and its importance is at the level of students and the corresponding level of evaluation, Understanding the guidance and training of the middle school football team is an important part of rapidly improving the level of Chinese football, It is necessary to adapt to the development characteristics of middle school students and conduct reasonable guidance training, Plans must be strengthened to implement training programs, On the training schedule, we must balance learning and training, and must fully consider the growth of students, As part of a layered education, stratified evaluation has the unique advantages of basic education and secondary education, The evaluation of the students who focus on various levels of learning, Football coaching and training requires a full display of the student's personality, the teacher's stratified evaluation method is very important for improving students' confidence in learning, enhancing students' enthusiasm for football training, and promoting students' continuous improvement, This study takes the application of stratified evaluation in the teaching and training of middle school football as the research direction, and puts forward reasonable suggestions by analyzing the training cases of the layered evaluation
Keywords: Middle School Sports, Football Teaching, Training Method, Stratified Evaluation, Training

1. INTRODUCTION

With the deepening of the new curriculum reform, sports have also received increasing attention. In sports, football is the favorite sport of young people; the development of football education among teenagers will not only enhance the physical quality of young people, but more importantly, enhance the sense of competition among young people and promote the formation of professional sports. In order to enhance physical strength and improve health, the purpose of exercising physical and mental health is achieved. The new physical education curriculum has "health first" as the central goal of the teaching curriculum. This includes: physical health, mental health, social adaptability, physical participation and athletic ability, and learning objectives are the reflection of students' goals [1-8]. The quantitative and qualitative comprehensive evaluation method pushes self-evaluation, mutual evaluation and teacher evaluation to a scientific, reasonable and humanized direction. Because middle school students are not affected by physical and psychological age characteristics, they have not yet formed a qualitative worldview and a mature cognitive system. Therefore, teachers in organizing students in the evaluation process should be rational organization, true participation, correct guidance, and stratified evaluation.

2. THE STATUS QUO OF ORDINARY SECONDARY SCHOOL FOOTBALL TEACHING AND TRAINING

2.1 From the Perspective of Students and Parents

Teachers tend to make huge differences in education, and the most basic scientific differences between different students in football determine that they cannot describe them with education and training standards. Football education and training require high-intensity personal fitness, which is simple for other students because they want to see huge differences. In these cases, the teacher is the basic purpose of the basic purpose of football (the basic skills of football and the basic skills of football) and the ultimate goal (to develop the professional skills of students' football). In order to achieve the full teaching process, the characteristics of the students must consider. On the other hand, students must suffer some damage in football education and training. Many parents have reservations about teaching methods [5-9].

2.2 From the Perspective of the School

Many common secondary education methods are still traditional. The football instruction course is combined with the textbook theory knowledge professor and teacher demonstration, and the students practice repeatedly in individual actions. In this process, students can learn more standard skills and actions, but they are not practical. Their classrooms are inefficient and the students in the classroom are not enthusiastic. In addition, most ordinary secondary schools are confused about the limited number of courses and equipment and the shortage of specialized physical education teachers. The reason is that the secondary education status of secondary education is not high and the attention is not high. The education sector also has a relatively small number of investor

candidates, and is oriented to ordinary middle school physical education teachers [1]. There are very few physical education teachers and the task is heavy because of the decline in quality. Under the traditional education mode, the teacher evaluation method for students also tends to be unified. They can't fully demonstrate their strengths, especially for students with excellent physical quality. For students with weak physical strength and students with poor foundations, uniform indicators are unreasonable for them.

3. THE APPLICATION AND IMPORTANCE OF STRATIFIED EVALUATION IN THE TEACHING AND TRAINING OF ORDINARY SECONDARY SCHOOL FOOTBALL

The student's stratified evaluation is based on the individual's foundation and basic skills related to football, effectively evaluating students' learning and progress [3]. The confidence of the students is improved, and the guidance of the football is enthusiastic. Improvement is important to help students develop positive qualities, build optimistic confidence, and work hard. The evaluation by level should be composed of two aspects: on the one hand, there should be a basic evaluation indicator, and on the other hand, there should be a development evaluation indicator.

3.1 Basic Evaluation

The basic evaluation index refers to the evaluation system centered on the physical education goal of the new curriculum. The main content of the assessment is consistent with the basic goals of sports, including the level of participation and motivation of physical and mental health education. Football is a group sport. The basic evaluation indicators include the level of teamwork that demonstrates skill levels during student instruction, coaching, and training. Teachers should establish a quality assessment mechanism based on the student's situation to enhance their participation and enthusiasm in physical education [9].

3.2 Development Evaluation

The development evaluation evaluates specific indicators such as the completion degree, completion time, and shooting intensity of the soccer action based on the basic skills and theoretical level. Teachers must set different evaluation criteria for “people” to enhance students' confidence. The common indicators in the football coaching and training process are as Table 1 follows.

4. RESEARCH PURPOSES

Course evaluation is very important for students' learning. In the process of education and training, students need to conduct different evaluations according to different levels of students in order to teach different levels of knowledge. If they evaluate their learning through traditional or unified activities, they cannot effectively reflect the level they have mastered. Therefore, the student's stratified evaluation is used as a measure of the completion of the student's guiding objectives, namely: the original knowledge, the improvement of the skill level and the improvement of the size. By leveling the training status of the football team, all levels of students can feel the joy of success through their own efforts. Hierarchical evaluation has the basis for improving the physical and athletic ability of all students. Give full play to the students' potential ability and individuality, and at the same time stimulate all students' self-confidence and encourage students to form a tenacious and optimistic psychological quality, which has played a positive role and laid the foundation for the gradual establishment of the concept of lifelong sports [6].

Table 1 Football teaching training evaluation index classification table

Basic evaluation index	Developmental evaluation index
Healthy body	Football action completion
Mental health and mental health	(For example, in the process of completing a high-level action around the shot, the master's ability to shoot the shot time and the perfect degree of completion of the action, etc.)
Participation and enthusiasm in classroom teaching	
Student teamwork ability	
Mastery of basic knowledge	
The mastery of basic football skills (such as the control and adjustment of the ball in the process of passing the basic action)	

5. RESULTS AND ANALYSIS

5.1 Hierarchical Evaluation Concept

Hierarchical evaluation is an evaluation system based on different characteristics of students' physical, technical and psychological characteristics. The purpose of stratified evaluation is to build students' confidence in learning, stimulate students' concern for sports, and experience the fun and success of sports in the process of active participation. Then, the concept of lifelong sports will be established step by step, and ultimately the physical and mental development of our students will be promoted in all rounds.

5.2 In the Actual Training, the Results of the Stratified Evaluation in Teaching and Training Were Compared by Setting a Case.

Control Panel 1: When the teacher is shooting around the goal, the team takes the ball in order to shoot the ball. In this process, the players who have completed the whole set of technical movements with high praise and the players who completed the technical movements are explained again. At the same time, you need to complete training for better students and encourage them to continue training. In the training

process, the teacher's evaluation of the students is fair and just [7].

Experimental Group 1: Several students felt fear when the teacher trained to shoot around the shot. To this end, the teacher designed the following guidance examples. The students have a high level of skill and can express themselves. In the interaction between education and learning, the teacher asked A and B to demonstrate together. A student's movements are correct, the time is short, and the shot is very strong. At the request of everyone, the B students finally completed the reluctance to complete the action of shooting around the pole. The teacher scored on the spot, scored 80 points for the class A and 85 points for the class B. Without sound, the team is like a hot water bottle. The teacher explained the reason and said that the student A scored 80 points when the project was completed. There was no significant improvement compared to the previous period. Student B scored 75 points when completing the project. Compared with the last time, the score with a significant improvement is 10 points. After the students heard it, they suddenly understood. The basis is different and the evaluation criteria are different. The key is that your own performance is to challenge yourself and confirm if you can surpass yourself [2].

In the process of learning, the teacher's evaluation should be fair and just according to the degree of student's learning. In this way, all students will be proactive when they are actively competing, and strive to solve the key and difficulties of guidance. The training atmosphere is active, teachers and students, students have a harmonious relationship, which helps students develop physically and mentally, as Figure 1.

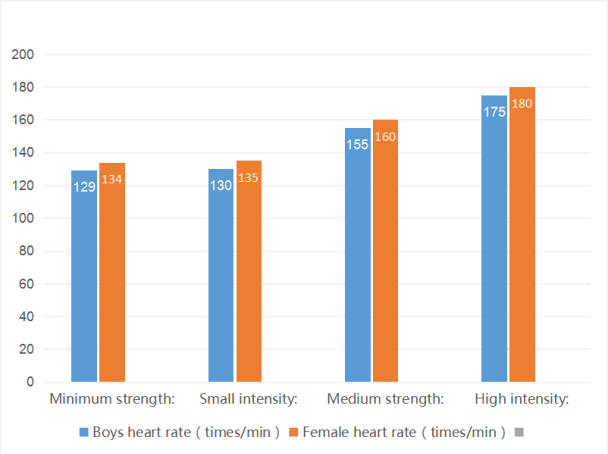

Figure 1 Heart rate is based on the difference between the load intensity of middle school students (juvenile) football players

5.3 Comparison Results

Control Panel: During the training process, athletes with lower skill levels can often overcome the fear and inferiority complex after achieving the goal of more practice suggested by the teacher. Athletes with higher skill levels will reach the goal recommended by the teacher more quickly during training. After that, the speed and space were squeezed to its rapid increase [4].

In the experimental group, in order to better understand the members of each team, teachers must carefully prepare for post-school training to help them better understand, record the course, feedback after school, and so on. They realized their sense of accomplishment through their own efforts in a short period of time, and realized the joy of success. Each team member has his or her own goals. We can use it to make each team's potential and character completely powerful.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusion

The teacher will formulate corresponding progress evaluation indicators according to the different situations of the students. Before implementing the stratified evaluation, comprehensively understand the physical and mental state of each student and prepare detailed records about the basic ability and technical level of the students. It is convenient for the teacher to record the student's grades and evaluate the student's progress and efforts.

The use of stratified evaluation by the above comparison has an important effect of mobilizing the enthusiasm of the entrant. Through the above comparison and the use of stratified evaluation, each team member can achieve a sense of accomplishment through their own efforts in a short time, and taste the joy of success. Through the above comparison, using stratified evaluation to improve supplements, each group member has its own goals, and each group member can make full use of their potential and personality.

6.2 Recommendations

Students have different cognitive styles, personality traits, and study habits. If they can be quantitatively measured through multiple benchmarks, some students will suffer setbacks and lose confidence in learning. Therefore, in the assessment, a stratified evaluation can coordinate and develop our students in five aspects: physical health, mental health, social adaptability, participation in sports and exercise.

In the specific stratified evaluation, the teacher should formulate some effective evaluation methods according to the characteristics of the students.

Before implementing the stratified evaluation, the teacher should make detailed records according to the current situation of each student, clearly understand each student's current physical state, mental state, skill level, and receive good training and application.

Teachers, the usual situation is, if there is no absence, pre-preparation, good class to do a good job, it is necessary to make a good class, class, class results in the class feedback, after class feedback. These are used as benchmarks for stratified evaluation courses.

In the stratified evaluation, it is necessary not only to strengthen the weak group, but also to emphasize

individuality, it is necessary to consider as comprehensively as possible. In order to strengthen the evaluation of vulnerable groups, we must fully consider the personality characteristics of students, improve their self-esteem, and at the same time, in order to self-respect, we should improve our body and mind through subtle methods. In terms of emphasizing individuality, teachers will blindly strengthen the disadvantaged groups and cannot ignore students at the excellent technical level. On the contrary, they may become the strongest in learning because they need these students to be stricter and stricter, so they can become masters of learning, and the core of the team is the example of other students' learning.

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