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CONTENTS

Credit Risk Assessment of Small, Medium and Micro Enterprises Based on Logistic Regression Model

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Abstract: As an intermediary department of credit business, banks need to evaluate the strength, supply-demand relationship and credit standing of enterprises, in order to estimate the credit risk of micro, medium and small enterprises and formulate credit strategies. In this paper, five risk indicators are extracted from two aspects of enterprise's comprehensive strength and reputation to establish a risk assessment system. Among them, the total input price and tax, total output price and tax, and profit rate are the assessment standards of enterprise's comprehensive strength, and the failure rate of input and sales transaction is the assessment standard of enterprise's reputation. Next, the selected risk indicators are standardized with z-score elimination dimension, and the standardized index data are evaluated with Logistic regression analysis model, to obtain the probability of corporate default risk. In order to give the optimal credit policy, we from the perspective of the bank, application of least square method, the fitting of the annual interest rate and turnover rate equation of the premise, established the model of credit strategy based on bank profits maximum, determine the constraint condition, and apply genetic algorithm for each enterprise loan amount and the bank loan interest rate.
Keywords: Logistic Regression; Genetic Algorithm; Least Square; Credit Policy

1. INTRODUCTION

Because the factors that affect the credit risk of enterprises are various and multi-level, for the selection of risk evaluation indexes, we use accounting related theory, from the perspective of the combination of quantitative and qualitative, eventually selected related evaluation index, and whether the default as dependent variable, using Logistic regression analysis of short-term forecast more accurate, for each enterprise credit risk considerations, and the results are nonparametric test to validate the feasibility of the model analysis, finally combining the credit risk and loan interest rates and credit strategy customer churn rate relations. Based on the data and parameters of a certain system given in question C of the national College Students mathematical Modeling Contest in 2020, as well as the transmission node diagram, this paper attempts to solve the following problems:

Through the quantitative analysis of the risk indicators of 123 enterprises in Annex 1, the credit risks of various small, medium, and micro enterprises are evaluated, and the credit strategies of the bank for different enterprises under the condition that the total annual credit amount is fixed are given [1-4].

Note: Topics can be downloaded from the official website of the National Mathematical Contest in Modeling for College Students: http://www.mcm.edu.cn

2. ASSUMPTIONS OF THE MODEL

(1) Assume that social and economic conditions (population, GDP) develop relatively stable in a short period of time.

(2) Assume that the total sales tax of the enterprise is all the sources of income of the enterprise.

(3) Suppose that only one sudden factor occurs in a short period of time.

3. ESTABLISHMENT AND SOLUTION OF THE MODEL

3.1 PROBLEM ANALYSIS

We are required to establish a risk index evaluation system by analyzing the enterprise information of 123 enterprises, to analyze the impact of various risk indexes on the credit risk of enterprises, and provide the credit strategies of Banks for various small, medium, and micro enterprises.

Because there are many factors that affect the credit risk of the enterprise multi-level, for the selection of risk evaluation indexes, we use accounting related theory, from the perspective of the combination of quantitative and qualitative, eventually selected related evaluation index, and whether the default as dependent variable, using Logistic regression analysis of short-term forecast more accurate, for each enterprise credit risk considerations, and the results are nonparametric test to validate the feasibility of the model analysis, finally combining the credit risk and loan interest rates and credit strategy customer churn rate relations.

3.2 MODEL ESTABLISHMENT

(1) RISK INDEX SELECTION

By studying the comprehensive strength and reputation of 123 small and medium-sized enterprises, a total of five risk indicators are extracted to establish a risk assessment system. These include total input price tax, total output

price tax, profit rate, transaction failure rate and transaction failure rate. After the quantitative treatment, the indicators can evaluate the credit risk of enterprises in a more scientific and comprehensive way, and then provide a basis for the formulation of credit strategies in the later period.

The establishment of this risk assessment system solves the previous risk assessment of enterprises by Banks, which is mainly based on qualitative analysis and less on quantitative analysis, thus leading to the insufficiency of its relatively one-sided judgment standard. From the comprehensive strength and credibility of the two aspects of the study, extract five risk indicators to establish a risk assessment system. Among them, total input price and tax, total output price and tax, and profit rate are the evaluation criteria for the comprehensive strength of an enterprise. These indicators can analyze the production, sales and operation capacity, profitability and production and operation stability of an enterprise to reflect the comprehensive strength of the enterprise. The failure rate of the input transaction and the failure rate of the sales transaction are the evaluation standards of the enterprise's reputation. Such indexes can analyze the production management aspects such as the purchase planning of the enterprise's goods and the production quality management, to reflect the credibility of the enterprise. Therefore, the selection of these two aspects for analysis can fully evaluate the enterprise's credit risk.

(2) Z - SCORE STANDARD

Since there is a big difference in the magnitude between the total input price tax and the total output price tax and the profit rate, in order to ensure the comparability and accuracy of the data, the z-Score standardized method, which can be applied to numerical data and eliminate the influence of data dimension, is adopted to conduct standardized processing of the data. The formula is as follows:

$$\acute{x}_{ij} = \frac{x_{ij} - \mu_i}{\sigma_i} \quad (i = 1, 2, \cdots, 5, j = 1, 2, \cdots, 123) \quad (1)$$

(3) ESTABLISHMENT OF CREDIT RISK ASSESSMENT SYSTEM BASED ON LOGISTIC REGRESSION ANALYSIS MODEL

At present, there are three representative credit risk assessment methods widely used, namely, expert system method, recursive classification tree method and Logistic model analysis method. The Logistic model analysis method is adopted to analyze the credit risk assessment by referring to the relevant analysis literature of credit assessment [1]:

According to the Logistic regression model, the relationship between the probability of enterprise default Z and the i-th index can be listed. By using the regression analysis module in the statistical analysis software SPSS, the independent variable coefficient in the Logistic regression model is calculated, and the following results are obtained:

$$Z_j = -7.744 - 29.435x_{1,j} - 0.545x_{2,j} + 0.005x_{3,j} + 0.742x_{4,j} - 11.646x_{5,j} \quad (2)$$

In order to obtain the probability of enterprise default, the probability of enterprise default is obtained:

$$P_j = \frac{1}{(1 + e^{-Z_j})} \quad (3)$$

By taking in the normalized index data, the default risk probability of 123 enterprises was obtained, and figure 1 was the schematic diagram of enterprise credit risk probability using MATLAB.

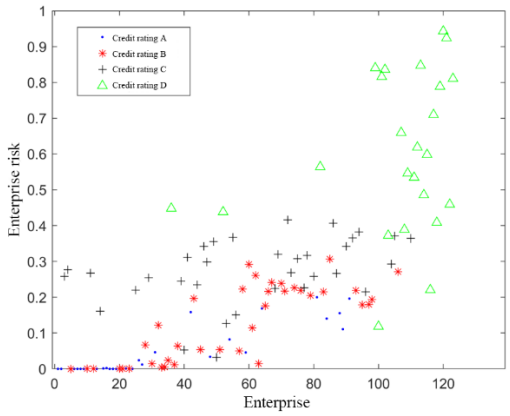

Figure 1. Probability distribution of default risk for 123 enterprises

As can be seen from the figure 1 above, the risk probability point distribution with credit rating of A, B, C and D has A gradually increasing trend. If it can be proved that the distribution of risk data points of enterprises with different credit ratings is significantly different, it indicates that the model has high accuracy.

(4) CUBIC TERM FITTING BASED ON LEAST SQUARE METHOD

According to Annex III, Banks do not lend to enterprises with credit rating D. In order to better study the relationship between annual interest rate and customer churn rate and to optimize the accuracy and error of the study, this paper USES the least square approximation [2] to fit the relationship between customer churn rate and annual loan interest rate for enterprises with different credit rating:

Expression of credit rating A:

$$f(X_i)_A = 640.9X_i^3 - 258.6X_i^2 + 37.97X_i - 1.121$$

SSE=0.005

Expression of credit rating B:

$$f(X_i)_B = 552.8X_i^3 - 225.1X_i^2 + 33.99X_i - 1.017$$

SSE=0.003

Expression of credit rating C:

$$f(X_i)_C = 504.7X_i^3 - 207.4X_i^2 + 32.16X_i - 0.9735$$

SSE=0.004

In the above equation, SSE is the sum of the difference between the value of the fitting sample function and the true value of the sample. The smaller the value, the more accurate the fitting and the smaller the error.

3.3 MODEL SOLUTION

Through the establishment of the maximum return target function, the problem of bank credit strategy formulation is solved. With the bank's income maximization as the optimal goal, the annual interest rate and the total loan amount as the constraint conditions, the expression is established as follows:

$$Max(Q_A + Q_B + Q_C) \quad (4)$$

$$s.t\begin{cases} Q_A=\sum_{A=1}^{27}\{[Y_A(1+X_A)(1-P_A)-f(X_A)\cdot Y_A]\cdot W_A\} \\ Q_B=\sum_{B=1}^{38}\{[Y_B(1+X_B)(1-P_B)-f(X_B)\cdot Y_B]\cdot W_B\} \\ Q_C=\sum_{C=1}^{34}\{[Y_C(1+X_C)(1-P_C)-f(X_C)\cdot Y_C]\cdot W_C\} \\ f(X_A)=640.9X_A^3-258.6X_A^2+37.97X_A-1.121 \\ f(X_B)=552.8X_B^3-225.1X_B^2+33.99X_B-1.017 \\ f(X_C)=504.7X_C^3-207.4X_C^2+32.16X_C-0.9735 \\ \sum_{i=1}^{99}Y_i=1,(i=A,B,C) \\ 0\le X_A,X_B,X_C\le 1 \\ 0\le Y_A,Y_B,Y_C\le 1 \end{cases} \quad (5)$$

Where, X_A, X_B, X_C are the annual interest rates assessed as A, B and C respectively;

Y_A, Y_B, Y_C Are the percentage of loan amount assessed as A, B and C respectively;

W_A, W_B, W_C Are the ratio of total business transaction tax of A, B and C assessed by reputation to total business tax of all enterprises respectively.

Objective function considering the first according to the annual interest rate, corporate default risk and losses due to the turnover and establish bank earnings last function, but also the constraint condition of considering the income alone could lead to some low power but high reputation enterprise loan amount of problems, which leads to the total amount of bank credit, the revenue and turnover efficiency drops, is not conducive to Banks to achieve benefit maximization[3].To this, we introduce another limit conditions *Wc*, namely the tax ratio, this ratio can measure the enterprise that tax accounts for the ratio of the total amount of all enterprises, there can be a representative to quantify the company's strength, as bank credit strategy more powerful support, at the same time can further enhance the robustness and accuracy of the model.

Through genetic algorithm of target function[4] get ideal, stable solution, and this article will get before a run at the end of the population as the initial population of the next run, therefore, before it is concluded that the optimal solution has been operation for many times, when QA and QB, QC were 0.0275, 0.0011, 0.0007, get the optimal objective function value is 0.0293, and give each enterprise loan interest rate, bank loan amount.

4. CONCLUSION

In this paper, five risk indicators are extracted from two aspects of enterprise's comprehensive strength and reputation to establish a risk assessment system. Among them, the total input price and tax, total output price and tax, and profit rate are the assessment standards of enterprise's comprehensive strength, and the failure rate of input and sales transaction is the assessment standard of enterprise's reputation. The standardized index data were evaluated by Logistic regression analysis model to obtain the probability of corporate default risk. In order to give the optimal credit policy, we from the perspective of the bank, application of least square method, the fitting of the annual interest rate and turnover rate equation of the premise, established the model of credit strategy based on bank profits maximum, determine the constraint condition, and apply genetic algorithm for each enterprise loan amount and the bank loan interest rate.

The model can be applied to dam safety protection in different weather and reduce the probability of dike bursting. Then, it can be used for forest fire prevention, agricultural irrigation, cost-performance analysis, etc.

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The Present Situation of Urban Land Intensive Use in China and Its Countermeasures

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Abstract: At present, China's urbanization process is accelerating, and the pressure of urban development on land demand is also increasing. Due to the scarcity of land resources, it is urgent to change the previous extensive land management system, improve the optimization of land layout, and improve the level of urban land intensive management. This paper first summarizes the content of land intensive management, analyzes the problems and influencing factors of land intensive use in China at this stage, and finally puts forward the measures to improve the level of land intensive use.
Key words: Urban Land; Intensive Use; Current Situation; Measures

1.INTRODUCTION

ntensive land use is a widely used method of land use. Land intensive use involves many aspects, and land intensive use involves not only the knowledge related to land. In order to save land resources and improve land use efficiency, in the process of urban planning and construction, high-rise or super high-rise buildings should be taken as far as possible to save land resources, improve land use efficiency and avoid occupying unnecessary cultivated land under the premise of ensuring building safety. We should try our best to improve the degree of land intensification and increase the unit output rate of land. Through the reserve and reasonable replacement of land resources, based on abiding by the principle of land protection and land conservation, the land should be rationally allocated according to the needs of urban development, to continuously improve the efficiency of land use and allocate land use resources reasonably and effectively. Intensive land use management is an important means to improve land use efficiency, alleviate the contradiction between supply and demand of land resources, and promote sustainable land use and urban sustainable and healthy development [1-4].

Text: For a long time, China has not only experienced rapid economic growth, but also experienced the huge contradiction of rapid economic growth. China's population is growing at a rate of 13 million to 14 million a year, but the land is decreasing at a rate of 30-40 kilometers. Compared with other countries, the waste of land resources is very serious, and the land utilization rate is relatively low compared with other countries. As a scarce and irreplaceable important resource, the fixed location and exclusive use of land determine the intensive use of land in the process of land use. City is the political, economic, and cultural center of a region, which makes many resources and talents gather. Land resource is of great significance in the process of urban economic and functional development, and it is the most basic factor of production.

1.1 Urban land management is extensive and intensive.

At present, the urban land management is extensive, the land use efficiency of our country is not high compared with other countries, and the phenomenon of wasting land resources is much more serious than that of other countries. The lack of land resources and improper government management methods lead to the continuous escalation of the contradiction between land demand and land supply, which makes the intensive land management difficult to sustain and can not realize the sustainable development of land management. From 2000 to 2012, the level of China's urbanization increased from 56.8% to 69%, an increase of only 12.2%, while the total urban area expanded from 9842 km to 258758 km, and the data increased by 248916 km. It can be seen from the data that the growth rate of land occupied by urban development does not match the speed of urbanization. The main reason is that the city city has a large population of agriculture, and the level of actual urbanization is higher than registered residence statistics. More importantly, local government leaders in some cities only care about their official career and pursue the so-called "political achievements" only for their own better future development. They are committed to developing development zones without considering the actual situation and current situation of local land resources and are too eager for success. Some development zones have been idle since the construction, while some cities have adopted the strategy of "spreading the pie" in the development zones. The government is just blindly pursuing the continuous expansion of the city scale. However, it does not pursue the urban land utilization rate and land output rate per unit area, and does not pursue good urban agglomeration effect, resulting in many land resources waste. Practice shows that in many places, the rapid expansion of the real estate industry and a large amount of land investment are often used to promote the development of cities.

1.2 The structure of urban construction land is not scientific, and there are problems in the overall planning and spatial layout.

With the rapid development of urbanization in China, the cities are expanding rapidly to the edge areas, and the distribution of small towns is scattered. The scale and function of the urban system have not been brought into full play, which can not meet the needs of urban

economic development. In addition, there is not enough public service land in the city to meet people's needs, and the urban infrastructure construction is not perfect, which can not produce urban agglomeration effect, which is very unfavorable to intensive management. The leaders only devote themselves to the construction of new urban areas and development zones, and concentrate on the development of large-scale real estate. Because only in this way can we drive the local economy to increase substantially and make ourselves have a better future in the future. In the construction of new area, in order to pursue the rapid growth of economic performance, the government will not hesitate to sacrifice the interests of farmers and the government's long-term debt. Most of the roads in many new areas are more than 50 meters, and the width of the green separation belt is more than 10 meters and more than 20 meters respectively, so the planning income is very low. On the other hand, some industrial enterprises often use part of the land after obtaining the land use right at a lower price (usually at the lowest protection price), but some land will not be used. In this way, a lot of land will not be used.

1.3 The phenomenon of illegal land use is widespread, and the land management system and policy need to be improved.

For waste of land, violation of laws and regulations and other phenomena, the government's punishment for this phenomenon is not enough, this practice of the government brings great difficulties to the intensive management of land. The current situation of land use in China is not suitable for the development strategy of land use planned by the government, and all kinds of land use policies and systems do not meet the needs of actual development. For a long time, the management after land examination and approval has not formed effective supervision. Although China's current laws have made relevant provisions on the disposal of urban idle land, government leaders in the actual implementation process, out of the protection of local interests, the relevant functions of the government often can not play well, the policies are often not effectively implemented, and there is no effective land intensive use evaluation system after approval. Although land investment intensity, building area ratio and building density are all checked in the form of land supply, once the company obtains the land, it can be used at will. As for whether the necessary investment intensity, building area ratio and building density have been achieved, the land and construction planning departments lack necessary restrictive measures.

2. ANALYSIS ON THE INFLUENCING FACTORS OF URBAN LAND INTENSIVE USE

2.1The impact of population density on land intensive use.

The continuous sharp decrease of land resources leads to the continuous shortage of land resources, but the population in densely populated areas is increasing, which will cause sharp contradiction between people and land in some areas. Because the city has the effect of population aggregation, many population aggregations leads to the continuous increase of urban population density, all kinds of elements gather, and at the same time produce different degrees of land intensification.

2.2 The fluctuation of urban land price.

Land price is the most direct factor that affects the degree of urban land intensive. The agglomeration effect of cities increases the demand for land resources. Under the mechanism of market competition regulation, the land price has been rising rapidly in recent years. In recent years, the land price is still high. It is difficult for cities to own new land. If a city wants to have new land, it can only continuously requisition the agricultural land around the city. In this situation, the demand for intensive use of urban land also increases.

2.3 The impact of urban ecological environment on urban land intensive use.

The normal production and the maintenance of the normal social life order have certain requirements for the ecological environment such as natural conditions. Due to the continuous consumption of resources and environment in the process of urban development, the sustainable increase of urban land use must consider the carrying capacity of urban ecological environment, which also determines that the urban land intensive degree should reach the highest level to a certain extent. Therefore, ecological environment is also an important influencing factor of urban land intensive use.

Intensive use of land is of great significance to protect cultivated land and save land resources, promote the stable development of urbanization process, and ensure the social and economic order and the virtuous cycle of ecological environment. Through land management, we can realize the effective use of urban construction land, optimize the layout of urban land, and reduce the investment in infrastructure construction. In order to realize the intensive management of land, it should be realized from the aspects of urban planning, land use management, strengthening supervision and perfecting legislation.

3. THE SPECIFIC MEASURES OF URBAN LAND INTENSIVE USE MANAGEMENT

3.1 Continuously optimize the urban planning scheme.

The feasible urban land planning scheme will directly affect the future construction and development direction of the city and the overall beauty of the city, which plays an important role in promoting the intensive use of land. Therefore, in the formulation of urban construction planning, it is necessary to make full preparation and investigation, combined with the natural environment, political function, and future economic development of the city, to plan the most suitable scheme for the future development of the city. In urban planning and design, we must adhere to the comprehensive needs of current and long-term development, and must reserve the urban construction land needed for the future development of the city. In the process of urban planning, urban planning scheme must not only be forward-looking, but also comply with the principles of saving land resources and improving the degree of intensive land use.

3.2 We will continue to strengthen the land reserve management and land use supervision system.

The urban land reserve system refers to the system that

the relevant government departments entrust the corresponding institutions to centralize the management of the scattered land in different regions by means of expropriation, replacement, and requisition. According to the urban land development planning, part of the land is put to the market through bidding in time to meet the development needs of different construction land in the city. At the same time, in order to improve the degree of intensive land use, the government should strengthen the supervision mechanism and punish the illegal land use behaviors in violation of relevant laws and regulations. Through investigation and research, we can understand the contradiction between supply and demand of urban land in detail, clearly know the latest situation of urban land use, sort out information materials, clearly understand the medium-term and long-term development requirements of land, improve the scientificity of urban planning and the level of intensive management of urban land use, and provide information support for land.

3.3 We will promote the legislative construction of land intensive management and improve the management of land property rights.

At present, the current situation of land management in China is: the management and protection of agricultural land and cultivated land is relatively strong, but the management of intensive land use is less, and there is a lack of a complete legal support system. Therefore, it is necessary to strengthen the understanding of land intensive management, combine with the actual development of the region, and provide legal protection for land intensive management through legislative means. At the same time, based on the principle of public ownership of land, we should make clear the ownership of land and the way to realize it. The government should strengthen the management of the land use right, especially the state-owned land use right, and formulate the land intensive management laws and regulations. From the reality, the economic benefits brought by land ownership are not included in the national financial management system in strict accordance with the law. In order to encourage the intensive use and management of land resources, appropriate income distribution measures should be taken through the current property right management relationship in China.

4.SUMMARY AND PROSPECT

Land is the foundation of a country's political power and people's survival and economic development, and a necessary condition to ensure the sustainable and good development of China's urbanization process. We should fully realize the significance of intensive land use management for the country and the collective. Combined with the actual situation in different regions, it is an effective way to solve the sharp contradiction between human and land, and it is also of great significance to the sustainable development of cities and economy in China.

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To Evaluate the Impact of COVID-19 Epidemic on College Students

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Abstract: Affected by the sudden COVID - 19 outbreak, college students are no longer back to school this term. Whether it's life, study, or psychological changes have taken place in different extent. By establishing the reasonable evaluation system to measure the sudden COVID - 19 outbreak's impact on college students. Firstly, questionnaire survey was used to collect data to select the influencing factors of COVID-19 epidemic on college students. Secondly, cluster analysis was used to group each influencing factor into three relatively systematic evaluation indicators, namely, life, study, and psychology. The weights of different factors on college students are obtained by using analytic hierarchy process, and the relative key factors are selected. It is concluded that life style and getting along mode with relatives affect the life of college students. Personal factors and online teaching and learning methods affect college students' learning. The trend of the epidemic situation, the environment of sports and activities affect the psychology of college students.

Key words: COVID-19; Analytic hierarchy process; K - Means; Colleges and universities

1.INTRODUCTION

Novel coronavirus is a new acute infectious disease with high incidence, strong infectivity, and certain mortality[1]. At present, the epidemic prevention and control has made important achievements, and the economic and social order is accelerating to recover. There is no doubt that the sudden pneumonia epidemic in COVID-19 has affected everyone to varying degrees[2].

In education, the Education Bureau decided to adopt online teaching mode in order to effectively reduce the gathering of people, block the spread of epidemic situation and better protect the life safety and health of teachers and students. This makes great changes in the life, study and psychology of college students. In order to measure the impact of pneumonia epidemic in COVID-19 on college students, this paper applies analytic hierarchy process to quantitatively evaluate the impact. Because there are many influencing factors, select appropriate evaluation indicators to cluster individual factors. Through clustering results, an appropriate evaluation system was established to evaluate the impact of sudden pneumonia epidemic in COVID-19 on college students[3].

The innovation of this paper lies in the application of analytic hierarchy process (AHP), which is systematic, concise and practical, and requires less quantitative data information.

Moreover, the clustering of influencing factors has the advantages of high efficiency and fast operation speed[4].

The analysis method of the influence of COVID-19 pneumonia epidemic on college students proposed in this paper has reference significance for the systematic evaluation without structural characteristics and the systematic evaluation with multi-objective, multi-criteria and multi-period[5].

2. EXPERIMENTAL

2.1 DETERMINATION OF INFLUENCING FACTORS BY CLUSTER ANALYSIS

The method of system clustering is to take each sample as a class at the beginning, and then cluster the relatively close samples into small classes according to the distance between the classes, and then combine the aggregated small classes according to the distance between the classes, and continue until the appropriate classification requirements are obtained, so as to find out the main factors affecting the system conveniently[6].

First, from the title, we can clearly find out three main aspects of the pneumonia epidemic affecting us, life, learning and psychology. Then we measure the correlation coefficient of the variable. In the cluster analysis of variables (specific factors), the first step is to determine the correlation coefficient of variables in different classes. The specific methods are as follows:

We define two variables, corresponding to our specific factors and types. The variable x_i is equal to $(x_{1i}, x_{2i}, \ldots, x_{256i})^T \in R^n$(i=1, 2, …, 11), The variable y_i is equal to $(y_{1i}, y_{2i}, \ldots, y_{256i})^T \in R^n$ (i=1, 2, …, 11), The correlation coefficient of the two variables x_i and y_i is calculated as follows:

$$r = \frac{\sum_{j=1}^{n}(x_{ji}-\bar{x}_i)(y_{ji}-\bar{y}_i)}{\sqrt{\sum_{j=1}^{n}(x_{ji}-\bar{x}_i)^2}\sqrt{\sum_{j=1}^{n}(y_{ji}-\bar{y}_i)^2}} \quad (1)$$

We will each variable effect on three different aspects of the correlation coefficient as a sample, every sample as sui generis, calculating the distance between the, we use the Euclidean distance as the distance calculation rules.

According to the calculated the distance between each type of merger, the distance between the last two classes for a new class. To calculate the distance between new class and other kinds of again, same again according to calculate the nearest distance merge two classes for a new class. Cycle the above process, the resulting class a total of three.

The correlation coefficient matrix of each influencing factor on different aspects was taken as the input parameter, and the system clustering diagram was obtained after MATLAB clustering analysis. Thus the influencing factors under three kinds of evaluation indexes are obtained. First, the coVID-19 is affecting our life, including the mode of getting along with relatives, parents' work and economic status, lifestyle; Second, the COVID - 19 epidemic affects our learning, including online teaching and learning, learning environment and personal factors; Third, the COVID - 19 is affecting our psychological factors, including the trend of the epidemic, the use of the Internet and the environment for sports and activities, The specific image is shown in Figure 1.

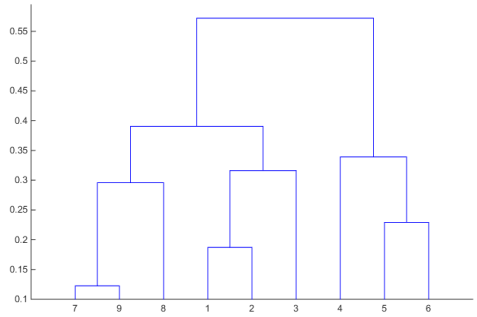

Figure 1. System cluster diagram

2.2ANALYTIC HIERARCHY PROCESS ESTABLISHES EVALUATION SYSTEM

(1) Hierarchical structure model is established

The decision-making problem is divided into three levels[7]. The top level is the target level O, which is to choose the most appropriate key indicator to evaluate the impact of coVID-19 on college students. The middle layer is life C1, learning C2, and psychology C3. The lowest layer is the scheme layer, namely, nine influencing factors P1, P2, P3, P4, P5, P6, P7, P8 and P9 (as shown in Figure 2):

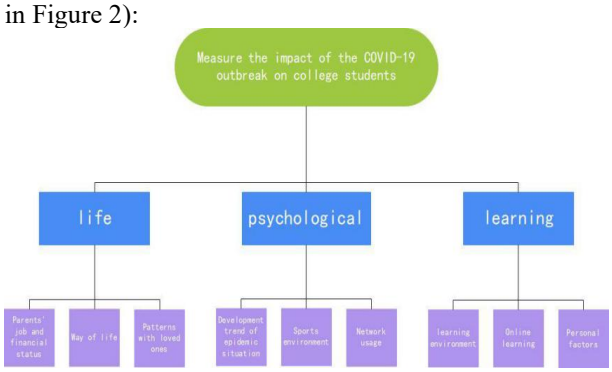

Figure 2.A hierarchical chart to evaluate the impact of the epidemic on students

(2) Model solution

Construct judgment matrix O-C: Compare the three elements C1, C2 and C3 of the criterion layer C in pairs to get the comparison matrix, as shown in Table 1.

Table1. Comparison matrix

O	C_1	C_2	C_3
C_1	1.0000	1.0000	2.0000
C_2	1.0000	1.0000	2.0000
C_3	0.5000	0.5000	1.0000

We use the eigenvalue method to calculate the weight. First, the eigenvalue of λ_{max}=3 can be easily solved by MATLAB, and the weight vector $\omega_i = (0.4, 0.4, 0.2)^T$. The consistency index CI is calculated by the formula CI= $\frac{\lambda_{max}-n}{n-1}$, and then the consistency ratio CR is calculated according to CR=CI/RI (RI is the average random consistency index). The solution CR=0<0.1, passed the consistency test. The relationship between n and average random consistency index RI is shown in Table 2.

Table 2. N's relationship with RI mean random consistency index

n	1	2	3	4	5	6	7	8	9	10	11	12	13
RI	0	0	0.52	0.89	1.12	1.26	1.36	1.41	1.46	1.49	1.52	1.54	1.56

Note: Here, when n=2, it must be a consistent matrix, so CI = 0.

Table 3 C layer weights calculated by three different methods

	The arithmetic mean method	The geometric mean method	Eigenvalue method
C_1	0.4	0.4	0.4
C_2	0.4	0.4	0.4
C_3	0.2	0.2	0.2

In order to ensure the robustness of the results, we also use two methods to calculate the weights respectively, one is the arithmetic average method, the other is the geometric average method. Then, according to the obtained weight matrix, the scores of each scheme are calculated, and the ranking and comprehensive analysis are carried out. In this way, the deviation caused by adopting a single method is avoided, and the conclusions drawn will be more comprehensive and effective. The weights obtained by the three methods are shown in Table 3.

Since the weights calculated by the three methods above are the same, we use the eigenvalue method to perform the following operations.

②Construct comparison matrices C1-P, C2-P and C3-P, and check the consistency between hierarchical sorting and total sorting. The maximum eigenvalue λ_i and the consistency index CR_i are listed as the maximum eigenvalue λ_i and the weight vector for the three judgment matrices calculated using the above method (the result is not far from the output of the three methods, using the eigenvalue method), as shown in Table 4.

Table 4. Choose the most reasonable evaluation of various indicators of the calculation results

C_1	Weights and others	C_2	Weights and others	C_3	Weights and others
P_1	0.1365	P_4	0.5714	P_7	0.5171
P_2	0.625	P_5	0.1429	P_8	0.1243
P_3	0.2385	P_6	0.2857	P_9	0.3586
λ_i	3.0183	λ_i	3.0000	λ_i	3.0015
CR_i	0.0176	CR_i	0.0000	CR_i	0.0015

The values of CR_i in Table 4 show that the matrix C1-P, C2-P and C3-P all pass the consistency test.

2.3 MODEL CONCLUSION AND ANALYSIS

According to the above calculated data, we can calculate the total weight of each influencing factor in the P layer. Summarize the final form into the following table5:

Table5. Weight list of influencing factors

The evaluation index	The total weight
Parents' jobs and financial status	0.0546
Way of life	0.2500
Patterns with loved ones	0.0954
Online learning	0.2286
The learning environment	0.0572
Personal factors	0.1143
The trend of the epidemic	0.1034
Network usage	0.0249
Sports and activity environment	0.0717

According to the above form, the new crown and epidemic factors that affect college students accounted for from big to small, before we choose six factors of heavy as branch of index system, namely: the way of life, the online teaching learning, personal factors, the development trend of the outbreak, and relatives get along mode, movement and activity environment.

So far, we have established an indicator system to evaluate the impact of COVID-19 on college students, as shown in Figure 4.

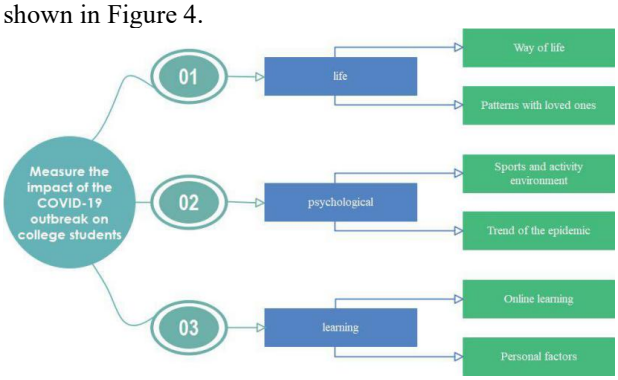

Figure 4. Index system

3.CONLUSION

3.1 FACTORS INFLUENCING COLLEGE STUDENTS' LIFE

a. The model of getting along with relatives: No one is an independent person during a lifetime. If you want to have a happy life, you cannot do without the support of your relatives and friends, especially the love and care of your family.

b. Lifestyle: Due to the nature of novel Coronavirus, students must be placed in home isolation, and school commencement is postponed. During this period, students' direct social contact objects will be reduced, the time they spend on the Internet will increase, and the entertainment mode will be simplified, which are all key factors affecting students' daily life.

3.2 FACTORS AFFECTING COLLEGE STUDENTS' LEARNING

c. Online teaching and learning: For most students, it is still a strange way of learning. How fast they adapt to this way of learning largely determines their learning efficiency and is a key factor.

d. Personal factors: Learning is a personal matter, which depends on the individual's subjective will.

3.3 FACTORS INFLUENCING COLLEGE STUDENTS' PSYCHOLOGY

e. The development trend of the epidemic: People are most afraid of the unknown things, and they may easily lose control under the mood of anxiety or panic for a long time. Therefore, the understanding of information related to the epidemic and the determination of the development results of the epidemic are one of the key links to manage negative emotions and maintain a good psychological state.

f. Exercise and activity Environment: The limitation of exercise and activity environment is an important reason for the psychological and physiological changes of those isolated at home. Appropriate physical activity or exercise can help us fight against negative emotions and make our emotions more positive.

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A Market Economy Model Based on Hierarchical Analysis and Gray Prediction

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Abstract: The epidemic has had a negative impact on economic development, how to drive consumption has become the focus of attention of the whole society. In this paper, Shenzhen as the research object, we need to determine the main factors affecting the design and distribution of consumer vouchers, the establishment of a hierarchical analysis model. Here, nine indicators are selected, the judgment matrix is constructed, the weight of each indicator is derived, the consistency test is carried out, the four judgment matrices constructed by the model are tested by consistency, and finally the combined weight of the nine indicators affecting the urban economy is derived. In the analysis of the design and distribution of consumer vouchers on the market economy, the establishment of a gray theory based on the prediction of market capacity model. Choosing the three indicators with the largest weight as the basis for forecasting, based on the data of these three indicators, establish a gray forecast model, forecast the market capacity that should have been. Combined with the establishment and solution conclusion of the previous model, considering the influence of the design, and sending of consumer vouchers on the market economy, we put forward reasonable suggestions to the government departments.
Keywords: Consumer Vouchers; Market Economy; Hierarchical Analysis; Gray Forecast

1. INTRODUCTION

Consumption plays a vital role in driving the relevant economic indicators of the country, and in the first half of this year, China was affected by the new crown epidemic, many important economic indicators are not up to standard, the epidemic has a great impact on the economy, social consumption tightening, enterprise shutdowns, layoffs, unemployment and other problems exacerbating poverty emerged. The current promotion of consumption can stimulate economic development. There are also many factors affecting the design and distribution of consumer vouchers, which promote the growth of the market economy by increasing people's purchasing power to boost consumption and increase total social retail sales. [1]

2. EXPERIMENTAL

2.1 STUDY AREA

Most of the consumer vouchers are issued online through mobile payment platform, which is the result of China's accumulated years of payment experience and digital capabilities. The bigger winners are the merchants and local governments that issue vouchers through this platform, as well as the vast number of users who benefit directly from them. A little broader, the biggest winners are the economy that will return to activity in the future, and the enhanced digital governance of society. From this point of view, the significance of issuing consumer vouchers everywhere, not only through the temporary difficulties, but also conducive to the future of companies and cities. This paper chooses Shenzhen as the research object, Shenzhen's biggest characteristic is also the biggest advantage is - young. Shenzhen from a small fishing village to today's bustling first-tier big cities, very rapid. Analysis of the factors affecting the design and issuance of consumer vouchers in Shenzhen can represent many first-tier cities.

2.1 THE ESTABLISHMENT AND SOLUTION OF THE MODEL

Step1 builds a hierarchical analysis structure model [2]
We divide the decision-making problem into three levels, first of all, the target level: the design and distribution model of consumer vouchers, followed by the criterion level, the development factors of small and medium-sized enterprises C_1 the structural factors of residents' consumption income C_2, cultural and tourism industry factors C_3 "As the three main , the programme layer is finally the programme layer, i.e. nine influencers: total retail sales of consumer goods." P_1 employment situation P_2 Industrial growth index P_3 consumer price index P_4 disposable income P_5 producer price index P_6 , operating income P_7 development index P_8, the scale of the industry P_9 , as shown in the following image:
Step2 model solving
Relative weights are given to factors based on their relative importance $C_{ij}(\mathrm{i},\mathrm{j}=1,2,3,4,\ldots)$That is, the two factors between the two comparisons, to judge the relative importance of the sub-criteria layer to the criterion layer. This leads to the conclusion C_{ij} . About. C_{ij} the establishment of, which will take the "1 to 9 scale method" torepresent.
matrix M-C: Will the criteria layer C, C_1 , C_2 , C_3 The three indicators are compared two or two times and the judgment matrix is obtained M As follows:

$$\begin{bmatrix} 1 & 3/4 & 1 \\ 4/3 & 1 & 4/3 \\ 1 & 3/4 & 1 \end{bmatrix}$$

a judgment matrix $C_1 - \mathrm{P}$, $C_2 - \mathrm{P}$, $C_3 - \mathrm{P}$, which is as follows

Table 1 Determines the matrix table

$\begin{bmatrix} 1 & 3 & 5 \\ 1/3 & 1 & 7 \\ 1/5 & 1/7 & 1 \end{bmatrix}$	$\begin{bmatrix} 1 & 1/3 & 4 \\ 3 & 1 & 5 \\ 1/4 & 1/5 & 1 \end{bmatrix}$	$\begin{bmatrix} 1 & 5 & 2 \\ 1/5 & 1 & 1/4 \\ 1/2 & 4 & 1 \end{bmatrix}$

By. MATLAB The code is obtained, and the characteristic vectors of each judgment matrix are as follows:

The judgment matrix $\mathrm{M} - \mathrm{C}$ The characteristic vector of $W^{(1)} = (0.3000, 0.4000, 0.3000)^T$

The judgment matrix $C_1 - \mathrm{P}$ The characteristic vector of $W^{(2)} = (0.6018, 0.3236, 0.0746)^T$

The judgment matrix $C_2 - \mathrm{P}$ The characteristic vector of $W^{(3)} = (0.2797, 0.6267, 0.0936)^T$

The judgment matrix $C_3 - \mathrm{P}$, The characteristic vector of $W^{(4)} = (0.5695, 0.0974, 0.3331)^T$ is calculated

When calculating the total weight of the scheme layer to the target layer, the product of the scheme layer accounts for the total weight of the target layer by the scheme layer to the weight of the correspondingcriterion layer and the corresponding criterion layer weight to the targetlayer. According to the above calculation method, the comprehensive weight coefficients of the evaluation factors at all levels can be calculated. According to the weight coefficient, we can get the ranking of the priority of each evaluation index in the evaluation index system, and the calculated weight of each index combination is shown in the figure below.[3]

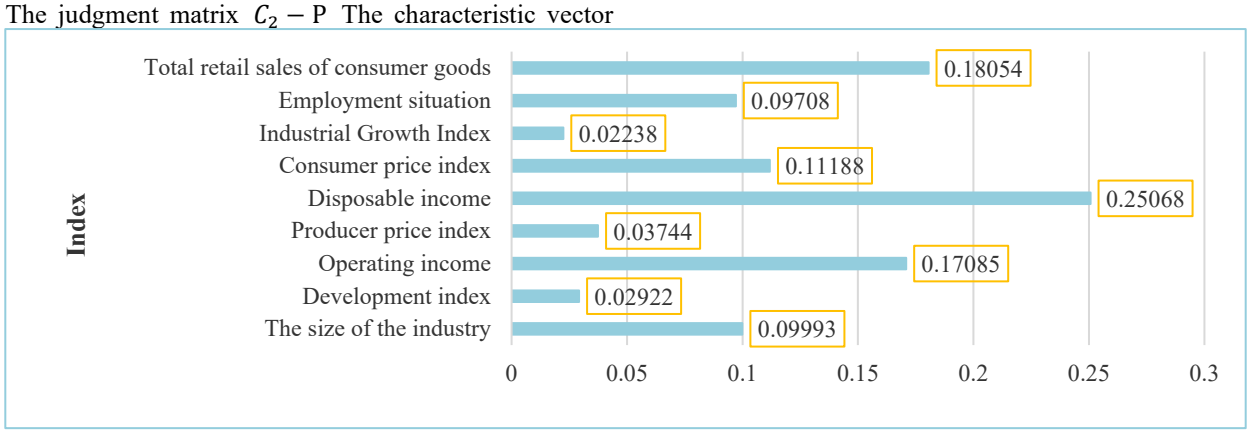

Figure 1 The indicators combine weights in the design and issuance of vouchers

2.2 ESTABLISH A GREY FORECASTING MODEL TO PREDICT FUTURE MARKET CAPACITY

Based on determining the weight of various impact indicators, in order to describe the impact of the design and issuance of consumer vouchers on the market economy, a gray forecasting model is established to predict the capacity of the futuremarket. [4]

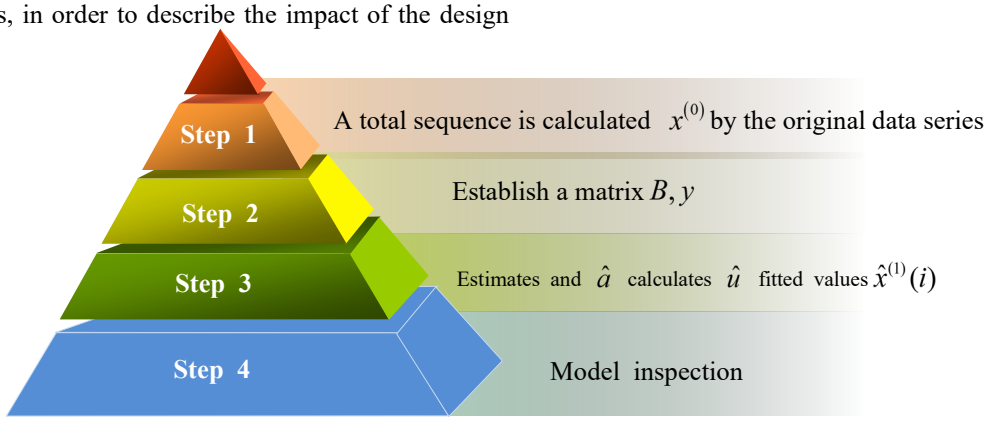

Figure 2 Gray predictive model structure diagram

Step1 is made up of the original data series $X^{(0)}$ Calculate a total sequence $X^{(1)}$

The model selects the three indicators with the largest weight ratio, namely, the total retail sales of consumer goods, the annual disposable income of residents, the operating income of the cultural and tourism industry, and the original data $X^{(0)}$ That is, data for the three indicators found in the previous years by the National Bureau of Statistics.[5]

The given observation data

$X^{(0)} = \{x^{(0)}(1), x^{(0)}(2), \ldots x^{(0)}(N)\}$;

A add-up is available;

$$X^{(1)} = \{x^{(1)}(1), x^{(1)}(2), \ldots x^{(1)}(N)\}$$

A generalization of the original data is available

$$X^{(1)}(i) = \{\sum_{j=1}^{i} x^{(0)}(j) | i = 1,2,3 \ldots N\} \quad (1)$$

The original data is subtracted and summarized

$$\Delta X^{(1)}(i) = X^{(1)}(i) - X^{(1)}(i-1) = X^{(1)}(i) \quad (2)$$

set

$$\frac{dx^{(1)}}{dt} + \mathrm{a}\, x^{(1)} = \mathbf{u} \quad (3)$$

It's available

$$X^{(1)}(t) = \left[x^{(1)}t_o - \frac{u}{a}\right]e^{-a(t-t_o)} + \frac{u}{a} \quad (4)$$

The discrete value of the equivalent interval sampling

$$X^{(1)}(k+1) = \left[x^{(1)}(1) - \frac{u}{a}\right]e^{-ak} + \frac{u}{a} \quad (5)$$

Step2 establishes a matrix B, y

Write the quantity product formula as a matrix

$$\begin{bmatrix} \chi^{(0)}(2) \\ \chi^{(0)}(3) \\ \vdots \\ \vdots \\ \chi^{(0)}(N) \end{bmatrix} = \begin{bmatrix} -\frac{1}{2}\left[\chi^{(1)}(2) + \chi^{(1)}(1)\right] & 1 \\ -\frac{1}{2}\left[\chi^{(1)}(3) + \chi^{(1)}(2)\right] & 1 \\ \vdots \\ -\frac{1}{2}\left[\chi^{(1)}(N) + \chi^{(1)}(N-1)\right] & 1 \end{bmatrix} \quad (6)$$

Make.$y = (x^{(0)}(2), x^{(0)}(3), \ldots, x^{(0)}(N))^T$

$$B = \begin{bmatrix} -\frac{1}{2}\left[\chi^{(1)}(2) + \chi^{(1)}(1)\right] & 1 \\ -\frac{1}{2}\left[\chi^{(1)}(3) + \chi^{(1)}(2)\right] & 1 \\ \vdots \\ -\frac{1}{2}\left[\chi^{(1)}(N) + \chi^{(1)}(N-1)\right] & 1 \end{bmatrix}, \quad U = \begin{bmatrix} a \\ u \end{bmatrix}$$

The matrix takes the form of

$$y = \mathrm{BU} \quad (7)$$

Step3 for an estimate $\hat{a}$,$\hat{u}$and calculate the fitted value $\hat{x}^{(1)}(i)$

The minimum squares of the equation are estimated

$$\hat{U} = \begin{bmatrix} \hat{a} \\ \hat{u} \end{bmatrix} = (B^t B)^{-1} B^t y \quad (8)$$

Brings in the available time response equation

$$\hat{x}^{(1)}(k+1) = \left[x^{(1)}(1) - \frac{\hat{u}}{\hat{a}}\right]e^{\hat{a}k} + \frac{\hat{u}}{\hat{a}} \quad (9)$$

When. $k = 1,2 \ldots, \mathrm{N}-1$, the corresponding equation for the calculation time can get a fitted value when $k \geq$ N The time equation is the forecast value.

3. CONCLUSIONS

According to the actual situation of the country at present, the effect of consumer vouchers to stimulate consumption is obvious. New consumption mainly flows to small micro-merchants such as catering services, which are affected by the epidemic, and the groups with the greatest pull effect are those with lower consumption levels. Digital vouchers avoid the possibility of cash issuance being converted into savings and can be designed flexibly and targetedly based on local industry conditions and people's spending habits.

For the distribution groups of consumer vouchers, the consumption pull effect of digital consumer vouchers on the population with low consumption level, middle-aged and old age, and low online consumption tendency is more significant. Therefore, the issuance of consumer vouchers we can focus on increasing the distribution of such groups, but not only for such groups, but also as far as possible to cover the mainstream consumer groups. Secondly, it is suggested that the face value design of consumer vouchers should take full account of the diversified needs of users and meet the different consumption needs of all. It is recommended to ensure the effective entry of consumer vouchers into the real economy through the digital distribution process and wind control mechanism, especially in the cultural and tourism industries severely affected by the outbreak.[6] The government should strengthen the management of consumer vouchers, consumer vouchers are still immature state, for the issuance of consumer vouchers we must put in place to ensure that consumer vouchers can be used in the hands of the people, to help the Shenzhen region to promote consumption, promote the development of the market economy.

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Fingerprint Password Design and Similarity Verification

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Abstract: Fingerprints have many unique biological immutabilities in biometrics, and they play a very important role in life and biometric identification. Many access control devices, mobile phones and other mobile devices and criminal investigations, fingerprints as biometrics, play a very important role effect. Nowadays, the collection method of image fingerprint recognition is mainly based on pixel image information. In the criminal investigation fingerprint database, because there are relatively large fingerprint data, and it needs to be compared in a very short time. This paper proposes a way to convert fingerprint image information into vector features for storage, and limit the storage size of vector features. Reduced storage volume is conducive to faster comparison of data without losing accuracy. In the verification of the comparison data, a method of using the bezier curve to fit the fingerprint lines for comparison is proposed to increase the accuracy of the fingerprint comparison and determine whether the fingerprints match.

Keywords: Fingerprint Recognition; Harris Corner Detection; Gabor Filtering; Bezier Curve

1.PREFACE

Fingerprint information is a person's identification information, which has strong applicability in life, such as the unlocking of smart phones and the verification of fingerprint information; and as the main tool of criminal investigation, fingerprints are urgently needed to store fingerprint surface characteristics [1-4]. The way and the way of quick comparison. In the existing literature, most methods use fingerprint corner detection methods to describe the corner features of fingerprint images, such as Harris corner detection, etc.; finally store the mutual positions and vector relationships of the corner points extracted by the detection. Optimize the storage of the relationship between the corner points to ensure that the size of the fingerprint feature data is within 200B.

Compressed storage space can help to obtain fingerprint comparison results faster in comparing fingerprint database data. The use of fingerprints in criminal investigation data comparison seems to be a huge workload. When storing data, the sparse matrix method is used to further compress the space at the storage level to ensure that more data can be stored, or it is recorded in the ID card in a portable way.

When comparing fingerprints in this paper, not only the ORB algorithm of corner detection is used for comparison, but also the method of determining the center point and the bezier curve fitting of fingerprint lines is used to verify by affine transformation and comparison, to a certain extent Increase the accuracy to determine whether the fingerprint matches.

2.FINGERPRINT CODING MODEL

2.1 Feature point extraction

In the storage of fingerprint images, pixel storage is commonly used. Before feature detection, the image is enhanced by averaging. By overlapping the images in the original image, the corner features and relative positions of the final recognition effect are displayed in the next image. By transforming the background of the black and white image, the texture information of the fingerprint can be clearly displayed. This feature is not affected by the size of the image, and can be compared with images of various sizes, with different features.

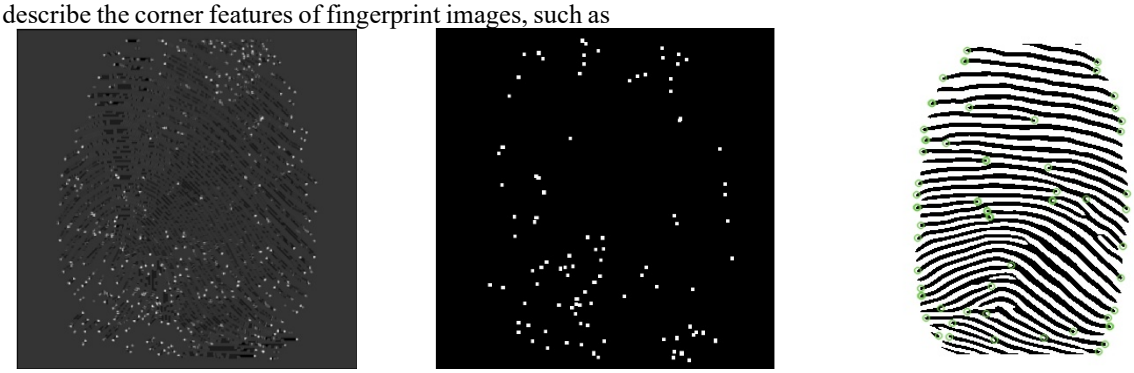

Fig.1 Fingerprint feature point detection and extraction example

Among them, ω(x, y) is the window function. According to the nature of the corner point, the above formula should be the largest, and the window function does not change with the position movement, so the second term on the right side of the equation should be the largest.

$$E(u,v) \approx [u \quad v]M\begin{bmatrix}u\\v\end{bmatrix}, M = \sum_{x,y}\omega(x,y)\begin{bmatrix}I_xI_x\\I_xI_y\end{bmatrix} \quad (1)$$

2.2 Construct feature vector matrix of feature key points

Sort the found feature points in descending order, select the first 32 optimal feature key points for storage, and record the information [3-7]. Each feature point holds 6 feature vectors to construct a 32*6 feature key point feature vector matrix (see Appendix Table 1 for examples), and export visualization:

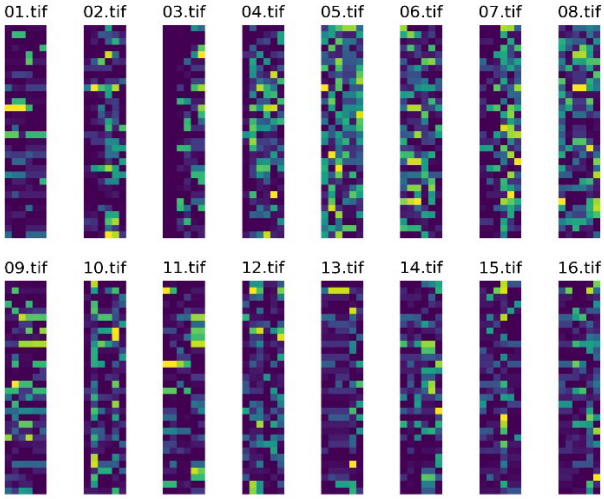

Fig.2 Eigenvector matrix visualization

Use the formula to uniformly express the feature vector:

$$\vec{R}_{ij}, i = 1,2,3 \ldots \ldots 32, j = 1,2,3,4,5,6 \quad (4)$$

Among them, $\vec{R}_{ij}$ represents the i feature vector of the j feature key point. Next, only need to encode and store the $\vec{R}_{ij}$ matrix corresponding to each fingerprint.

2.3 Information storage

Observation matrix characteristics, any feature vector between 0 ~ 255, considering 1-byte memory is composed of 8-bit binary number, just can express a feature vector in the fingerprint, the binary storage is adopted.

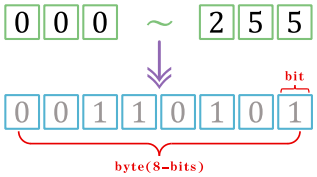

Fig.3 Eight diagram 1 byte storage ways

The binary coding method is not only suitable for logical operations, but also easy for information conversion. Has a strong anti-interference ability. Even if it is affected to a certain extent, it can still distinguish high and low.

3. FINGERPRINT MATCHING OPTIMIZATION MODEL

3.1 Fingerprint image preprocessing

Fingerprint images, as identity authentication or identification information, should be easy for machine processing to keep the images clear and easy to identify. However, during the acquisition process, due to human or environmental reasons, it may be contaminated, causing some images to be lost or unclear. In this case, the image must be preprocessed to improve the accuracy of recognition.

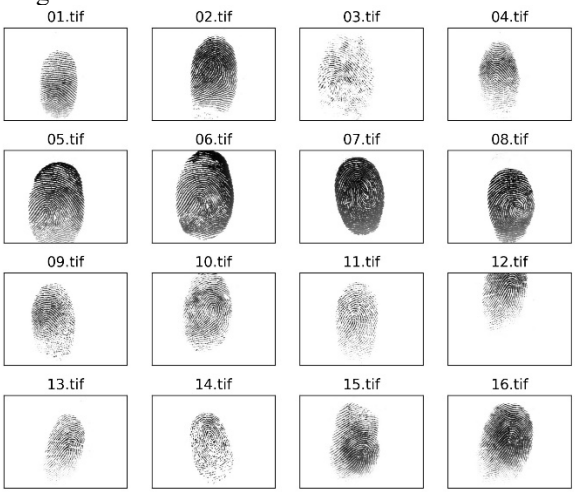

Fig.4 Overview of reading the original fingerprint image

3.2 Histogram equalization

For fingerprint images that contain information, the histogram equalization method is used to improve the contrast of the image, The histogram equalization effect is as follows:

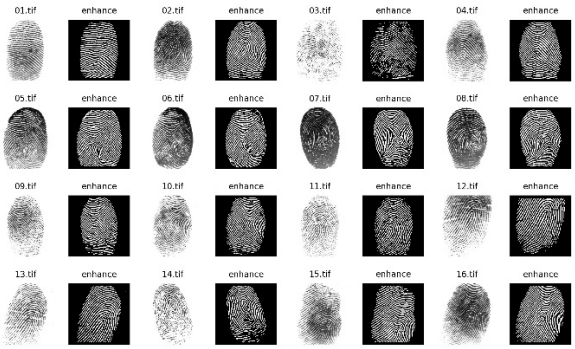

Fig.5 Histogram equalization comparison chart

3.3 Key point matching model based on Harris corner detection and BF

The ORB algorithm is selected on the key points of description, which is based on the detection and description of FAST and BRIEF, and other modifications are made. In the descriptor, ORB uses the BRIEF descriptor, but optimizes the disadvantages of unstable rotation.

When comparing two fingerprint images, the matching feature points are arranged in descending order of distance to reflect the better matching result.

For two fingerprint images, the gap score can be represented by the following adjacency matrix:

$$score_{m\times n} = \begin{bmatrix} d(1,1) & d(1,2) & \cdots & d(1,m) \\ d(2,1) & d(2,2) & \cdots & d(2,m) \\ \vdots & \vdots & & \vdots \\ d(n,1) & d(n,2) & \cdots & d(n,m) \end{bmatrix}, m = n = 1,2,\ldots \quad (10)$$

Among them, m and n are the number of feature points of the two fingerprint images, and a threshold value of 33 is set for the score. When the score exceeds the threshold [7], the two fingerprint images are different, and when they are within the threshold range, they are the same.

Perform the above operations on two fingerprint images,

and get the comparison image as follows:

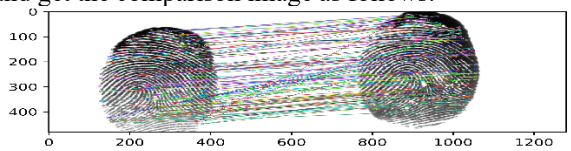

Fig.6 Comparison of fingerprint feature point matching

The calculated Hamming distance is 2666.0, and the average matching point Hamming distance is 32. Within the threshold range, it is recognized as the same fingerprint and the matching is successful.

3.4 Based on the connected domain retrieval and the Bezier spline interpolation curve model test

To accomplish fingerprint image pre-processing, according to the principle of connected domain retrieval, retrieval of fingerprint pattern curve, further parameters to obtain the outline of straight lines or center. Because of the connected domain is made with the same set of pixel values of the adjacent pixels pixels, can identify different continuous curve in the image, and the different curve.

To compare the corresponding curve, should find a point positioning, convenient to identify, select use hoff principle of gradient method to find the image center, and on this basis, using Radon transform, center of optimization results.

With fingerprint is not a simple circular image, not according to normal hoff gradient method to deal with, to the image for step length at 0.01 and 0.5 for interval Radon transform, get the signal after the image projection, the signal of the bright spots for possible intersection, fingerprint image center Radon transform as shown below:

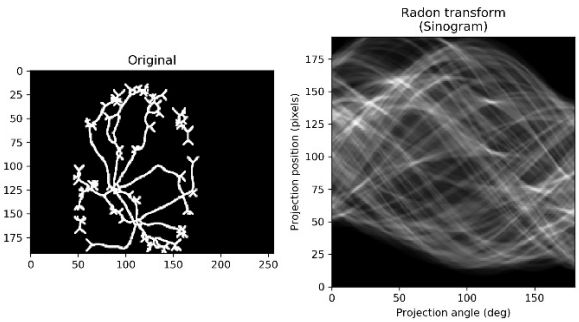

Fig.7 Comparison of fingerprint feature point matching

Extraction of the obvious signal of Radon and inverse transformation, inverse transformation as shown in the figure below:

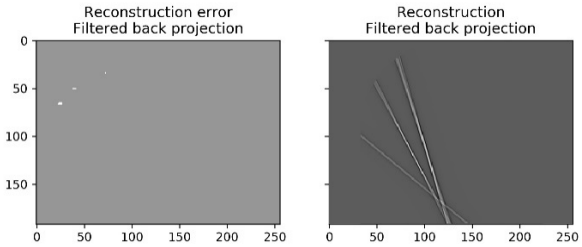

Fig.8 Comparison of fingerprint feature point matching

Get more obvious after the intersection, set a certain threshold value range, obtain the most obvious point as the center.

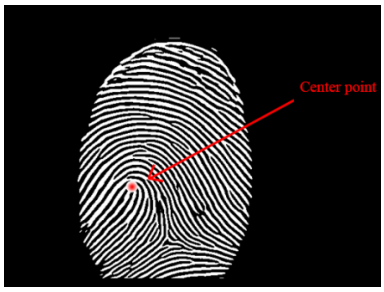

Fig.9 Locate the fingerprint center

4.CONCLUSION

This paper effectively stores the characteristics of fingerprint images in order to shorten the comparison time when comparing fingerprint images in many databases. Using corner detection and storing feature vectors, the collected images are converted into spatial feature vectors. For better storage and comparison.

In this paper, Harris corner points are used to detect the key points in fingerprints, the ORB algorithm is used to describe the key point features, the Hamming distance of any two key points in two fingerprint images is calculated by BF matching, and the adjacency matrix is constructed. The shortest distance is considered as a matching point. Then calculate the average Hamming distance for each matching point as the fingerprint matching score, set a threshold, and judge whether the fingerprint matches. The 16 fingerprint images are compared one by one, and the above method can be used to find the morphological corner features of the fingerprint and judge whether the fingerprint matches.

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An Index Model of Urban Economic Vitality Based on Factor Analysis

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Abstract: With the development of economy, science and society, economic globalization has become a trend. The vitality and resilience of my country's economic development continues to increase, the room for maneuver is broader, the vitality of various market entities is further enhanced, the new economy develops rapidly, and the formation of new momentum is accelerated. Economic vitality is an important indicator for evaluating the economic capacity of a region. In this article, a series of investigations and solutions are mainly made with Shenzhen as the research target. Analyze the factors that affect the urban economic vitality from multiple angles. Enterprises and their income, foreign trade and foreign investment, technology and education, residents' income, finance and social security, environment etc. will all affect the development of urban economic vitality, and establish a principal component analysis model. Based on the analysis of influencing factors, a factor analysis model is established. First, use the KMO test model and the Bartllett spherical model to test whether the data is representative, calculate the correlation coefficient matrix R of the standardized matrix, and then calculate the score value of the factor. This eliminates the multi-collinearity and integrates the various factors that affect the urban economic vitality into a whole.

Keywords: Influencing Factors of Economic Vitality; Economic Vitality Index System; Principal Component Analysis; Factor Analysis

1. INTRODUCTION

Economic vitality refers to the growth rate and potential of the total supply and total demand of a region in a certain period. Urban economic vitality refers to the capacity and potential in the process of urban economic development, economic vitality, social vitality, environmental vitality, and cultural vitality Together they constitute the entire vitality system [1]. This article selects Shenzhen as the research object. Its biggest characteristic and greatest advantage is its youth. In just 40 years of reform and opening, Shenzhen has grown from a small fishing village to a prosperous first-tier city today. Because of being "young", it is more inclusive, open, and creative.

2. EXPERIMENTAL

2.1 STUDY AREA

As a special economic zone, Shenzhen has a relatively high economic vitality index and rapid development of innovative enterprises. In recent years, Shenzhen has seized the power of the reform of the corporate investment environment [2], optimized the corporate environment, allowed the vitality of market entities to burst, and improved the overall economic vitality index of the city. The development of a city always keeps pace with the times, and it needs to continuously inject fresh vitality. Analysis of its influencing factors will help to improve Shenzhen's economic vitality. The following table shows the GDP value of Shenzhen in recent years.

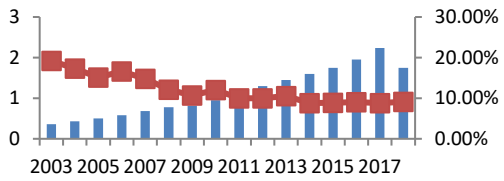

Fig. 1 Shenzhen GDP and year-on-year growth rate

The great contribution of Shenzhen's foreign trade development to the economic development of the region and the whole country is beyond doubt. Shenzhen's economic strength is inseparable from its foreign trade exports. The following table shows the GDP basic situation of its foreign trade exports

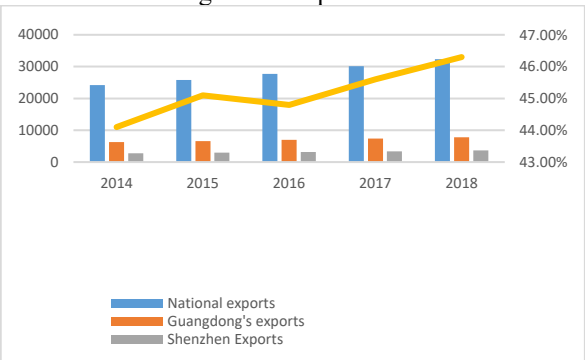

Fig.2 Shenzhen's foreign trade exports

The advancement of technology provides technical support for the economic development of the city, thereby further promoting the development of the city's economy. To a certain extent, the income of residents reflects the quantity and quality of the labor force in the region, and the continuous and stable growth of the labor force is an important driving force for the vitality of the urban economy. The picture below shows the government's

investment in education and residents' income in Shenzhen in recent years.

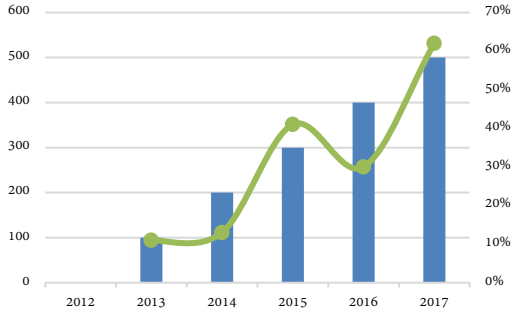

Fig.3 Financial education investment (100 million)

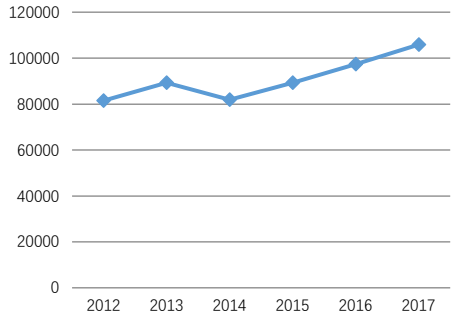

Fig.4 Resident disposable income (yuan)

2.2 METHOD

There are many factors that affect the economic vitality of a city. There are multiple indicators to measure the economic vitality of a city. The model will be constructed below for specific analysis.

According to the principle of principal component analysis [3], since each index value has a different dimension, the data is standardized and analyzed in Spss. The processing result shows the characteristic value, contribution rate, cumulative contribution rate, etc. of the principal component. The following table:

T able.1 Eigenvalues of the Correlation Matrix

	Eigenvalue	Difference	Proportion	Cumulative
1	7.20904379	5.01101963	0.6554	0.6554
2	2.19802416	1.07111216	0.1998	0.8552
3	1.12891222	0.91819794	0.1024	0.9576
4	0.20871506	0.10818118	0.0191	0.9644
5	0.10053287	0.04637985	0.0091	0.9857
6	0.0541534	0.00498564	0.0049	0.9907
7	0.05014285	0.02444875	0.0046	0.9952
8	0.02566335	0.00888332	0.0023	0.9976
9	0.0167765	0.00687343	0.0015	0.9991
10	0.00992914	0.00982345	0.0003	1
11	0.00010776		0	1

From the table, we can see that the corresponding variance contribution rates of the first three items are $S_1 = 55.54\%$, $S_2 = 28.98\%$, $S_3 = 15.24\%$, and the cumulative variance contribution reaches 99.6%, and their characteristic values are all greater than 1, which shows that The three components are the principal components. Using them to replace the original data can reflect most of the information contained in the evaluation index, which is very representative.

The analysis results of all data sample data are statistically sorted, and the feature vector of principal component analysis can be obtained from the analysis results, and further three principal component expressions expressed by standardized variables are obtained:

$$Prin_1 = 0.0313523x_1 + 0.336370x_2 + \cdots + 0.332865x_{11} \quad (1)$$

$$Prin_2 = -0.296709x_1 + 0.304239x_2 + \cdots - 0.291478x_{11} \quad (2)$$

$$Prin_3 = 0.176678x_1 + 0.020089x_2 + \cdots + 0.158460x_{11} \quad (3)$$

Select a certain number of representative data, use the principal component analysis method to analyze, and sort the analysis results, you can get the standardized expression of the principal component analysis feature vector, according to the characteristics of a certain area, specify the development plan that meets the area, Improve the economic vitality index to promote regional economic development.

3.MODEL OPTIMIZATION AND IMPROVEMENT

When using principal component analysis, each original variable occupies a certain weight in the principal component, and the extracted principal component cannot clearly explain its meaning. In factor analysis, when extracting common factors, it not only pays attention to whether the variables are correlated, but also considers the strength of the correlation, so that the extracted common factors not only play a role in dimensionality reduction, but also can be well explained. The factor analysis method is used to analyze the factors that affect the urban economic vitality [4]. The specific steps involved in the model are as follows:

(1) Standardize the data to eliminate the influence of different dimensions

(2) Use the KMO test model and Bartllett sphere model to test the data

Process the selected representative sample data, and then

use the KMO test model and the Bartllett sphere model to test the data, and judge the selected according to the KMO value and the Bartllett value can the data be sampled. The results are as follows.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		759
Bartlett Test of Sphericity	Approx.Chi-Square	139467
	df	10
	Sig	000

From the table, we can get KMO=0.75, and p<0.05 of Bartllett's sphere test, so the selected samples from Shenzhen are suitable for factor analysis.

(3) Calculate the correlation coefficient matrix R of the standardized matrix

Find the eigenvalue of R, and determine the corresponding orthogonalized eigenvector according to the eigenvalue;

The eigenvalues and contribution rate of R are shown in the following table:

	Initial Eigenvalues			Extractions Sums of Squared Loading		
Component	Total	% of Variance	Cumulative%	3.806	76.113	76.113
1	3.80	76.113	76.113			
2	.765	15.297	91.410			
3	.238	4.766	96.176			
4	.105	2.109	98.285			
5	.086	1.715	100.000			

(4) Calculate the cumulative contribution rate of the characteristic root, and determine the number of main factors and the corresponding eigenvector matrix according to the principle that the cumulative contribution rate is greater than 85%;

(5) Calculate factor score value

a) $X(x_1, x_2, \cdots, x_p)\mathcal{M}$ is an observable random variable, mean vector $E(X) = 0$, covariance matrix $Cov(X) = \sum_{i=1}^{n} x_i$, After standardizing the variables, the covariance matrix $\sum x_i$is equal to the correlation matrix R.

b) $F = (F_1, F_2, \cdots, F_m)$ $\mathcal{M}$ $(m < p)$ is an unmeasurable vector, its mean vector $E(F) = 0$, covariance matrix $Cov(F) = 1$, that is, each component of the vector They are linearly independent and independent of each other. Among the factors that affect urban economic vitality, changes in certain factors will not affect other factors, but will have an impact on the overall economic vitality. This model allows all factors Can be reflected.

c) $e = (e_1, e_2, \cdots, e_p)\mathcal{M}$ and F are independent of each other, and $E(e) = 0$, the covariance matrix of $\sum x_i$ is a diagonal matrix, that is, the components e are linear Irrelevant, the model:

$$x_1 = a_{11}F_1 + a_{12}F_2 + \cdots + a_{1m}F_m + e_1 \quad (4)$$

$$x_2 = a_{21}F_1 + a_{22}F_2 + \cdots + a_{2m}F_m + e_2 \quad (5)$$

$$\cdots\cdots\cdots$$

$$x_p = a_{p1}F_1 + a_{p2}F_2 + \cdots + a_{pm}F_m + e_p \quad (6)$$

These expressions are factor expressions. Since the model is performed on variables and each factor is orthogonal, it is also called an R-type orthogonal factor model. Each factor represents a factor that affects the economic vitality of a city, and the proportion of the factor in all factors that affect the economic vitality of the city can be obtained by bringing in a specific value.

The main factor or common factor in the model is a factor that appears in the expressions of each original observation variable. They are mutually independent and unobservable theoretical variables. The specific meaning of the common factor must be combined with specific issues and defined in specific situations. Specific meaning. The special factors and the special factors and all common factors are independent of each other. The elementa_{ij} in the load matrix A in the model is the factor load, and the factor load a_{ij} is the covariance betweenx_i andF_j, and also the correlation coefficient between x_i andF_j, which represents the degree to which$x_i$depends on F_j. Regardinga_{ij} as the weight of the i-th variable on the j-th common factor, the greater the absolute value of a_{ij}, the greater the correlation between $x_i$andF_j, that is, the greater the load of the common factor$F_j$on x_i. In order to obtain an economic explanation of the results of factor analysis, this model can be better applied to the analysis of factors affecting the economic vitality of cities. There are two statistics in the factor loading matrix A that are very important, namely the commonality of variables and the variance contribution of common factors [5].

Calculate the total score of the comprehensive evaluation, arrange the influencing factors in order, and obtain the arrangement of the factors that affect the urban economic vitality.

4. CONCLUSIONS

Principal component analysis and factor analysis both use a few variables to comprehensively reflect the main information of the original variables. Although only a few variables are used, these variables are very representative and the amount of information contained accounts for the original information. More than 85%, so even a few new variables can effectively explain the problem. The new variables are not correlated with each other, eliminating multicollinearity, and organically combining the various factors that affect the urban economic vitality into a whole, with more comprehensive factor analysis and higher accuracy .Calculate the index weights that affect

the urban economic vitality from the factor elements, formulate corresponding policy measures to promote the development of the local economy [6].

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Research on The Development Path of Cloud Fitness in The Post-Epidemic Era

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Abstract: Under the influence of the outbreak, hard-hit in all walks of life, fitness industry offline store is affected by the epidemic closures, it put forward severe challenges to the development of fitness industry. Online fitness arises at the historic moment, therefore, in order to meet the needs of the exercise that occupy the home. With the effective control of the outbreak, the outbreak era, the "cloud" fitness agencies how to seek their own development path, is the question that needs careful consideration. To this end, this paper analyzes the outbreak during the "cloud" fitness development present situation, and with examples analysis methods to analyze the advantages and disadvantages of online fitness exist, to improve the experience mode, the Internet online sports fitness become a new fashion trend and shows its great development momentum.
Keywords: Outbreak Era; Cloud Fitness; Development Path

1. INTRODUCTION

According to the statistics of Liyun.com, before 2020, there were more than 56.5 million users participating in live sports courses alone [1]. This data does not include people who are not in the live-streaming category, such as those who use the non-live-streaming online exercise instruction of apps such as KEEP to KEEP fit. After the coVID-19 epidemic hit the country, homebody fitness has become a new life content for people across the country, and the Internet online service has become an important engine of "homebody fitness" in just a few weeks.Just so called, the epidemic stopped the pace of going out, unable to stop the desire to sweat body and mind. In May, as the fight against the epidemic becomes a "protracted war", the Chinese people calmly enter the post-epidemic era [2]. Having experienced the test of the epidemic, everyone has been reflecting on themselves. They not only have a new understanding of life, a new understanding of life, but also have a new understanding of consumption and become more cautious. People pay more attention to consumer's safety and quality, previously, created by crazy marketing's hot style, impulse to follow suit, web celebrity steps for a slowing economy, hope all those who put on a "retaliatory consumption" brand enterprise, also gradually return to rational operation state, whether social, or economic, cultural as profound changes into a new historical development period.

With the normalization of epidemic prevention and control, the business mode of "cloud fitness", once popular, has also become a concern in the industry. Will physical gyms continue their past glory before returning to the epidemic?

2. THE NEW SITUATION AND TREND OF FITNESS INDUSTRY

After the Spring Festival in 2020, the novel Coronavirus with a fierce momentum has prevented offline gyms across the country from opening, and fitness users have no choice but to choose homehouse online exercise. The profound experience caused by the epidemic has made everyone pay more attention to their own health. Stimulated by consumer demand, online service providers and live streaming platforms have carried out online teaching wars in various ways, and both have achieved good traffic, which indicates that the crisis is also a business opportunity, and cloud fitness is likely to have a historic breakthrough [3].

Although entering the post-epidemic era, people's fear of the epidemic has not disappeared. It is believed that for a long time after the epidemic, indoor sports and fitness venues and some outdoor sports venues that used to be crowded will not reproduce the images of crowds. However, the rigid demand for human health and immunity improvement caused by the epidemic situation shows a continuous upward trend, and it is even very likely that the cut-off point of an event will show an explosive growth, which puts forward a new topic for the health industry -- where do people go to exercise? How to exercise effectively? In fact, this is the driving force behind the development of the fitness industry and the prosperity of the fitness market. As the saying goes, wherever there is demand, there is opportunity.

What will be the basic situation of cloud Fitness during the epidemic in 2020. Basically, present the following several trends.

2.1 Ideas determine the way out, and the market determines the direction

Novel Coronavirus is cunning and rampant. Those who would have regarded fitness as a non-necessity begin to realize that a healthy body is the greatest asset for a happy life. Every day, we learn from TV and the Internet that more and more people bid farewell to the beautiful world because of the virus, and some people overcome the virus because of their strong body immunity. The living fact in front of us urges more and more people to participate in the online movement. The new format has also given more attention to live-streaming coaches and fitness gurus. Online fitness market thousands of sail competition show, benefit rising, also attracted more research and development companies to focus on the cloud fitness field.

2.2 Information technology enables cloud fitness people

to experience different experiences

Under the traditional technology, online sports are monotonous and boring, while Internet information technology relies on live broadcast tools, which makes online sports interesting. The interactivity of various live broadcast functions also makes online sports more attractive. At the same time, mobile live broadcasting makes online sports easy and easy to do, with a high affinity [4]. According to statistics, health and fitness topped the list of the top 1,000 IOS apps downloaded during the Spring Festival in 2020. KEEP and Daily Yoga, which are widely popular, have attracted many active users, making online sports extremely active.

2.3 Intelligent experience makes online interaction possible

People who have experienced the traditional online live sports course have a profound experience of the imreplicability of sports. Because of the differences in sports level and sports basis, many beginners find it difficult to accurately grasp the essentials of movements and precautions through a short live course, which leads to fear of difficulties and reduces the enthusiasm for sports.On the other hand, training participation can not achieve synchronous visual, coaches and students can not timely communication, fitness quality is difficult to ensure.These two factors require online training tools to be convenient, fast and fully functional. Therefore, the conditions for barrier-free communication and live broadcast system to truly achieve fitness effects [5-6]. The author has been using fitness smart dumbbells for more than 3 years. The reason why I can stick to it is that the somatosensory system can obtain heart rate, burn calories, monitor physical fitness data and other reasons, to understand my physical condition and adjust exercise frequency and intensity.

2.4 Colorful online sports, accelerated upgrade

Traditional online sports have occupied on the body of the fitness of cloud, curtilage home movement led to a more comprehensive quality fitness needs, a large number of sports broadcast platform quickly into the bureau, they use their own technological edge positive and each big media and fitness sports institute work together to get the stable flow, more directly open the online live to participate in the competition. PP Sports adopts the way of inviting star coaches to live broadcast, integrating video teaching, social contact, including guidance, equipment procurement, and launching one-stop service, making online athletes more active than ever, thus opening a new way of playing sports on the cloud.

3. DEVELOPMENT DILEMMA OF PHYSICAL GYMS

Over the years, the entity is the gym fitness staging area, affected by the outbreak, all entities in the gym into shutdown mode, operating costs, however, did not enter a state of "shut down", as usual to pay the rent, employee wages as usual to pay, the pay cost less as all didn't, operators have a whimper, but did not abandon but positive as [7].But at the same time, the potential problems in the traditional fitness industry are accelerating. It is mainly manifested in the following two aspects:

(1) Extensive operation leads to low anti-risk capability of the industry. Physical gyms have long operated mostly as clubs. The so-called health club system, is by the operator to provide places, equipment, the organization of the coach, recruit members, provide exercise class guidance, individual sports guidance as the main content of service. A club is an organizational form that focuses on cultivating loyal customers and deriving benefits from services. Therefore, the core of club marketing is relational service marketing, and production and consumption are carried out simultaneously. Since the core of the club is relationship and service, it requires that the operation of the club should be customer-satisfaction-oriented. The most important theoretical support for the success of membership marketing is "keeping old customers". However, most fitness clubs in China cannot resist the temptation of expansion. They pursue the opposite market effect from the service users and lock their profit point on expanding the membership team, that is, attracting new marketing.Especially in some urgent work to the best of the club will be cheap new as the main profit model, ignore the internal management and service, ignore the customers' satisfaction, with new customers prepaid to drive business, relying on new members to create cash flow, once the new members into the slower, cash will flow, the club was run.This kind of marketing is easiest to create an illusory profit growth, resulting in the odd "positive cash flow negative profit" operating phenomenon, known as presale cash flow.The result? They sell 10 million gym memberships, they pay 8 million in the first year, it looks like they make 2 million a year, but they need to spend 7 million in the second year, so once the gym needs to spend 12 million in the third year, they must run. That way, the people who lose the most are the loyal members who join first, and they are the ones who make the gym truly profitable.

(2) Unreasonable income structure of fitness coaches. When the gym closed, many fitness instructors had no classes, so they had no income source. Many of them had no choice but to cook take-out food. This exposes another business disadvantage. Typically, a gym coach's salary is made up of base salary, sales, class hours, team performance and other awards, and once a member is lost, it's a clean break. In other words, sales are the most important part of a coach's salary, and with little basic security, they can easily become promoters.

The deviation of business direction and the weakness of profit core have led to many problems exposed by physical gyms under the test of the epidemic. Although this test comes early, it is also a good thing. For the fitness industry, it may be a sunrise.

4. TAKE LE KE SPORTS AS AN EXAMPLE TO ANALYZE THE ADVANTAGES AND DISADVANTAGES OF FITNESS ON THE CLOUD

Founded in 2015 in Hangzhou, Leck Sports is an O2O sports platform developed by Hangzhou Leck Network Technology Co., LTD., and is the largest 24-hour chain fitness enterprise in the industry. 280 stores are in 8 cities including Beijing, Shanghai, Guangzhou and Shenzhen.

The off-line stores of Leck Sports are called "smart gym", which use environmental protection, modern and intelligent hardware facilities to build a "warm gym". Relying on the two core concepts of "coach dismedia" and "venue sharing", leck sports is committed to providing consumers with convenient, cost-effective, and happy fitness services. With the resumption of work and industry in various industries, Leck has announced its performance during the epidemic, which is generally encouraging. Without the full opening of stores, sales of Leck platform in May exceeded 101 million, up 11% from the same period last year. Such outstanding performance prompts Leck to further expand new business in Suzhou, Guangzhou, Chengdu, Ningbo, Changsha, Zhengzhou and other six cities. So, what kind of business model does Leck adopt to win the battle?

Compared with the club membership system of traditional gyms, Leck does not lock the profit point on purely developing members, but carries out new retail of sports products from the perspective of perfecting and developing new services. In fact, the new retail is to make use of big data to optimize the distribution of customers who need to buy, how many people come to exercise every day, what is the ratio of male to female, what courses are signed up for, how long each class is scheduled, and when is the most efficient time to schedule classes...Ultimately, this is the result of user-oriented and platform-based operations, refined operations. Its premise is that Leck's products are good enough (exercise is effective) and its service is good enough (meet all customers' needs). If they can't arrange a rich enough curriculum system, build a good coach, or meet the needs of users for fitness, then it won't have such an effect. However, the restoration of fitness trainers, who are in an awkward promotion position in the chain of traditional gym management, has become a part of their assets, and can even be positioned as merchants of Le Ke platform. In fact, it is to put the service products on the sales platform, which provides the service place and personnel flow. Because this new service relationship clarifies the identity of the business, the coach can focus on what the customer values most -- service! On May 23, Leck launched a course themed with "Cloud Fitness at home", and invited hundreds of stars to participate in the course. This unique "cloud fitness" has attracted much attention and attracted extensive attention from insiders. According to official statistics from Leck, as of 23:00 on that day, 840,000 home users had participated in the campaign through their TV screens. In fact, this kind of interactive live broadcast not only expands the communication between students and coaches, but also expands the traffic flow for online live broadcast teaching. The effective combination of online and offline facilitates The rapid development of online business of Leck and effectively reverses the passive situation. If the epidemic cannot be controlled within an effective time, the losses of offline businesses will be huge, and some companies may even face bankruptcy. Faced with the great test of the epidemic, Leck has been actively exploring and innovating, starting from the five aspects of means, resources, scenes, consumption patterns and sports ecology, to open a new era of Shared fitness.

(1) Innovate consumption patterns. Traditional health clubs pay more attention to the annual membership, while Leck provides a small and sharp monthly card service, which is widely used throughout the country. The monthly fee is 199 yuan at Leck stores in Beijing and Shanghai, and 99 yuan at Leck stores in Jinan, Nanjing and Hangzhou. What fitness lover can resist the temptation to buy quality free services at rock-bottom prices? At the same time, the service scope of Vrle covers a variety of sports forms, covering most of the population, and promoting special sports services for those groups with special needs, which is a new sports ecology.

(2) Innovate fitness scenes. As a social animal, people need not only the circle but also the atmosphere. Raku attaches great importance to the building of fitness scene. In Raku, both of people's needs are realized. Leck will provide members with free physical examination and scientific fitness knowledge courses from time to time to guide them into the realm of scientific and effective fitness.

(3) Innovative management resources. The biggest difference between Leck and traditional gyms is that they don't sell. Cloud in the classroom, brought together a large number of professional fitness coach, can like to buy real goods, selection of service goods, complete with autonomy, can according to the platform provided by listening to lectures, trial class, listen to the teacher according to their own tried to choose their own curriculum, the contents of the course is very broad, all kinds of training programs, according to different levels of fitness crowd demand courses in different projects.What's more, no matter it is free of charge, or one-to-one reasonably charged private lessons, there are all set up. Leck has built a platform for excellent fitness coaches to provide fitness guidance at home, making up for the disadvantages of offline stores not being able to serve during the epidemic. In addition to the full use of human resources, idle social resources are also used. Leck has several rent-free sharing stores, which help it reduce costs and provide more cost-effective fitness services.

(4) Innovate business methods. Strong big data platform, intelligent technology and other new means are the key to support the continuous development and growth of Leck intelligent gym. Like other online apps, you can browse various course resources by downloading Leck APP, and make reservation for relevant courses according to the location of nearby stores. The operation means is basically a combination of offline and online mode of operation. Of course, these functions are not unique to Leck, and companies like KEEP are also using them [8-9]. Small but sophisticated gyms avoid the restrictions of time and place, allowing fitness to develop along with the nature. Cost-effective value-added services enable fitness to evolve into a new way of leisure and entertainment.

(5) Innovate business model. There are three business models of gyms. One is to open a shop to earn money from one shop, distribute the difference and then expand the scale.Second, establish an online platform model to

connect users with offline gyms, but only harvest 15% of the total consumption.Third, after the establishment of the online platform, the self-run offline stores, that is, linking people goods yard, make money offline. To explain it further, we not only connect users to the app, but also promote private classes, coaches, and group classes on the app. Once we have self-run stores, we can achieve more refined operation and better profits through user tagging and scene data. This is the logic of strong products. For example, when the 1-yuan baozi sold by the baozi shop is more delicious, healthier and more considerate than the 5 yuan baozi sold next door, there is no need for any promotion.

5. TAKE HEART YU UNIVERSITY AS AN EXAMPLE TO ANALYZE THE DIVERSIFIED MARKETING STRATEGIES OF FITNESS ON THE CLOUD

Do yu (Beijing) technology co., LTD. Was established in May 2015, as the deepening in yoga industry science and technology enterprise, it advocates "yoga health way of life" concept, with professional product technology research and development team, from the BAT and its 10 years of operation experience in senior yoga BD team, to "make yoga benefit people" for the mission, to build a "fu can yoga 120 data technology company". At present, it owns designed for yoga to build intelligent mobile management system "as yu zhang pavilion", and "do yoga university" yoga online education platform two sets of Internet product, solve the small and medium-sized venues yoga teaching management, entrepreneurship, three big industry problems, and will be the fashion activities, goods, curriculum, management, introduction of yoga venues, promote to build some gas, culture and value of new ecological community yoga way of life.With the business model of The Internet (S2B2C) and the thinking of new manufacturing and new education, Heart Yu University is committed to building "the most professional online yoga education platform in China", enabling online students to "be persistent and effective" and "spend the least money to learn from the best yoga instructors".At present, there are 200 top yoga teachers at home and abroad who have taught the most professional and systematic yoga knowledge through online live streaming, thus helping over 1 million yoga instructors and practitioners to improve their professional level.

As mentioned above, the ultimate direction of fitness enterprises is to arouse the enthusiasm of athletes, stimulate their interest in sports and provide them with all-round sports services. The latest sports scene designed and developed by Heart Yu focuses on the family. It provides a very comprehensive audience for yoga courses, and covers practitioners throughout the entire life cycle of yoga. It will also build a platform for users to select venues and instructors to exchange trial classes, and in the future, intelligent AI, yoga life and other services will be launched.

Like Leck, Heart Yu is also committed to the closed loop mode of S2B2C, providing promotion channels for its nearly 31,000 cooperative venues, 1 million cooperative coaches and famous teachers in the industry, to achieve a three-in-one solution for the needs of yoga studios, coaches, and practitioners. Therefore, when the offline yoga studio was closed during the epidemic, Heart Yu University organized famous teachers in China to conduct 43 live broadcasts, with a total number of 100,000 participants. Faced with the sudden outbreak of the epidemic, it is indeed a challenge for many venues. If we do not know how to change our thinking in the face of the epidemic, we will face closure. Heart Yu has provided a platform for all kinds of yoga stores, large and small, to meet the challenges brought by the epidemic. It is this coVID-19 that has pushed many users' health awareness, including the concept of yoga, forward for three to five years. Before the epidemic, the yoga industry was developing too fast, and the quality of yoga studios and yoga instructors was uneven. Faced with the challenge of the epidemic, venues that could not adapt to the development of The Times would surely fail.

Open the home page of Heart Yu PC terminal, we will find a variety of services covering all aspects of yoga movement development, including venue diagnosis for yoga clubs, intelligent management for members, promotion tools focused on marketing, and colorful service sections.With the integration of big data analysis function, heart Yoga can track members' exercise data and use big data to conduct intelligent body data evaluation, so as to recommend reasonable exercise courses for users. On the platform, there are such contents as the director of The Yoga studio and the University of the Yoga Studio. Traditional yoga studios can join the platform and make use of the advantageous resources of the platform to expand the management and promotion of their own shops, so as to provide better services for customers.In addition, the platform has added offline yoga parties, nutritional eating services, shopping and other one-stop benefits on the basis of yoga classes.These are not only more scientific, but also more humane, yoga practitioners have been dreaming of a full range of carefree services.

6. WISDOM DEVELOPMENT CLOUD FITNESS IMPERATIVE

6.1 Fitness market calls for intelligent services

New crown after the outbreak, sports venues, the gym were shut down, offline store has been hit, but head straight home fitness, fitness training online APP live class, home fitness clock, social friends marks great without calling, flares, which accelerated the fusion, information technology and the depth of the fitness industry ushered in the wisdom of fitness service platform development, wisdom fitness will be unstoppable.

6.2 Widespread use of digital technology

Technology always is the motive force of development, pattern recognition, virtual reality and computer simulation technology element calm wisdom on live since the media platform, under the technical support for sports training course in field of the strong, just idea of online action before decomposition, action analysis, action to correct and implemented, in addition, online fitness + + + fitness social health management, physical fitness monitoring all personalized, scientific, the wisdom of the service concept will become a reality. With the support of information technology, the blue sky, white

clouds, empty valley, and other scenes that could not be enjoyed at home and fitness were also realized.

7. DEVELOP KEY POINTS FOR FITNESS ON THE CLOUD

Must grasp the opportunity above all, cannot lose on the starting line. The COVID-19 epidemic is just like a starting gun. Fitness companies that are ready can reach a new high with a snap leap, while those who hesitate, cannot see the situation clearly and are slow in thinking can only share the remaining cup of business. As an online sports platform, KEEP launched the "Home Health Guide for Spring Festival" before the outbreak of the epidemic, and started live teaching for users. After the outbreak of the epidemic, KEEP took advantage of its market and traffic advantages to direct services to user groups, thus gaining the initiative of intelligent sports [9].

Secondly, we should pay attention to provide humanized service. Regardless of the service industry, the goal is to provide high-quality personalized services. Therefore, intelligent sports enterprises should also design products from the overall and detailed aspects, improve the functional positioning of products, constantly improve the service ability, and do their best to provide exclusive services for the people who pursue the quality of life. For example, during the epidemic period, the online courses of motivation sports were open for free, which retained many users [9]. Gudong platform launched a live broadcast system specially designed for sports content research and development, which focuses on the communication between coaches and students. Typing and voice interaction can increase customer engagement and make online and offline sports communication zero distance.

Thirdly, pay attention to corporate culture and brand publicity. Every century-old store has a cultural soul in it, so do the so-called brand added value, and so do fitness enterprises. However, it is not a matter of creating corporate culture overnight, which requires all employees to resonate with each other, and establish and promote it through effective training attempts. Applying this principle to cloud fitness means choosing a platform with high traffic and quality, such as Le Ke and Heart Yu. Once the corporate image is positioned, do not change it at will.

8. CONCLUSION

In short, in the post-epidemic era, fitness enterprises must pay attention to the development of the "cloud" market no matter they try to promote smoothly or move forward with wave acceleration. Others may advance or retreat, but you still linger, and quietly delistment is the doomed end. Therefore, sports in various enterprises should firmly grasp the "wisdom + sports" this a very engine, its features and the integration of information technology, business when they have used artificial intelligence, computer simulation and virtual reality to make scenery pleasant movement scene, you have customers running in rough boring concrete room; When people are already using big data, the Internet of Things, cloud computing to match courses and create personalized services, you're still charging, notifying, scheduling...In this way, being eliminated by the market or customers is the only outcome.

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Optimal Design of Pricing for Vehicle Less Carrier Platform

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Abstract: The platform of non vehicle carrier in China develops rapidly, but how to provide the pricing to the carrier can not be solved well. This paper establishes the pricing model of the transportation platform from the perspective of the platform of the vehicle free carrier, and makes a secondary analysis and evaluation of the original pricing according to this model to obtain the accurate results. Transportation pricing has always been a key issue in the development of the industry, among which there are many factors affecting pricing. This paper establishes linear regression equation, and then uses the correlation analysis model to find out the correlation between each factor and pricing, and obtains the main factors affecting pricing: total mileage, business type, line code, renewal status and transportation time. This paper uses machine learning to establish XGBoost model. According to the objective function, the factors affecting pricing, such as total mileage, order emergency, order completion time, etc., are fitted and transformed. Finally, it is predicted that the three pricing should be gradually increased, emergency orders should also be kept for the first time, and the cost price can be obtained by the optimal solution and influencing factors.
Keywords: Carrier Platform Pricing; Weighted Rank Sum Ratio Comprehensive Evaluation Method; Xgboost Model; Machine Learning

1. INTRODUCTION

Since the opening of domestic road transportation market, the development status of "small, scattered and disorderly" has gradually formed. In order to standardize the transportation market, the general office of the Ministry of transport issued the opinions on promoting the reform pilot and accelerating the innovative development of vehicle free carrier logistics in September 2016, and initially announced 48 vehicle free carrier pilot platforms. With the gradual rise of China's car less carrier industry, the scientific pricing of the carrier line is an urgent problem for many vehicle less carrier platforms.

At present, the main operation mode of domestic car free carrier is as follows: the cargo owner, the vehicle less carrier platform and the carrier participate in the operation. The cargo owner publishes the information on the vehicle free carrier platform. The driver at the carrier end will judge whether to accept the order according to the route task and price released by the platform. The driver receiving the order is regarded as the successful transaction of the line task Be sure to dismount from the platform immediately.

As a vehicle less carrier platform, this paper needs to make reasonable quotation to the owner, carrier and driver at the same time. For the time being, it only considers quoting to the carrier and individual driver. The platform needs to use the algorithm model to predict the price of the line task carried in advance, and then publish it to the network platform with a certain price for the carrier driver to browse and decide whether to carry the transport task. The platform adopts the form of dynamic pricing to ensure that each task must be carried. If the task is not carried, the price of the line can be adjusted, but it can publish the price three times at most (that is, the line price can be refreshed twice after the first release of the line price). If there is no carrier driver or individual truck driver to receive orders, the platform will have corresponding losses.

At the present stage, the vehicle less carrier platform is more concerned about the goal of setting a reasonable price so that the carrier driver and the individual truck driver can receive orders at a lower cost (assuming that the above line tasks are all fixed vehicle tasks, that is, a task needs to be completed by 1 of a certain vehicle type Therefore, this paper will use the algorithm model to help the platform to solve the problem of fast transaction promotion and low transportation cost.

2.ESTABLISHMENT OF PRICING MODEL FOR VEHICLE LESS CARRIER PLATFORM

2.1PROBLEM DESCRIPTION

Through the quantitative analysis method, according to the relevant knowledge research, this paper expounds the main factors that affect the freight line pricing of the vehicle less carrier platform, and the indexes that can be referred to are as follows: mileage number, business type, price adjustment proportion, line code, renewal status, transportation time, demand state, etc.

The mathematical model of route pricing is established, and the three times guiding price and total cost pricing of the unpriced transportation task are obtained (the results are shown in the annex). For a certain task, if one transaction is completed in the three quotations, the subsequent price will not be considered. At the same time, according to the mathematical algorithm model and relevant results, the price adjustment strategy of this paper is given.

2.2 ASSUMPTIONS OF THE PROBLEM

It is assumed that each transportation task in this paper is independent of each other;

The communication between the consignor, the underwriter and the individual truck driver is conducted through the vehicle free carrier platform without private negotiation;

It is assumed that all the above-mentioned line tasks are vehicle tasks of fixed vehicle models, that is, a task needs to be completed by one vehicle of a certain vehicle type, and the combined loading task is not considered;

The data used in this paper ignores the human factors in the transportation process.

2.3ESTABLISHMENT OF MULTIPLE LINEAR REGRESSION

Cost oriented pricing method is the most simple and direct pricing method. It takes the cost of transportation services provided by underwriters or individual drivers as the basic basis for formulating market price. On this basis, the expected profit is taken as the final freight rate. According to the different methods of setting profit, the cost-oriented pricing method can be divided into four methods: complete cost-plus pricing, processing cost plus pricing, break even analysis pricing and marginal cost pricing. [1]

According to the existing literature on knowing the price, it can be preliminarily concluded that the guiding price (pricing) of the line is greatly affected by the total mileage, business type, line code, renewal status, transportation time and other factors [2], as shown in Figure 1.

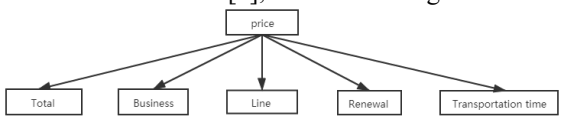

Figure 1 Factors Influencing pricing

2.4CORRELATION OF PRICING INFLUENCING FACTORS

According to the linear relationship between the total mileage, business type, line code, price adjustment proportion, renewal status, transportation time and line guiding price is obtained [3].

It can be concluded that the main factors that affect freight line pricing on NVOCC platform are total mileage, business type, line code, renewal status and transportation time. The degree of influence is shown in Table 1.

Table 1 influencing factors and extent of pricing

INFLUENCE FACTOR	DEGREE OF INFLUENCE
TOTAL MILEAGE	0.9911
BUSINESS TYPE	-0.2162
RENEWAL STATUS	0.0062
TRANSPORTATION TIME	0.0038

2.5SOLUTION AND EVALUATION OF PRICING WEIGHT

Analytic hierarchy process (AHP) can decompose the problem into different constituent factors according to the nature of the problem and the overall goal to be achieved, and combine the factors according to different levels according to the mutual influence and subordination relationship between the factors to form a multi-level analysis structure model, so that the problem is finally reduced to the relative important weight of the lowest level relative to the highest level [4].

Through the construction of judgment (pairwise comparison) matrix, hierarchical single ranking and its consistency test, hierarchical total ranking and its consistency test, then we can get the weight of total mileage, line price, line code, transaction success time, vehicle length, vehicle tonnage, C-end bargaining feedback quantity, b-terminal bargaining feedback quantity, total line cost and other factors, as shown in Table 2 .

Table 2 hierarchical ranking and weight coefficient

sort	Hierarchical sorting	weight coefficient	sort	Hierarchical sorting	weight coefficient
1	Total mileage	0.0690	6	Vehicle tonnage	0.0067
2	Line price	0.4850	7	Quantity of bargaining feedback at C end	0.0005
3	Line coding	0.0464	8	Quantity of bargaining feedback at B end	0.3165
4	Transaction success time	0.0711	9	Total line cost	0.0002
5	Vehicle length	0.0047			

In this paper, AHP is used to calculate the weight coefficient, which is the basis of establishing an ordered hierarchical index system. Through the comparison of two indicators, the advantages, and disadvantages of each index of the system are evaluated.

2.6ESTABLISHMENT OF WEIGHTED RANK SUM RATIO EVALUATION MODEL

The basic principle of weighted rank sum ratio comprehensive evaluation model (wrsr) is to obtain dimensionless Statistics (RSR) between 0-1 by rank transformation of multiple index values of samples, and then use parameter analysis to study the specific distribution of RSR. Therefore, the larger the RSR is, the better the result will be.

In this paper, the value of RSR is used to directly rank or rank the evaluation objects, to make a comprehensive evaluation of the evaluation objects. This model is evaluated according to the rank, RSR, probability unit, regression equation, grading and rest scheduling algorithm, and the estimated value of wrsr is calculated. Then through the estimated value, we can see whether the pricing in the historical transaction data of the completed freight lines is reasonable, and make an evaluation on it.

According to the solution of the weight coefficient and

the establishment of the weighted rank sum ratio comprehensive evaluation model, this paper can make a reasonable evaluation on Annex 2. The evaluation score is 1-10, and the score is close to 1, which indicates that the pricing is not reasonable. Some results are summarized in Table 3.

Table 3 Annex 2 part pricing evaluation

ID	4715	6240	6463	175	6114	6281	13072	6888
Appraisals	2	7	6	2	9	9	2	8

2.7ESTABLISHMENT AND SOLUTION OF XGBOOST ALGORITHM

XGBoost is based on gbdt (grade boosting decision tree) improvements. The core algorithm idea of XGBoost is: adding trees constantly, continuously dividing features to grow a tree, adding a tree at a time, in fact, learning a new function f (x) to fit the residual predicted last time. When the training is completed, K trees are obtained, and then the score of a sample is predicted. In fact, according to the characteristics of this sample, a corresponding leaf node will fall into each tree, and each leaf node will correspond to a score. Finally, we only need to add the corresponding scores of each tree to the predicted value of the sample.

The target functions used by XGBoost are as follows:

$$\ell^{(t)} = \sum_{i=1}^{n} l(y_i, \hat{y_i}^{(t-1)} + f_t(x_i)) + \Omega(f_t)$$

From the above functions, we can see that XGBoost adds L1 and L2 regular terms to the error function of gbdt. The loss function can be square loss or logical loss, T represents the number of leaf nodes, and W represents the score of leaf nodes. The advantage of adding regular term is to prevent over fitting, which is reflected in two aspects: one is pre pruning, because there is a limited number of leaf nodes in the regular term; the other is that the coefficient of L2 modulus square of leaf scroe in the regular term smoothes the leaf scroe.

$$\ell(\phi) = \sum_i l(\hat{y_i}, y_i) + \sum_k \Omega(f_k)$$

$$where \Omega(f) = \gamma T + \frac{1}{2}\lambda \|w\|^2$$

Function representation: the error function of the t-th iteration of the i-th sample is based on the above formula. This learning method has been transferred from function space to function space.

According to the objective function. The total mileage of factors that will affect pricing. Order urgency. Finally, it predicts that the three pricing should be gradually increased. Emergency orders should also be conservative pricing, the first time and so on, through the optimal pricing solution and influencing factors to get the cost price.

2.8PRICE ADJUSTMENT STRATEGY

When no one takes over the task in the first pricing, we will refresh the price and raise the price. If no one takes over the order, we will reduce the income we get and raise the price again in order to avoid loss, and the increase range is greater than the second increase, which can reduce a lot of losses.

As for the signing of contracts, we will appropriately increase the pricing of the trading partners who have signed contracts with us, so that more transactions are willing to renew contracts with the platform for a long time. This will reduce the single revenue, but increase the number of tasks completed. In this way, if I control the number and increase the value of pricing, our final revenue will increase, and this can increase the reputation of our platform, which is conducive to future development.

For business types, we will make the planned pricing higher than the temporary pricing, which can potentially encourage trading partners to plan more transactions. Through this way, we can reasonably arrange tasks, increase the working efficiency of the platform, and increase revenue.

When there is a large amount of bargaining feedback, we will consider increasing the pricing appropriately, which can increase the transaction volume, which will not reduce the revenue in the long run.

For the urgency of demand, we will also increase the pricing of urgent orders, to achieve faster speed, because the consignor will also increase the price given by them when they provide us with urgent orders. Therefore, we only need to control the price difference between the two and separate out how much more quickly we can get the object to accept the task when the pricing increases The increased pricing should also be controlled within a certain range, so that the difference between the direct increase of the consignor and the trading partner is our additional income.

For the line coding, because the trading partner will consider the line problem when trading. For some rough roads, the selection of trading partners will be greatly reduced, which will increase our task and the task completion rate of this line, which will greatly reduce the revenue of this line. Therefore, when adjusting the price, we should analyze which line according to the previous data When the trading partner is more inclined to the line, which line is the trading partner is not willing to choose. For the line that the trading partner does not want to select, we will increase their pricing, to improve the selection of the line by memory object, which can increase the task completion rate, reduce the loss, and increase the income [5].

3.MODEL CHECKING AND OPTIMIZATION

3.1SPECIAL DATA MODIFICATION

When the correlation analysis method is used to calculate the correlation R2 between business type and line guidance price, R2 = -0.2162 is negative. When looking at the correlation, if it is negative, it means that the increase of one variable may cause the decrease of another variable, that is, negative correlation. We can take its absolute value to see the degree of correlation, so the correlation between service type and line guidance price is 0.2162.

3.2ERROR ANALYSIS

In this paper, the evaluation is divided into 1-10, and the result is > 10, as shown in Table 4.

Table 4 Annex 2 pricing evaluation

ID	11812	11658	6875	6896
Appraisals	20	20	19	14

When the vehicle less carrier platform issues tasks, it should consider both the total cost price of the carrier and the price given by the cargo owner. At the same time, it will be affected by human factors, such as government policies, the rise and fall of oil price, so there will be errors in guiding the price evaluation.

When the model is optimized, other factors can be considered. At the same time, the volume cost profit method is used to process the data dimensionless. At the same time, the total cost is only predicted by the platform. Further investigation can be carried out to obtain the accurate total transportation cost.

3.3OPTIMIZATION OF THE MODEL

The data used in the model in this paper are from May 2019 to January 2020. With the price rising, this algorithm can not calculate the future transportation cost, so we can establish other mathematical models to infer the price change trend, to get the price change with time, so that the model can be used for a longer time.

4.RESULT EVALUATION

4.1ADVANTAGES

The model established in this paper has universal applicability, has a high guiding role for relevant departments, and the model is simple to use, and has strong practicability and versatility.

The data obtained by the model established in this paper have high credibility, and the data obtained are in line with the actual situation, and can have a good prediction of pricing.

The model used in this paper makes weight analysis on the prediction of pricing in various aspects. Considering the different influence of some factors on pricing, the data obtained is more accurate.

The model established in this paper optimizes the price adjustment and adopts a variety of price adjustment strategies, which can better adapt to the changes of market situation and make timely response strategies to achieve better results.

The model used in this paper also considers the influence of the carrier's stickiness to the platform on the pricing.

4.2 DISADVANTAGES

In the process of establishing the model, this paper does not involve the influence of some subjective factors, such as the quantity of bargaining feedback, and the lowest bargaining price, etc., but it is not without influence, so the prediction of pricing by the model will have certain errors.

The model only considers the factors with larger influence factors when calculating the pricing. As the other factors have little impact on the pricing and are not easy to calculate accurately, such factors are ignored, but they still have certain influence on the pricing, so there will be some errors.

5.EXTENSION OF THE MODEL

The model established in this paper can be applied to shipping companies, car carrier platforms, air transport companies and other industries, providing a good standard for their pricing. For the sale of small items, we can also change the definition of variables in the model according to this model, to set a reasonable price. For other industries, the model established in this paper can also be used if there is a need for dimensionless data processing or quantitative analysis of qualitative problems.

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Design of Mooring System

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Abstract: The mooring system is a particularly important part of the offshore observation network, and it is also an important carrier tool in marine meteorological monitoring and ocean exploration. In the design of the mooring system, determining the type and length of the anchor chain and the mass of the weight ball so that the draught of the buoy, the swimming area and the inclination angle of the steel drum are as small as possible. When only considering wind speed without considering water flow speed, the overall force balance of the system is the key to solving the problem. In order to see the relationship within the system more clearly, this article chooses to separate the system and analyze it in turn. Starting from the anchor chain, the system is divided into four parts. The weight ball and steel drum, steel pipe, and buoy are carried out on the Internet for force analysis and moment analysis. Based on the catenary equation and differential equation, the quantitative analytical equation of the entire system can be obtained. The group, using MATLAB, can solve the required inclination angle of the steel barrel and each section of steel pipe, the shape of the anchor chain, the draft of the buoy and the swimming area. Then calculate the floating area of the buoy based on the projection of the entire system in the horizontal direction.
Keywords: Mooring System; Catenary Equation; Differential Equation

1.INTRODUCTION

In the design of mooring system, how to determine the type, length of the anchor chain, the weight of the ball, and then make the draft depth and swimming area of buoy and the inclination angle of steel barrel as small as possible is an important problem in the research of mooring system at present [1-6].

A 600- kg anchor chains for five models (I~V), steel drums of 1m, 30cm, 100kg length, outer diameter and weight respectively (including underwater acoustic communication system), Weight ball, 4 sections of steel pipes with a length of 1m, a diameter of 50mm, and a mass of 10kg, a cylinder with a height of 2m, a weight of 1000kg, and a bottom diameter of 2m constitute an offshore observation network. Based on this, we will study the mooring system.

The existing transmission node uses type II anchor chain 22.05 meters or 1200 kg weight ball, which is placed in the sea area with a water depth of 18 m, flat seabed, and a sea water density of 1.025×103 kg/m³. When the sea water is still, the inclination angle, anchor chain shape, draught depth and swimming area of the buoy are calculated when the sea surface wind speed is 12 m/s and 24 m/s respectively.

2.PARTIAL TREATMENT OF MOORING SYSTEM

(1) Anchor chain analysis

In order to facilitate the determination of the position of each part of the system, we set up a plane rectangular coordinate system with the connection point between the anchor chain and the anchor as the origin. As shown in figure 1 below:

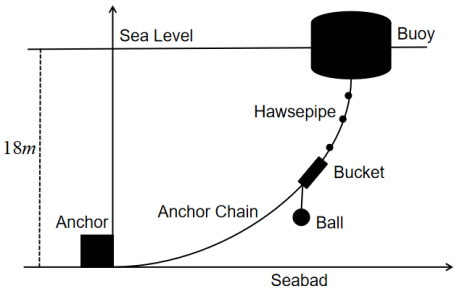

Figure 11

Take out the anchor chain from the system, record the force on the lower end of the anchor chain as F_{N_1}, the angle between the force and the horizontal direction as α_1, and the upper end on the tensile force F_{N_2}, and the angle α_2 in the horizontal direction, cut the anchor chain at point B, starting from the origin. The arc length to point B is denoted as s, the upper part of the pulling force on point B is T, the angle with the horizontal is α, and the force F_{N_1}, T, F_{N_2} is along the tangent direction of the curve. As shown in Figure 2 below:

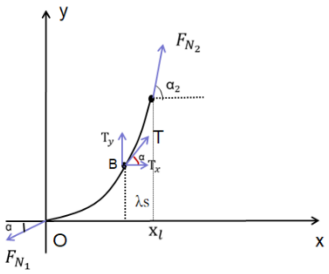

Figure 2. 2Recorded λ as unit line weight

$\lambda = 7 \cdot g = 68.6\ (N \cdot m^{-1})$, The mass of the truncated curve isλs.

Since the intercepted chain is in equilibrium, and according to the equilibrium conditions of any force system in the plane, the sum of all forces projected on the x -axis is 0, and the sum of all forces projected on the y -axis is 0, we can get:

$$\begin{cases} T\cos\alpha = F_{N_1}\cos\alpha_1 \\ T\sin\alpha = \lambda s + F_{N_1}\sin\alpha_1 \end{cases}$$

Divide the two formulas:$tan\,\alpha = \frac{\lambda s + F_{N_1} sin\,\alpha_1}{F_{N_1} cos\,\alpha_1}$

Since the pulling force T is along the tangential direction, $tan\,\alpha = \frac{dy}{dx}$

Then take the differential for $u = \frac{dy}{dx}$ and get

$$du = \frac{\lambda ds}{F_{N_1} cos\,\alpha_1}$$

According to the arc differential formula:

$ds = \sqrt{1 + (\frac{dx}{dy})^2}dx = \sqrt{1+u^2}dx$,

Then $du = \frac{\lambda\sqrt{1+u^2}dx}{F_{N_1} cos\,\alpha_1}$

Separate variables, both sides of the same indefinite integral:

$$\int \frac{\mathrm{du}}{\sqrt{1+u^2}} = \int \frac{\lambda dx}{F_{N_1} cos\,\alpha_1}$$

$$\Rightarrow \mathrm{arcsinh}(u) = \frac{\lambda x}{F_{N_1} cos\,\alpha_1} + C_1$$

$$\Rightarrow u = sinh(\frac{\lambda x}{F_{N_1} cos\,\alpha_1} + C_1)$$

Due $u = \frac{dy}{dx}$

Taking the indefinite integral of the above formula at the same time can get

$y = \frac{F_{N_1} cos\,\alpha_1}{\lambda} cosh(\frac{\lambda}{F_{N_1} cos\,\alpha_1} x + C_1) + C_2$

To determine the constants C_1, C_2, Take the boundary condition of $x = 0$,

$\begin{cases} u(0) = tan\,\alpha_1 \\ y(0) = 0 \end{cases}$,

Solution:

$$\begin{cases} C_1 = \mathrm{arcsinh}(tan\,\alpha_1) \\ C_2 = -\frac{F_{N_1} cos\,\alpha_1}{\lambda} cosh(\,\mathrm{arcsinh}(tan\,\alpha_1)) \end{cases}$$

Then the equation can be rewritten as:

$y = \frac{F_{N_1} cos\,\alpha_1}{\lambda} cosh(\frac{\lambda}{F_{N_1} cos\,\alpha_1} x + \mathrm{arcsinh}(tan\,\alpha_1)) - \frac{F_{N_1} cos\,\alpha_1}{\lambda} cosh(\,\mathrm{arcsinh}(tan\,\alpha_1))$

a. If the chain does not mop the floor:

Let the arc length of the anchor chain be $L = 22.05\ (m)$, then we can get

$$\int_0^{x_L} \sqrt{1 + (y')^2} = L \Rightarrow$$

$$x_L = \frac{F_{N_1} cos\,\alpha_1}{\lambda} \mathrm{arcsinh}[(\frac{\lambda}{F_{N_1} cos\,\alpha_1} L + tan\,\alpha_1) - \mathrm{arcsinh}(tan\,\alpha_1)]$$

The force at the upper point is also in the tangent direction, so we can get:

$y'(x_L) = tan\,\alpha_2$

At this point, we get the following equations:

$\begin{cases} \int_0^{x_L} \sqrt{1 + (y')^2} = L \\ y'(x_L) = tan\,\alpha_2 \end{cases}$

b. Assuming that the anchor chain mopping:

Under the influence of wind, the anchor chain will partially contact the seabed. Remember that the bottom of the sinking is divided into x_0, and the y coordinates from the origin to the bottom of the sinking are all 0. Currently, the length above the ground is $s - x_0$.The end of the anchor chain satisfies the equation

$$\begin{cases} \int_{x_0}^{x_L} \sqrt{1 + y'^2}\,dx = s - x_0 \\ y'(x_L) = tan\,\alpha_2 \end{cases}$$

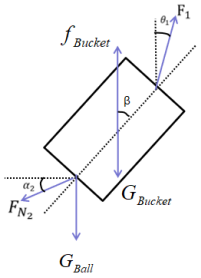

Figure 33

(2) steel barrel analysis

The steel drum is taken out of the system, and the steel drum is balanced under the action of 5 forces. As shown in Figure 3, the magnitude of the reaction force from the anchor chain is still F_{N_2}, and the angle with the horizontal direction is still α_2. The pulling force given to him by the gravity ball, after consulting, the density of the gravity ball is generally very large, and the buoyancy force received is negligible relative to its own gravity, then the force of the ball on the barrel can be approximated as the gravity of the ball, which is recorded as $G_{Ball} = 11760\ (N)$ direction vertical downward. Subject to its own gravity and buoyancy, recorded as

$$G_{Bucket} = 100g = 980\ (N)$$

$$f_{\mathrm{Bucket}} = \rho_{Sea} V_{Bucket} g = 226.01\ (N)$$

Both directions are along the vertical direction, and the angle between the barrel and the vertical direction is recorded as β. The height of the barrel is recorded as $l = 1\ (m)$, the barrel is also subjected to the tensile force of the steel pipe, recorded as θ_1, and the angle with the vertical direction is recorded as F_1. The necessary and sufficient conditions for the equilibrium of the arbitrary force system on the plane are obtained:

$$\begin{cases} \sum F_x = 0 \\ \sum F_y = 0 \\ \sum M_C = 0 \end{cases} \Rightarrow$$

$$\begin{cases} F_1 sin\,\theta_1 = F_{N_2} cos\,\alpha_2 \\ F_1 cos\,\theta_1 + f_{Bucket} = F_{N_2} sin\,\alpha_2 + G_{Bucket} + G_{Ball} \\ G_{Ball} sin\,\beta \frac{l_{Bucket}}{2} + F_1 sin(\beta - \theta_1) \frac{l_{Bucket}}{2} = F_{N_2} sin(\frac{\pi}{2} - \alpha_2 - \beta) \frac{l_{Bucket}}{2} \end{cases}$$

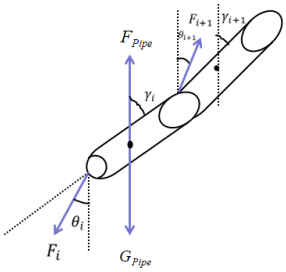

Figure 44

(3) steel pipe analysis

Take the i -th steel pipe for force analysis, as shown in Figure 4. The angle between the steel pipe and the vertical direction is γ_i, the steel pipe is subject to its own gravity

$$G_{Pipe} = 98\ (N)$$

Buoyancy

$$f_{Pipe} = \rho_{Sea} V_{Pipe} g = 6.28\ (N)$$

The directions are all vertical. The force on the bottom of the steel pipe is recorded as F_i, the direction is recorded as θ_i, the top force is recorded as F_{i+1}, and the direction is recorded as θ_{i+1}. The necessary and sufficient conditions for the balance of any force system in the plane:

$$\begin{cases} F_i \sin\theta_i = F_{i+1} \sin\theta_{i+1} \\ F_i \cos\theta_i + G = F_{i+1} \cos\theta_{i+1} + f \\ F_i \sin(r_i - \theta_i) = F_{i+1} \sin(r_i - \theta_{i+1}) \end{cases}$$

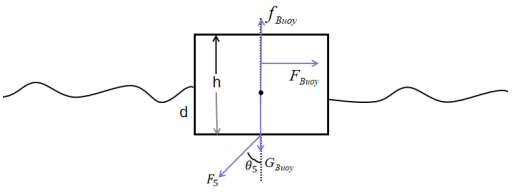

Figure 55

(4) buoy analysis

Take the buoy out of the system, and the buoy maintains balance under the action of four forces. The height of the buoy is $h = 2(m)$ as shown in Figure 5. The tensile force of the steel pipe and the force on the upper end of the fourth steel pipe are the reaction forces each other, the magnitude is recorded as F_5, the angle with the vertical direction is θ_5, and its own gravity is recorded as

$$G_{Buoy} = 9800\ (N)$$

Both wind force and buoyancy are related to draught d.Considering that the part below the horizontal plane will not be disturbed by wind, and if the wind acts on the center of mass of the object, F_5 will give the buoy a clockwise rotation moment, and the buoy cannot be balanced. Therefore, we simplify the wind force to the center of mass of the upper half, namely

$F_{wind} = 0.625(2 \times (2-d)) \cdot v_{wind}^2 = 1.25(2-d)v_{wind}^2$

The buoy is buoyant

$f_{Buoy} = \rho_{Sea} g d (\frac{2}{2})^2 = \rho_{Sea} g d = 10045d$

According to the necessary and sufficient conditions for the equilibrium of any force system in the plane:

$$\begin{cases} F_{wind} = F_5 \sin\theta_5 \\ f_{Buoy} = F_5 \cos\theta_5 \\ F_{Wind}(\frac{h}{2} - \frac{h-d}{2}) = F_5 \sin\theta_5 \frac{h}{2} \end{cases}$$

3.CONDITION SUPPLEMENT

After the whole system analysis is completed, we now have to further organize all our formulas

We have a total of 20 equations, 21 equations, this equation has no unique solution, we need to supplement the equation.

A total of 18 meters of water depth is studied. The sum of the anchor chain, steel barrel, steel pipe and draft depth projected to the y -axis should be 18, that is

$$y(x_L) + l_{Bucket} \cos\beta + l_{Pipe} \sum_{i=1}^{4} \cos\theta_i = y(x_L) + \cos\beta + \sum_{i=1}^{4} \cos\theta_i = 18$$

The radius of the floating region of the buoy can be R as the projection of the whole system on the x axis

$$R = x_0 + l_{Bucket} \cos\beta + l_{Pipe} \sum_{i=1}^{4} \sin\theta_i\, R = x_0 + l_{Bucket} \cos\beta + l_{Pipe} \sum_{i=1}^{4} \sin\theta_i$$

Take all the above formulas into the MATLAB and solve them with MATLAB:

4.CONCLUSION

a.When the wind speed is 12 m/s:

According to the following table, the inclination angle $\theta_1 \sim \theta_4$ the four steel pipes is:

θ_1	θ_2	θ_3	θ_4
1.093012°	1.084470°	1.076059°	1.067779°

The angle of inclination of the barrel is:$\beta = 1.135290°$

The shape of the chain is shown in Figure 6 below:

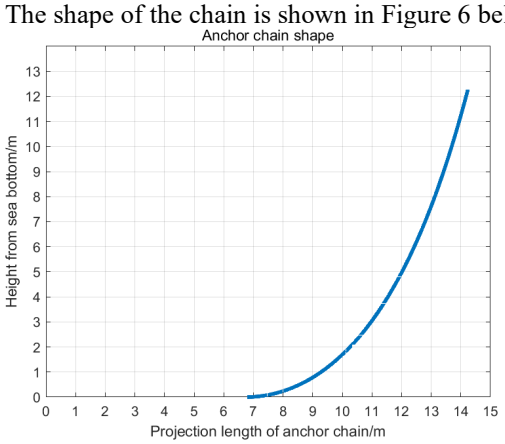

Figure 66

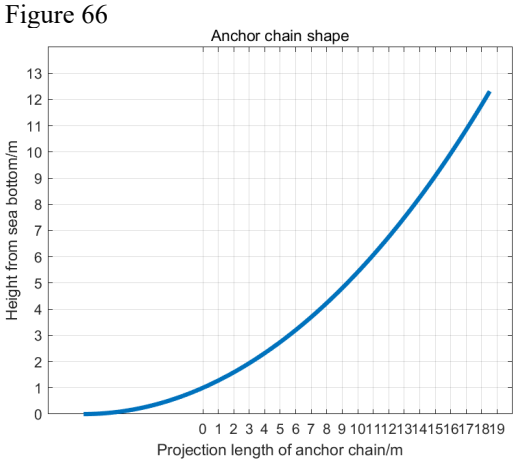

Figure 77

Depth of draft of buoy: $d = 0.708749(m)$

Radius of buoy's swimming area: $R = 14.3341(m)$

At this point, the anchor chain is about 6.74 m in contact with the seabed.

b.When the wind speed is 24 m/s:

According to the following table, the inclination angle $\theta_1 \sim \theta_4$ the four steel pipes is:

θ_1	θ_2	θ_3	θ_4
4.161438°	4.130172°	4.099373°	4.069028°

The angle of inclination of the barrel is:$\beta = 4.315875°$
The shape of the chain is shown in Figure 7 below:
The draught depth of the buoy $d = 0.723117(m)$
The swimming radius of the buoy $R = 17.4809(m)$
At this point, the anchor chain seabed is not in contact.

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Analysis of Ship Mooring System Based on Genetic Algorithm

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Abstract: This article is for the 2016 national college students' mathematical contest in modeling A problem solution, to buoy, steel pipe, steel drum and cable force model is established, which is obtained from the catenary and constraint chain discriminant equation, by using the genetic algorithm to solve the constraint equations, and it is concluded that different wind speed, water flow, water depth and cable specifications mooring system of steel barrels and Angle of each section steel cable shape, water depth of the buoy and swimming area. Among them, force analysis is made for each component in the mooring system, constraint chain and self-catenary equations are established respectively, and genetic algorithm is used to solve each index, and the shape of anchor chain is drawn.
Keywords: Mooring system; Genetic algorithm; Catenary equation; Static analysis

1. INTRODUCTION

The transmission nodes of the near-shallow sea observation network are composed of buoy system, mooring system, and underwater acoustic communication system. In order to adapt to various changing environments, the mooring system needs to select the appropriate anchor chain type, length, and mass of the heavy ball, to minimize the draft depth of the buoy, the swimming area, and the inclination Angle of the steel bucket. In this paper, according to the data and parameters of A system given in question A of the 2016 National Mathematical Contest in Modeling for College Students, as well as the transmission node diagram, the following problems are attempted to be solved:

Type II electric welded anchor chain 22.05 meters and 1200 kg weight ball transmission node are selected. The transmission node is placed in the sea area with water depth of 18 meters, flat seabed and sea water density of 1.025×103kg/m3.In the water under the condition of static, respectively calculate the surface wind speed of 12 m/s and 24 m/s Shi Gang barrels and each section of the steel tube Angle, shape, buoy mooring chain draught and swimming area.

Note: Topics can be downloaded from the official website of the National Mathematical Contest in Modeling for College Students: http://www.mcm.edu.cn

2. ASSUMPTIONS OF THE MODEL

(1) Since it is difficult to determine the volume of the anchor chain and the heavy ball, and the mass is relatively large, the buoyancy of the anchor chain and the heavy ball is not considered.

(2) Assuming that the buoy is in a horizontal state, the force analysis process of the buoy is simplified, and there is no inclination, that is, the draft depth remains unchanged.

(3) Ignore the waves.

(4) Do not consider the influence of the overlapping part at the connection of the anchor chain on the anchor chain, and assume that the anchor chain gravity is uniform, can bend but has no elasticity, and the anchor chain is constant along the direction of the self-catenary.

3. ESTABLISHMENT AND SOLUTION OF THE MODEL

3.1 PROBLEM ANALYSIS

Solving a problem, first of all, buoys, first I root steel pipe, steel drum and the cable force under the same type frame model, the chain is divided into the two models of catenary and constraint chain was established, finally put the problems into the optimal solution, to establish the objective function and the catenary two constraint function and constraint chain, using genetic algorithm.

3.2 THE KNOWN CONDITIONS

Transmission nodes are placed in the sea area with a water depth of 18 m, a flat seabed, and a sea water density of 1.025×103 kg/m^3. Type II electric welded anchor chain is selected to be 22.05 m. The mass of the heavy ball is 1200 kg, and the sea water is assumed to be still.

3.3 PERFORM FORCE ANALYSIS ON THE SYSTEM

(1) THE FLOATING FORCE MODEL IS ESTABLISHED

Suppose the direction of wind force is along the positive direction of X-axis, and it is a one-way plane flow. Under the static situation of sea water, it can be known that the forces on the buoy include gravity G, buoyancy F_{pf}, sea breeze load F_c and steel tube tension T_0. Then the following conditions can be obtained through the force analysis [1-3]:

$$\begin{cases} \sum F_x = 0, F_c - T_{0,x} = 0 \\ \sum F_y = 0, F_{pf} - T_{0,y} - G = 0 \end{cases} \quad (1)$$

The sea breeze load force F_c and buoyancy force F_{pf} can be expressed by the formula. Combined with the above conditions, the expression of θ_1 for the inclined Angle of the first steel tube and the expression of T_0 for the force between the buoy and the steel chain can be obtained.

(2) THE ESTABLISHMENT OF STEEL TUBE STRESS MODEL

In this paper, the steel pipe is regarded as a particle, and

the force of each steel pipe is analyzed. Since each steel tube has the same specification (same mass, length and diameter), the gravity and buoyancy of each steel tube are equal. The force of gravity on each tube, the buoyancy of F_{pi}, and The force acting on the i steel tube and the i+1steel tube is *Ti*

The horizontal force F_x, vertical forceF_y and external force distance M of the ith steel tube are zero, that is, the component forces of the interaction between the two steel tubes in the horizontal direction are $T_{i,x}$ and $T_{i+1,x}$ equal.The vertical component of the interaction force on the ith steel tube $F_{i,y}$ and the buoyancy force F_{pi} on the ith steel tube $F_{i+1,y}$ is equal to the gravity $G_l$on the ith steel tube.When the combined external torque of the steel tube is zero, the torque vector sum of forces in all directions is zero, where is the length of $l_1$steel tube, and θ_i is the tilting Angle of the ith steel tube.

According to Newton's third law, the action of the force is reciprocal, and the tension between two steel tubes is equal. Given the diameter $d_i$and length l_i of each steel tube, the buoyancy force of each steel tube can be calculated according to the formula of buoyancy.

According to the above conditions, given T_0、θ_1、G_l、F_{pi} according to the static equation, the slope Angle of each section of the steel tube is θ_{i+1} and the pull force of each steel tube on the previous steel tube is F_{i+1}.

(3) THE STRESS MODEL OF STEEL DRUM IS ESTABLISHED

The buoyancy of the heavy ball can be ignored because its volume cannot be determined and the buoyancy of the heavy ball in seawater is less than that of gravity. The steel barrel is subjected to its own gravity of G_2, the drag force of the weight ball T_{ZWQ}, the buoyancy force F_{pg}, the pull force of the fourth steel tubeT_4 and the pull force of the anchor chain T_Z.

If the steel drum is regarded as a rigid body, according to static equilibrium [2] and force and moment equilibrium conditions, the force analysis of the steel drum can be obtained, which shows that the steel drum is in equilibrium state, that is, the horizontal component $T_{z,x}$ of anchor chain tension exerted on the steel drum is equal to the horizontal component $T_{4,x}$ of the fourth steel tube tension exerted on the steel drum. The vertical component $T_{4,y}$ of the fourth steel tube tension subjected to the steel barrel and the sum of the component $T_{z,y}$ of the buoyancy and gravity ball, gravity and anchor chain tension in the vertical direction are equal and the combined external moment of the steel barrel is zero.

(4) COORDINATE MODEL OF ANCHOR CHAIN IS ESTABLISHED

The establishment of self-catenary coordinate system

When the anchor chain is at an Angle to the seabed. When there is a horizontal chain, the coordinate origin of the corresponding equation above is defined at the contact point between the anchor chain [3] and the anchor. In order to simplify the operation, the coordinate origin is moved down to unit A (as shown in the figure), and then the catenary equation becomes:

$$y = ach\frac{x}{a} \quad (2)$$

The establishment of the constrained chain coordinate system

When the Angle between anchor chain and seabed is $\theta_A \geq 0$, the self-suspended chain is not satisfied, so the constrained chain coordinate system is established. Suppose S 0 constraint chain extended down, make constraint chain since part of the catenary, is extended to the bottom of the point θ_A = 0, make $S_0 + S$ from the catenary, the established system as shown:

3.4 MODEL SOLUTION

In order to make the system more stable, the objective function of the steel barrel is established, which can be known from the above analysis:

$$T_{4,y} + F_{pg} - T_{z,y} - T_{zwq} = 0 \quad (3)$$

The self-catenary and constrained chain equations are established and solved by genetic algorithm:

$$min\left|T_{4,y} + F_{pg} - T_{z,y} - T_{zwq}\right| \quad (4)$$

Since the catenary ($S_0 \geq S_m$):

$$\begin{cases} 0 \leq h \leq 2 \\ T_{4,y} = F_{pg} - G - 4F_{pi} \\ T_{z,y} = kpS_m \\ F_{pg} = \rho_{water} g v_{ironbucket} \\ T_{zwq} = M_2 g - \rho_{water} g V_{ball} \\ G_2 = m_2 g \end{cases} \quad (5)$$

Constraint chain ($S_0 < S_m$):

$$\begin{cases} 0 \leq h \leq 2 \\ T_{4,y} = F_{pg} - G - 4F_{pi} \\ T_{z,y} = Hsh\frac{x_B}{a} \\ F_{pg} = \rho_{water} g v_{ironbucket} \\ T_{zwq} = M_2 g - \rho_{water} g V_{ball} \\ G_2 = m_2 g \end{cases} \quad (6)$$

For this paper uses genetic algorithm to solve the above model, genetic algorithm starts from the solution set of string search, able to handle multiple in the group at the same time, and only with the fitness function to evaluate the individual, the change rules of probability is used to guide the search direction, has the self-organizing, adaptive and self-learning habits, so that can better solve the established model, make the results more accurate. Then the basic operation of genetic algorithm simulates the genetic inheritance of biological organisms. After the initial population is formed through coding, genetic operation is to impose certain operations on the individuals of the population according to their environmental fitness, so as to realize the evolutionary process of survival of the fittest, which can make the problem optimized from generation to generation and ultimately approach the optimal solution. MATLAB software is used to describe the shape of the chain is roughly, the sea wind speed of 12 m / s and 24 m / s cases the result is as follows:

3. CONCLUSION

In this paper, through the study of the static analysis of mooring system completely solved the problem, get their static mechanics equilibrium equation, this area is analyzed, to better understand the connection between the mooring system, the solution of steel barrels and each

section of the steel tube Angle, shape, buoy mooring chain draught and swimming area, in order to reduce the complexity of the model. Finally, in order to ensure the stability of the system, the optimal force on the steel drum is taken as the objective function and the genetic algorithm is used to solve the optimal solution.

Table 1. Values of various parameters when the sea surface wind speed is 12m/s and 24m/s respectively

	$12\,m/s$ Since the catenary	$24\,m/s$ Constraint chain
The depth of the draft	0.6850m	0.6988m
Angle of steel tube one	1.1486 degree	4.3764 degree
Angle of steel tube two	1.1563 degree	4.4045 degree
Angle of steel tube three	1.16411 degree	4.4045 degree
Angle of steel tube four	1.1719 degree	4.4617 degree
Angle of steel barrel	1.2083 degree	4.5945 degree
Chain highly	12.3161 degree	12.3163 degree
The tangential direction of the anchor junction and the Angle of the sea bed	0 degree	3.5332 degree
The upper end of the chain is at a horizontal Angle	76.2245 degree	3.5332 degree
Lie the chain length	6.3497m	6.3497m
Swimming area	14.5877m	17.7270m

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Design and Analysis of Mooring System Under Multi-Objective Planning

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Abstract: The mooring system is an important part of the shallow sea observation network. The design problem is to make the draught of the buoy, the swimming area, and the inclination angle of the steel drum as small as possible by adjusting the length of the anchor chain, the model, and the mass of the weight ball. Based on problem two and problem three in CUMCM2016Problems A, this paper studies the mooring system design through catenary equations, simulation, multi-objective planning and other methods. Aiming at the second problem, the equation is established after the force analysis of the first problem, the wind speed is adjusted to 36m/s, and the key values such as the draft of the buoy, the inclination angle of the steel tube, the steel bucket, and the draft of the buoy are obtained. 5°, the angle between the anchor chain and the seabed is less than 16° and the draft of the buoy is less than 2m as the target multi-objective programming equation. The target value is calculated iteratively by setting the initial mass of the weight ball to 1000kg and the step length to 50kg. Through data visualization and fixed-step search strategy, the quality interval that satisfies the conditions is 2220kg~5700kg. Considering factors such as consumables, 2220kg is selected as the weight of the weight ball. Currently, the draft of the buoy is 0.9850m, the inclination angle of the steel drum is 4.5122°, and the angle between the anchor chain and the seabed is 15.9977°. For question three, in the design of the mooring system, for the wind speed and water speed in the harshest environment on the sea surface, the control variable method and multi-angle horizontal comparison are used to finally determine the choice of anchor chain model IV and model V, considering the economy of consumables, etc. Question, finally choose the best mooring system parameters: anchor chain length 22.05m, anchor chain type IV, weight ball weight 4200kg. According to calculation, the parameters of this mooring system can be obtained under the environment of wind speed of 36m/s and sea water speed of 1.5m/s: buoy draught 1.6092m, steel drum inclination angle 4.6929°, anchor chain and seabed angle of 15.9251°.
Keywords: Mooring System; Fixed-Step Search Strategy; Multi-Objective Planning; Simulation

1 INTRODUCTION

The transmission node of a near shallow sea observation network is composed of a buoy system, a mooring system and a hydroacoustic communication system. The design problem of the mooring system is to determine the type and length of the chain and the quality of the weight ball, so that the draft and swimming area of the buoy and the inclination angle of the steel drum are as small as possible. How to design a mooring system that considers water depth, seawater velocity, sea surface wind speed and anchor chain length is a hot issue of current research.

In this paper, through rigid body force analysis, catenary equations, multi-objective planning, comprehensive consideration of water depth, sea water velocity, anchor chain type and anchor chain length, the mooring system equation is established. The buoy draft is used as the cycle start condition and the fixed step is used. Long search strategy, to obtain a reasonable quality change interval of the weight ball, and choose a lighter weight ball under economic and environmental conditions. When studying the influence of water depth, wind speed and water flow speed on the operation status of the entire mooring system, due to the many influencing factors, the control variable method is used to adjust a certain variable, and the others remain unchanged to obtain the system status under different conditions, which is intuitive and obvious Observe the impact of a variable on the system. , Set the environmental conditions as the worst, that is, the conditions of the mooring system under different system parameters under the maximum sea water speed and sea surface wind speed, and the conditions that meet the conditions are regarded as the optimal parameters.

1.1 Solve the system state with a wind speed of 36m/s

- Initial value assignment to solve equation

By setting the value of the buoy draft x as the starting condition of the equations, all the forces on the buoy at this time and the tension of the first section of the steel pipe can be obtained, and the solution is continued until the anchor position is obtained.

Then calculate the ideal water depth, then continuously correct the equation through the actual water depth, and determine the solution in constant iterations [1].

Therefore, the intersection of the buoy draft and the water depth curve is the actual draft.

Based on the problem one model, adjust the wind speed to 36m/s, and the mooring system operates as shown in the figure 2 below:

The draft of the buoy, the inclination angle of the steel pipe, the steel bucket, the angle between the anchor chain and the seabed, the draft and the swimming area of the buoy, the visualization of the anchor chain shape and the solution curve of the buoy draft are as follows:

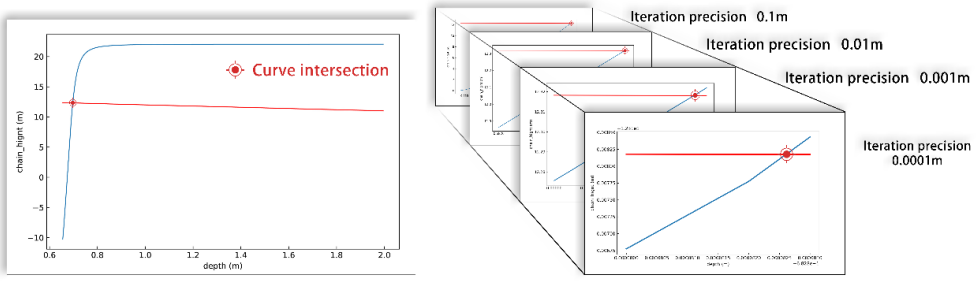

Fig.1 Fixed step search strategy to solve equation

Table 1 The inclination angle of each part under 36m/s wind speed

Wind speed	slope				
	Steel pipe 1	Steel pipe 2	Steel pipe 3	Steel pipe 4	Steel drum
36m/s	9.1783°	9.2337°	9.2897°	9.3464°	9.4468°

Table 2 Corresponding system results under different wind speeds

Wind speed	Buoy draft	Buoy draft	Swimming area	Angle between anchor chain and seabed	Anchor chain mopping length
36m/s	0.7198m	18.8719m	1118.8749 m2	20.8880°	0°

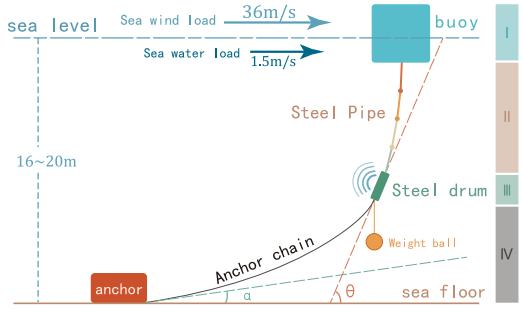

Fig.2 The wind speed of 36m/s corresponds to the visualization of the mooring system

1.2 The mass solution of the weight ball

When the wind speed is 36m/s, the inclination angle of the steel drum is calculated to be 9.4468o>5o, and the angle between the anchor chain and the seabed is 20.8880o>16o. In this case, the weight of the ball can no longer meet the requirements of the problem. According to life experience, the larger the weight of the ball, the smaller the angle of the steel drum and the angle between the anchor chain and the seabed [2]. Therefore, to make the angle of the two smaller, the mass of the weight ball needs to be increased.

The specific calculation results are as follows:

➢ Multi-objective programming optimization equation

In the process of adjusting the quality of the weight ball, the following three goals should be ensured:

$$\begin{cases} x \le 2m \\ 90° - \theta_5 \le \\ \theta_7 \le 16° \end{cases} \quad (1)$$

Therefore, a multi-objective programming equation can be constructed to find the optimal solution set satisfying the objective equation [3-4].

Since the problem one model, with the mass of the weight ball as a variable, a nested iterative loop is set up. Using 1200kg as the initial value condition and step length 50kg, gradually increase the weight of the weight ball. Each time the corresponding steel drum inclination angle, anchor chain and seabed angle, and buoy draft are recorded, and finally the dual-axis data visualization is performed. The results are as follows:

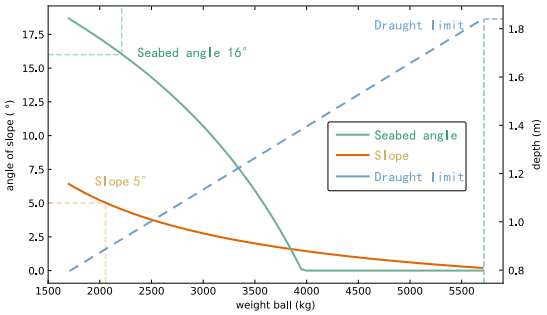

Fig.3 Multi-objective programming equation solving visualization

According to the curve image, the solution that satisfies the multi-objective programming equation is a quality interval.

Table.3 Comparison of parameters before and after weight ball quality adjustment

Heavy ball quality	Draft	Tilt angle of steel drum	Angle between anchor chain and seabed
1200kg	0.7198m	9.4468°	20.8880°
2220kg	0.9850m	4.5122°	15.9977°

Using the step search strategy mentioned above to solve the problem, the quality interval is: 2220kg~5700kg, that is, formula (1) can be satisfied in this interval. Considering the aspects of economy, energy conservation and environmental protection, select the smallest quality that meets the standard Heavy ball, so the final weight of

the ball is adjusted to 2220kg.

➢ Calculation results

Substituting the mass of the final weight ball into the model one equation set, the parameters obtained are shown in the following table 3:

2 DIVERSIFIED MOORING SYSTEM ANALYSIS

2.1 Design of mooring system

The main components of the mooring system are buoys, steel pipes, steel drums, anchor chains and anchors. The five parts will not change due to the diversity of the external environment.

2.2 Optimal system state for control variable analysis

In the design of the mooring system, there are many types of anchor chain models. In different actual environments, the status parameters of the mooring system will also change. Therefore, the number of variables should be controlled when analyzing the system status under different conditions. The variable is unique, which improves the descriptability of the state [5].

➢ Determination of anchor chain model and weight ball quality in harsh environments

According to the subject requirements, it can be determined that the worst environmental conditions in the mooring system design process are: sea wind speed 36m/s, sea water speed 1.5m/s, and water depth 20m.

Under the condition that the draft of the buoy is less than 2m and the length of the anchor chain remains the same, the nested loop iteration found that if you want to meet the requirements of the inclination angle of the steel drum and the angle between the anchor chain and the seabed, the weight ball needs to be adjusted to 4200kg , And only anchor chain type IV and type V meet the conditions[6].

➢ The effect of wind speed on the system

Next, we will explore the influence of the chain type and sea surface wind speed on the system design under the condition of the chain length of 22.05m and the weight of the ball of 4200kg. The specific calculation results show that only the chain type IV and the chain type V are selected for design. Only then can the conditions for normal operation of the system be met.

Through the calculation of catenary engineering application equation, when choosing different anchor chain models, the influence of different wind speeds on the swimming radius of the buoy in the system is visualized as follows:

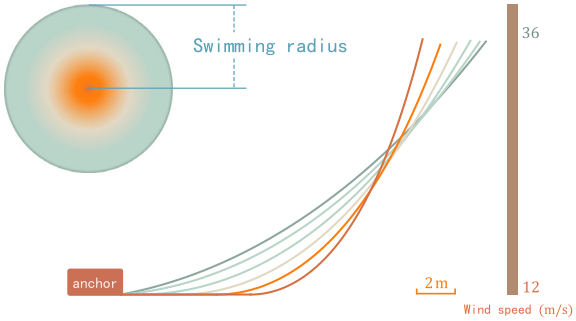

Fig. 4 The swimming radius of buoys of different anchor chain models under dynamic wind speed

It can be seen from the figure that as the wind speed increases, the buoy's swimming radius corresponding to different anchor chain models also increases. Relative to the anchor chain models with large mass per unit length, they have higher stability [7]. If considering the same chain length, when designing a mooring system, models IV and V can be preferred.

➢ Determination of optimal mooring system parameters

In summary, considering wind speed, water depth, anchor chain type and consumables, etc., the anchor chain type IV is finally selected, and the weight ball is adjusted to 4200kg.

Substituting into the calculation, the solution can be obtained, the draught, the inclination angle of the steel drum and the angle between the anchor chain and the seabed under the worst environment, the results are as follows:

Table 4 Solution results in the worst environment

Heavy ball quality	length	model	Draft	Tilt angle of steel drum	Angle between anchor chain and seabed
4200kg	22.05m	IV	1.6092m	4.6929°	15.9251°

It can be seen from Table 4 that the selected parameter corresponding system can meet the actual work requirements, and the design is reasonable.

3. CONCLUSION

Based on problem two and problem three in CUMCM2016Problems A, this paper studies the mooring system design through catenary equations, simulation, multi-objective planning and other methods. Finally, the design parameters of the mooring system are given through simulations: the weight of the ball is 4200kg, the length of the anchor chain is 22.05m, and the anchor chain is Type IV. This system can meet the inclination of the steel drum under the worst conditions given by the subject. The angle does not exceed 5 degrees, and the angle between the anchor point and the seabed does not exceed 16 degrees, which meets the design requirements.

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Credit Decision of Small and Medium Sized Enterprises

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Abstract: China's small and medium-sized enterprises are in a period of rapid development, and they are playing a more and more important role in the national economy, but the difficulty of financing has always been the bottleneck restricting their development. It has become the choice of most small and medium-sized enterprises to help enterprises with bank credit policies. However, there are many risks in the process of enterprises' growth and expansion, which can be achieved through external credit Reputation rating has been well revealed. Therefore, it is necessary to give a comprehensive credit rating to the SMEs with the upstream and downstream enterprises, to provide reliable credit risk decision for bank lending. According to the existing data of 123 enterprises, such as invoice status, credit rating, stability of supply and demand relationship and influence of upstream and downstream enterprises, the weights are obtained by fuzzy analytic hierarchy process (FAHP), and the credit risk assessment model is established. Then, the companies with different scores are graded by cluster model. Finally, the enterprise system with different reputation is evaluated by multi-objective programming model combined with actual policies Set a reasonable loan amount and interest rate. By sorting out the national GDP data and the impact of different industries and different types of enterprises facing risks, processing customer churn data, and on the basis of the existing conclusions, build a prediction model to deal with emergencies (considering the impact of natural disasters, social direction, industry trend and other factors on the production and operation of small and micro enterprises), and accurately give the letter of the bank when the annual total credit is 100 million yuan Loan adjustment strategy, put forward the control measures of loan credit risk for banks.

Keywords: K-Means Clustering Analysis; Fuzzy Analytic Hierarchy Process, Grey Correlation Analysis; Credit Risk Assessment

1. INTRODUCTION

In recent years, supporting the development of small and micro enterprises has become an important part of national development. Carrying out loans for small and medium-sized enterprises is an important measure for banks to optimize the credit structure. Banks usually provide loans to enterprises with strong strength and stable supply-demand relationship according to the credit policy, transaction note information of enterprises and the influence of upstream and downstream enterprises, and can give preferential interest rate to enterprises with high reputation and small credit risk. However, small, and micro enterprises have weak internal capital base, low management efficiency, and relatively small size of the company, which often does not pay enough attention to their own business process commitment, resulting in relatively poor reputation. This paper starts from the existing capital business situation of small and micro enterprises, integrates the evaluation indicators that can represent the characteristics of small and micro enterprises, and studies the credit strategy of small and micro enterprises by establishing mathematical model.

This paper analyzes and forecasts the relevant data of 123 enterprises with credit records, 302 enterprises without credit records and the relationship between loan interest rate and customer churn rate in 2019. It is known that the loan amount of a certain bank to the enterprise to be lent is 100-1 million yuan, the annual interest rate is 4%-15%, and the loan term is one year.

This paper uses SPSS to summarize the relevant data of 123 enterprises' credit records, and processes the data by combining with MATLAB, classifies the transaction data of different companies, and comprehensively analyzes the amount and quantity of positive and negative invoice, the ratio of void invoice to effective invoice, and the influence of enterprise scale on enterprise credit risk. Firstly, credit rating is integrated into credit risk assessment, and credit rating index model is established. Secondly, using the "Delphi method" rating index system constructed by rating agencies, the index weight is determined by fuzzy analytic hierarchy process. Then the processed data are classified into different influencing factors, corresponding charts are drawn and abnormal data are extracted for recording and analysis. Secondly, the final credit risk is calculated according to the proportion of each influencing factor. Finally, cluster analysis is carried out on different credit risk sizes, and the corresponding A B, C, D four grades are evaluated. According to the policy of the current year, the companies with four credit risk levels will formulate the corresponding credit amount, calculate the total amount of the bank's annual credit to these 123 enterprises, and give the corresponding credit strategy.

By sorting out the national GDP data and the impact of different industries and different types of enterprises

facing risks, SPSS software is used to process the customer churn data in Annex III. It is concluded that the annual interest rate of bank loans is positively correlated with the customer churn rate, and on the basis of the above analysis, a prediction model is constructed to cope with emergencies (considering the natural disasters, social direction, industry trend and other factors on the production of small and micro enterprises The bank's credit adjustment strategy is accurately given when the annual total credit is 100 million yuan.

2.ESTABLISHING CREDIT RISK ASSESSMENT MODEL

2.1CREDIT RATING INDEX SYSTEM OF SMALL AND MICRO ENTERPRISES

When constructing the credit rating index system of small and micro enterprises, the existing credit rating is included in the credit risk assessment for comprehensive evaluation.

2.2CALCULATE THE WEIGHT OF CREDIT RISK ASSESSMENT

Firstly, the fuzzy analytic hierarchy process is used to analyze the processed data, in which the target layer is the credit risk assessment of small and medium-sized enterprises. In order to determine the credit risk assessment of small and medium-sized enterprises in the target layer, it is necessary to define the index weight coefficient in each layer [1].

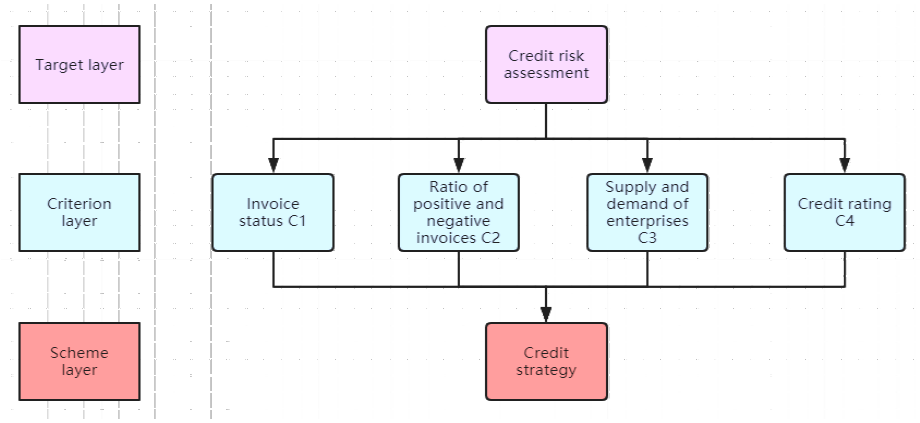

Figure 1 Credit risk assessment model

Let h_{ij} denote the relative importance of i to j, then calculate the corresponding eigenvector and determine whether the matrix satisfies the consistency test. According to the formula, calculate the comprehensive score to determine the credit rating of small and micro enterprises. [2-5] According to the importance set as equally important, slightly important, obviously important, strongly important, and important, the values of 1, 3, 5, 7 and 9 are assigned respectively. If the importance is between some two values, the values of 2, 4, 6 and 8 may be taken to determine the judgment matrix. The matrix formed by pairwise comparison results is called judgment matrix, which has the following properties:$hij = \frac{1}{hji}$

Table 1 Priority relation matrix

	Invoice status(C1)	Positive and negative invoice ratio(C2)	Supply and demand relationship of upstream and downstream enterprises(C3)	Credit rating(C4)
Invoice status(C1)	1	3	5	7
Positive and negative invoice ratio(C2)	1/3	1	4	6
Supply and demand relationship of upstream and downstream enterprises(C3)	1/5	1/4	1	3
Credit rating(C4)	1/7	1/6	1/3	1

The relative weight of the compared elements to the criterion is calculated by the judgment matrix, and the consistency is checked. Since λ is continuously dependent on h_{ij}, the more λ is larger than n, the more serious the inconsistency of A. the consistency index CI is calculated. The smaller CI indicates the greater the consistency. The consistency index is defined as follows:

$$CI=\frac{\lambda max-n}{n-1}$$

The calculated CI=0.0575, if CI=0, has complete consistency; the more CI tends to 0, there is satisfactory consistency; the larger the CI, the more serious the inconsistency. In order to measure the size of CI, the random consistency index RI is introduced:

$$RI = \frac{CI1 + CI2 + \ldots + CIn}{n}$$

Find the corresponding average random consistency index RI:

Table 2 Average random consistency index RI

Matrix order	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.52	0.90	1.12	1.26	1.36	1.41	1.46	1.49

According to the above table, the consistency ratio CR is calculated according to the following formula for RI=0.90 corresponding to the fourth-order square matrix:

$$CR = \frac{CI}{RI}$$

If CR<0.1, the judgment matrix is consistent; if $CR \geq 0.1$, the judgment matrix is inconsistent, the judgment matrix needs to be modified.

In order to ensure the robustness of the results, this paper uses three methods (arithmetic average method, geometric average method and eigenvalue method) to calculate the average value after calculating the weight, and then calculate the scores of each scheme according to the obtained weight matrix, and carry out sorting and comprehensive analysis, so as to avoid the deviation caused by single method, and the conclusion will be more comprehensive and effective.

The index vectors of C1, C2, C3 and C4 are calculated by MATLAB, and the index vectors are normalized and converted into index weight. The calculation results are as follows:

Weight of invoice status (C1) = 0.5536

Weight of positive and negative invoice ratio (C2) = 0.2890

The weight of supply and demand relationship between upstream and downstream enterprises (C3) = 0.1061

The weight of credit rating (C4) = 0.0513

2.3PLOT THE FILTERED DATA

a.The ratio of voided invoice to sales point of each company

The void invoice and valid invoice of each company in the credit records of 123 enterprises are summarized and the ratio is calculated.

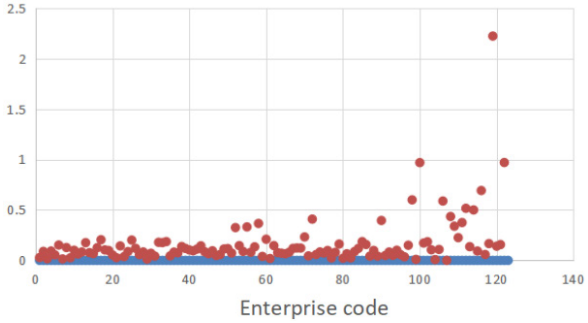

Figure 2 Ratio of voided invoice to valid invoice of each company

Extract the data deviating from the normal value in the scatter diagram, and find out the codes of corresponding companies, namely, E99, E101, E107, E113, E115, E117, E120 and E124. The ratio of void invoice to effective invoice quantity of these companies is greater than 0.5, which deviates from the average ratio level of other companies. Therefore, it is considered that these companies have poor reputation.

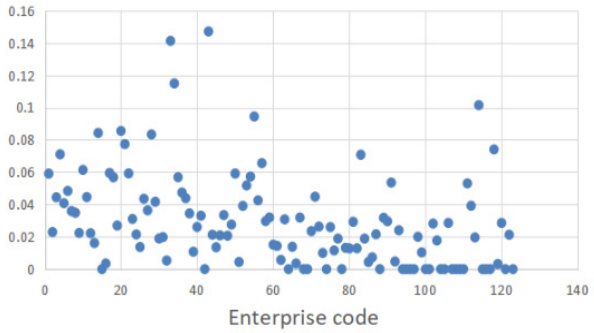

Figure 3 Ratio of void invoice to valid invoice of each company's input

b.Draw the scatter chart of the ratio of void invoice to valid invoice of each company

As can be seen from Figure 3, the ratio of voided invoice to effective invoice of each company's input is below 0.2, and the proportion of void invoice is relatively small. Relatively speaking, the reputation of each company in the input is not different.

c.Draw the line chart of the total profit of each enterprise in the past three years

Since the transaction is cancelled due to the invoice issued after the transaction activity or when the enterprise has entered the account for tax calculation when goods are purchased and sold between enterprises, the return and refund will be caused. After collecting the relevant policies on tax and tax refund, it is found that the invalid invoice does not record tax, and the tax recorded in the negative invoice of the current month can offset the equivalent tax of the next month. Therefore, when calculating the profit, the account data of the negative invoice and the voided invoice should be eliminated first, and then the following method is used:

Total output including tax - total input tax = profit

Calculate the total profit of each company in recent three years. In order to make the drawing beautiful and concise, multiply all the calculated profits by 10^{-9} to ensure the data concentration. The drawing is as follows:

Figure 4 Total profit of each enterprise in recent three years

Among them, the total profits of E1-E13 and E17-E24 are higher than the average level of other companies in recent

three years, so these companies are strong enterprises in the supply and demand relationship (C3) of upstream and downstream enterprises. Because the calculated data show that the total profits of some companies in the past three years are in the state of loss, or considering the bankruptcy of some companies due to the break of the capital chain, these companies will have greater risks in repaying loans.

d.Draw a scatter chart of the ratio of positive and negative invoice quantity of each company's purchase and output items

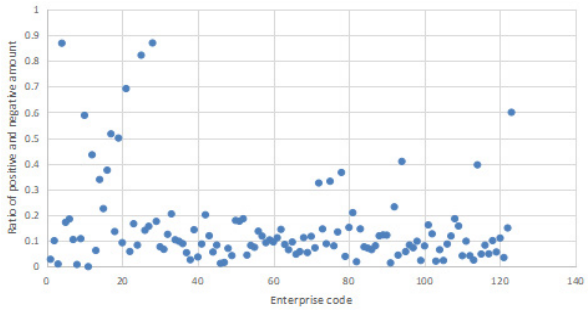

Figure 5 The ratio of the number of negative invoice to positive invoice for each company's output

Sum up the positive and negative invoice data of each company's purchase and sales items in recent three years, and then compare the copied invoice with the positive invoice, and draw a scatter diagram of the obtained ratio as follows:

As can be seen from Figure 5, E3, E7, E15, E16, E20, E28, E29, E30, E64, E68, E72, E78, E79, E80, E85, E86, E88, E95, E96, E99, E101, E107, E109, E110, E113, E115, E116, E117, E119, E120, E121 and E123 have higher negative value invoices, which indicates that the probability of return and refund is high when both parties conduct transactions.

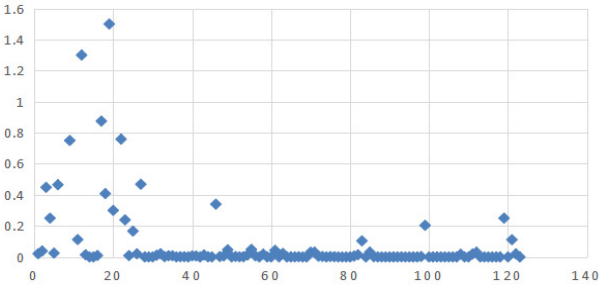

Figure 6 The ratio of the number of negative invoice to positive invoice of each company's input

As can be seen from Figure 6, companies with E7, E8, E10, E14, E15 and other companies with positive and negative invoice numbers tending to 0 account for a very low proportion of the total number of invoices, which can indirectly prove that these companies have low probability of refund and return and high reputation.

2.THE WEIGHTS ARE CLUSTERED AND CLASSIFIED

According to the above weight and the factors obtained from the analysis, the result score is obtained:

C1*0.5536+C2*0.2890+C3*0.1061+C4*0.0513=Result score

The K-means clustering analysis was carried out on the obtained scores by SPSS, and then the credit rating was carried out according to the clustering range of different clustering centers, and 123 groups of data were clustered and grouped in turn.

Table 3 Extract the cluster data calculated by the top ten companies

Enterprise code	Invoice status	Positive and negative invoice ratio	Credit score	Profit(10^{-9})	Result score	Credit rating
E1	0.027	0.027	93	-2.101	25.718	A
E2	0.000	2.709	93	0.523	27.454	A
E3	0.000	0.150	64	0.625	18.858	C
E4	0.000	0.000	64	1.965	19.584	C
E5	0.000	0.006	78	0.011	22.549	B
E6	0.000	0.003	93	0.101	26.933	A
E7	0.000	0.019	93	0.545	27.181	A
E8	0.000	0.010	93	0.249	27.016	A
E9	0.000	0.016	93	0.354	27.075	A
E10	0.033	0.000	78	0.374	22.751	B

The initial cluster centers are as follows:

Table 4 Initial cluster center

Credit rating	A	B	C	D
Initial cluster center	27.453917	22.942711	18.558637	15.602982

After K-means clustering with SPSS, the iterative records are as follows:

Table 5 Iterative records after K-means clustering

Iteration	1	2	3	4
1	.061	.542	.002	.357

Because there is no change or only a small change in the cluster center, the convergence is realized. The maximum absolute coordinate change of any center is .000. The

current iteration is 2. The minimum distance between the initial centers is 2.956.

After several iterations, the final cluster center is obtained. Taking the cluster center as the center of the circle, the radius range of 2 is planned as a, B, C and D, respectively, as follows:

Table 6 Final cluster center

Credit rating	A	B	C	D
Final cluster center	26.91	22.59	18.56	15.66

After referring to the loan amount and interest rate of the national credit policy for small and medium-sized enterprises from 2017 to 2019, it is found that the default rate of bank credit is negatively correlated with the macroeconomic prosperity index.

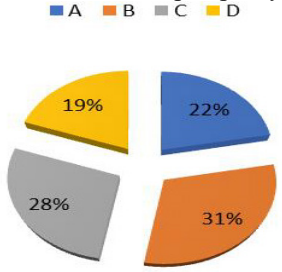

Figure 7 Proportion of enterprises with different credit rating

Fu Lin (2011) found that an important reason for credit risk is the cyclical fluctuation of the economy, which will lead to the continuous accumulation of bank credit risk. Now it is known that the loan amount of a certain bank for the enterprise to be loaned is 100000~1000000 yuan, the annual interest rate is 4%-15%, and the loan term is one year. For the credit rating of a, B, C and D, the loan is not allowed due to the poor reputation of grade D. the maximum amount of loan for a, B and C credit rating enterprises is 1 million, 750 000 and 600 thousand respectively, and the maximum loan interest rate for a, B and C credit rating enterprises is 4.35%, 5.7% and 6.35%.

3.BUILDING A PREDICTION MODEL TO DEAL WITH EMERGENCIES

GDP represents the outcome of the productive activities of all permanent units in a country over a certain period. GDP is the core index of national economy, and it is also an important indicator to measure a country's economic situation and development level. There are three methods of GDP accounting, namely production method, income method and expenditure method. The three methods reflect the results of national economic production activities from different angles.

According to relevant basic data and national economic accounting method, the main results of China's GDP (hereinafter referred to as GDP) in the first quarter of 2020 are as follows:

Table 7 Preliminary GDP accounting data in the first quarter of 2020

	Absolute amount in the first quarter (100 million yuan)	Year on year growth in the first quarter(%)
GDP	206504	-6.8
Primary industry	10186	-3.2
The secondary industry	73638	-9.6
The tertiary industry	122680	-5.2
Agriculture, forestry, animal husbandry and fishery	10708	-2.8
Industry	64642	-8.5
Manufacturing	53852	-10.2
Construction	9378	-17.5
Wholesale and retail	18750	-17.8
Transportation, storage, and postal services	7865	-14.0
Accommodation and catering	2821	-35.3
Finance	21347	6.0
Real estate	15268	-6.1
Information transmission, software, and information technology services	8928	13.2
Leasing and business services	7138	-9.4
Other services	39660	-1.8

Affected by the impact of Xinguan epidemic, the production of factories has gradually slowed down, people's purchasing power has declined, and the sales of goods are not optimistic. The negative growth of China's GDP has continued for a period. As far as the current epidemic situation is concerned, driving national consumption, and revitalizing the economy have become the most important part of the national development

strategy. The program of increasing support and loan for small and micro enterprises has been gradually improved, which promotes the injection of equity into viable enterprises and the provision of venture capital to new enterprises. [3]

Table 8 Year on year growth rate of GDP

Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4
2015	7.1	7.1	7.0	6.9
2016	6.9	6.8	6.8	6.9
2017	7.0	7.0	6.9	6.8
2018	6.9	1.7	1.5	1.5
2019	6.4	1.5	1.3	1.5
2020	-9.8			

Note: The year-on-year growth rate is the same as that of the same period of last year.

Table 9 Month on month growth rate of GDP

Year	Quarter 1	Quarter 2	Quarter 3	Quarter 4
2015	1.8	1.8	1.7	1.6
2016	1.5	1.8	1.7	1.6
2017	1.7	1.8	1.6	1.5
2018	1.7	1.7	1.5	1.5
2019	1.6	1.5	1.3	1.5
2020	-9.8			

Note: The month on month growth rate is the growth rate compared with the previous quarter after seasonal adjustment.

According to the relevant information, SME loans include: credit guarantee loan, comprehensive credit, project development loan, natural person guarantee loan, personal entrusted loan, bill discount loan, pawn loan, intellectual property pledge loan and remote cooperation loan. Credit risk management strategies generally include risk aversion, risk dispersion, risk transfer, risk control and risk compensation. In terms of risk diversification strategy, the bank credit department should avoid concentrating credit funds to one or several major customers in the actual operation, reasonably allocate the loan type, loan term, amount, and other structures, and do not excessively concentrate on a certain industry or a certain region. For example, in terms of the industry concentration limit of credit projects, credit resources should not be too concentrated in one or several industries, but should be dispersed to a variety of industries, so as to avoid a certain industry being dragged down when there are industry risks. Generally, the credit line of the same industry should be controlled within 20%. Banks should make different loan adjustment plans for different enterprises in different periods. When considering the credit risk of each enterprise and the impact of possible sudden factors on enterprises, banks should appropriately relax or extend the credit policies of small and medium-sized enterprises in some fields (such as health care enterprises and agricultural products enterprises during the epidemic period) to help them tide over the difficulties more smoothly. While actively supporting small and medium-sized enterprises, banks should also focus on the control measures of loan credit risk, such as:

We should establish and improve the separation system of loan examination and approval, and improve the speed and level of loan decision-making.

Promote mortgage loans and pledge loans, and improve their effectiveness, reliability, and safety.

We should strengthen post loan inspection, regularly review loan procedures, and actively clear and collect non-performing loans.

We should set up a large scale of micro credit to improve the use of different means of micro credit.

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Mooring System Analysis Based on Catenary Equation

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Abstract: The mooring system is an important part of the near-shallow sea observation network. Under different wind speeds, the draft depth of buoys, the swimming area and the tilting Angle of steel barrels will be different. In this paper, the state of the mooring system is studied nationwide based on the data in CUMCM2016Problems by using catenary equations and rigid body forces. According to the composition of mooring system, first of all to orthogonal decomposition of the buoy stress, four steel tube is regarded as four catenary, calculated by the catenary equation between the steel tube of traction and traction Angle, then the rigid body stress analysis was carried out on the steel drum, finally analyze the chain part of catenary equation, equations is established. The value of buoy draft depth x was set as the starting condition of the equations, and the ideal water depth was calculated. The equation was continuously corrected with the actual water depth, and the search strategy of fixed step length was used to solve the equation. Finally, the following equation was obtained: Under the wind speed of 12m/s, the draft depth of the floating mark is 0.6829m, the tilt Angle of the four steel tubes from top to bottom is 1.1636°, 1.1715°, 1.1794°and 1.1875°, respectively, the tilt Angle of the steel barrel is 1.2019°, the anchor chain is 6.249min the towing state, that is, the Angle with the seabed is 0°, and the swimming area of the buoy is 221.9380m^2; In the case of wind speed of 24m/s, the draft depth of the buoy is 0.6970m, the tilt Angle of the four steel tubes from top to bottom is 4.4270°, 4.4556°, 4.4847°and 4.5140°, respectively, the tilt Angle of the steel barrel is 4.5663°and the swimming area of the buoy is 4.4712°, the Angle between anchor chain and seabed is 993.0874m^2.

Keywords: Mooring System; Catenary Equation; Force Analysis of Rigid Body; Set the Step Size Search Strategy

1.INTRODUCTION

The transmission node of a near-shallow sea observation network is composed of buoy system, mooring system and underwater acoustic communication system. According to the changes of the external environment, the draft depth and swimming area of the buoy as well as the tilt Angle of the steel barrel will change accordingly. Analysis in different environments can predict the real situation.

In this paper, the buoy, water depth and wind speed can be directly taken into account in the orthogonal decomposition[1], the force and steel pipe and cable force are not along its direction, not directly for force analysis, the shape similar to the catenary characteristics, so the cable and steel pipe for each catenary, the use of catenary equation for stress analysis[2]; The steel barrel can be analyzed for its rigid body due to the traction force of the heavy ball. After the force analysis of each part in the system is completed, the equations are listed and solved to obtain the inclined Angle of steel barrel and steel pipe, the shape of anchor chain and the draft depth of buoy.

The analysis of the mooring system state can not only deepen the understanding of the mooring system to achieve the purpose of maintaining the system, but also take the state prediction of different situations as the reference basis for installing the mooring system.

1.1 Overall visualization and preparation conditions of mooring system

➢ the overall visual

The components and connections of the mooring system are shown in the following figure:

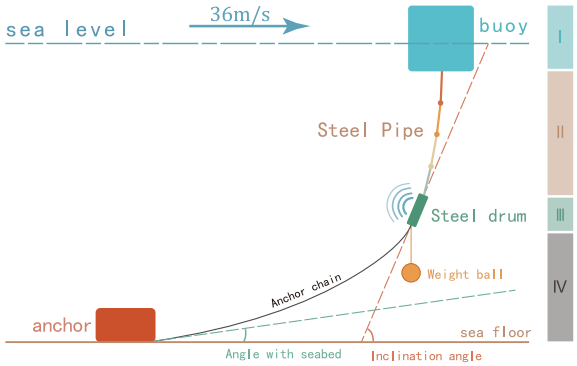

Fig.1 Overall visualization of mooring system

➢ catenary equation

According to the standard equation of catenary and engineering application equation, the tension formula and distance formula can be obtained. Examples are as follows:

(a) Tension formula

$$\begin{cases} T_1 \sin\theta_1 = M_1 g + T_2 \sin\theta_2 \\ T_1 \cos\theta_1 = T_2 \cos\theta_2 \end{cases} \quad (1)$$

(b) Distance formula

$$a = \frac{T}{\sigma g} \quad (2)$$

According to the catenary length and horizontal distance, the horizontal distance x of the catenary and the vertical height y can be solved:

$$L = a\,sinh\frac{x}{a} \tag{3}$$

$$y = a\left(cosh\left(\frac{x}{a}\right) - 1\right) \tag{4}$$

1.2 Force analysis of main parts of the system

➢ steel pipe

According to the buoyancy formula[3], gravity formula and catenary equation, and the equilibrium state of the steel tube, the tension formula can be obtained:

$$\begin{cases} T_i\,sin\,\theta_i = (\pi r^2 L_1\,\rho g - mg) + T_{i+1}\,sin\,\theta_{i+1} \\ T_i\,cos\,\theta_i = T_{i+1}\,cos\,\theta_{i+1} \end{cases} \tag{5}$$

➢ heavy ball

To analyze the force of a heavy ball, it is subject to three forces: gravity, buoyancy and tension. The buoyancy force can be obtained by the formula. Tension is obtained by balancing the force exerted on the heavy ball in seawater.

➢ steel drum

(a) The buoyancy force is obtained by the formula of the whole steel barrel immersed in water, and the traction force of the fourth steel tube and the pull force of the heavy ball are obtained according to the relationship between the acting force and the reacting force.

(b) The traction of the anchor chain on it

Due to the force balance of the steel drum, the traction force T6 of the anchor chain is obtained:

$$T_6\,cos\,\theta_6 = T_5\,cos\,\theta_5 + f_b - M_t g - F_b \tag{6}$$

$$F_6\,sin\,\theta_6 = T_5\,sin\,\theta_5 \tag{7}$$

➢ chain

The stress analysis of anchor chain is shown in Fig. 2 and Fig. 3. The anchor chain is subjected to gravity, buoyancy, steel barrel tension and anchor tension.

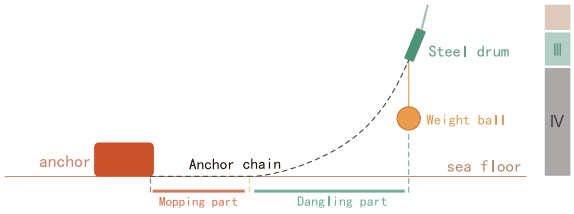

Fig.2 Anchor chain stress condition 1

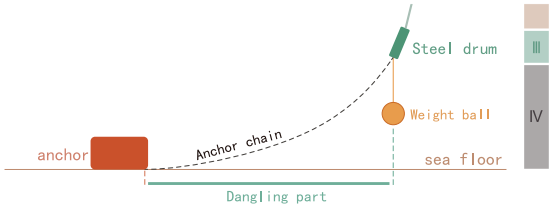

Fig.3 Anchor chain stress condition 2

(a)Gravity and buoyancy

The mass per unit length of type II anchor chain is 7kg/m. Considering cable volume effect, so the net buoyancy conversion for the unit length are directly related to the quality, computing available per unit length cable net quality for M_1:6.085988kg/m, Force analysis can be directly called unit length net quality.

(b) pull

If the catenary standard formula is used, it is only applicable to the stress condition of the anchor chain 2. Calculate the Angle between the anchor chain and the seabed as Figure4. If you want to calculate the stress condition of the first type of anchor chain, extend the length of the anchor chain tangent to the imaginary plane[4-5].

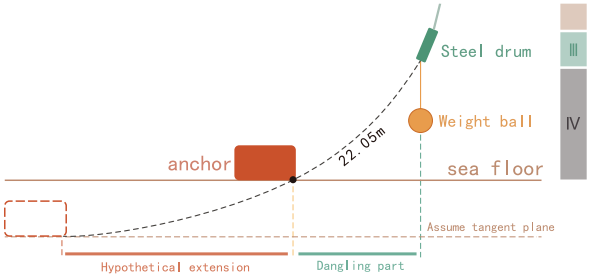

Fig.4 Calculation diagram of the included Angle of anchor chain stress situation 2

1.3 The interpretation of the height formula

➢ steel pipe and cable

The steel pipe and anchor chain are regarded as catenary. According to the catenary distance formula, the corresponding relationship between the vertical distance and catenary is listed, and the formula is arranged as follows:

$$\begin{cases} tan\,\theta_i = \dfrac{(\pi r^2 L\rho g - mg) + T_{i+1}\,sin\,\theta_{i+1}}{T_{i+1}\,cos\,\theta_{i+1}} \\ y_i = \dfrac{T_{i+1}}{\sigma g}\left(cosh\left(\dfrac{\sigma g}{T_{i+1}}x\right) - 1\right) \\ L = \dfrac{T_{i+1}}{\sigma g}\,sinh\dfrac{x}{a} \end{cases} \tag{6}$$

➢ height formula

Add the heights according to the above.

1.4Swimming area

As the wind direction is unknown, the maximum area of the buoy should be: the circle with the projection length of steel pipe[6], steel barrel and anchor chain on the sea bed as the radius:

$$R_1 = L_l\,sin\,\varphi_1 + L_l\,sin\,\theta_5 + \sum_{i=1}^{4} L_g\,sin\,\theta_i \tag{7}$$

2.INITIAL VALUE ASSIGNMENT SOLVES THE EQUATION

The value of draft depth x of the buoy was set as the starting condition of the equations, and then all the forces of the buoy and the tension of the first section of steel tube could be obtained. Then, the solution continued downward until the anchor position was obtained. Then the ideal water depth is calculated, and then the solution is determined through the constant correction equation of the actual water depth. Therefore, the intersection point of buoy draft depth and water depth curve is the actual draft depth[7-10]. When solving the intersection point, the fixed step size search strategy is used to gradually reduce the step size, and the bidirectional approach is used to reduce the range of the solution, at the same time, the precision of the solution is improved to achieve the goal of fast solution.

3.SOLUTION RESULT OF EQUATION

Plug in the wind speed, and calculate the inclined Angle, anchor chain shape, buoy draft depth and swimming area of the steel barrel and steel pipe under the corresponding conditions. The visual curve of anchor chain shape is shown as follow Figure:

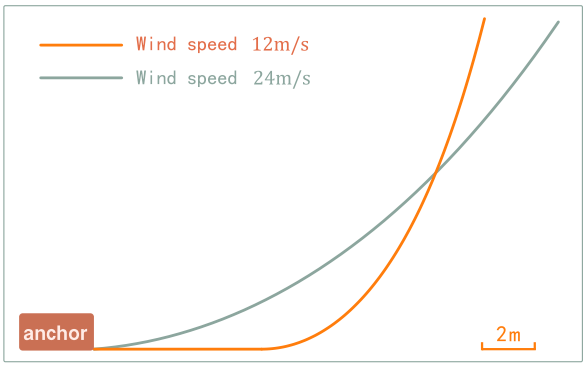

Fig.5 Different wind speed corresponds to the visualization of anchor chain shape

➢ specific results

Under the wind speed of 12m/s, the draft depth of the floating mark is 0.6829m, the tilt Angle of the four steel tubes from top to bottom is 1.1636°, 1.1715°, 1.1794°and 1.1875°, respectively, the tilt Angle of the steel barrel is 1.2019°, the anchor chain is 6.249min the towing state, that is, the Angle with the seabed is 0°, and the swimming area of the buoy is 221.9380m2;

In the case of wind speed of 24m/s, the draft depth of the buoy is 0.6970m, the tilt Angle of the four steel tubes from top to bottom is 4.4270°, 4.4556°, 4.4847°and 4.5140°, respectively, the tilt Angle of the steel barrel is 4.5663°and the swimming area of the buoy is 4.4712°, the Angle between anchor chain and seabed is 993.0874m2.

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Development of Additive Polyurethane Foam Flame Retardant

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Abstract: The flame-retardant mechanism and flame-retardant effects of several types of additive flame retardants are briefly summarized. The development status, flame retardant principle and characteristics of several typical flame retardants in recent years are emphatically introduced, and the future development direction of the additive polyurethane flame retardant is prospected.
Keywords: Polyurethane Foam; Flame Retardant; Additive Flame Retardant; Inorganic Flame Retardant

1. INTRODUCTION

Polyurethane foam is one of the most widely used, acceptable and highly applied foam today. Because of its light weight, low thermal conductivity, expansion coefficient ratio, viscosity, pore vacuum is larger. It is widely used in gap filling, wall insulation, sound insulation materials, shock absorbing materials and various application froth. However, the oxygen index of polyurethane is only about 14% - 17%, which belongs to flammable materials. Moreover, polyurethane foam will release a large amount of smoke and toxic small molecule gas when burning, which will cause air pollution.

Polyurethane foam has simple preparation process and various preparation methods. The main reaction mode is the reaction of hydroxyl group and isocyanate group. In addition, isocyanate with high activity can capture the active hydrogen in water and produce carbon dioxide, which makes polyurethane foam fluffy.

Although the flame-retardant polyurethane foam has many shortcomings in terms of its flame retardance effect, it has great advantages in simple preparation and low cost of combustion products. At present, the main research directions of inorganic additive flame retardants are adding hydroxide type, inorganic nitrogen phosphorus type, borate type, modified graphite type and inorganic organic combined compound [1]. These methods have good effects on flame retardancy of polyurethane and reducing the output of harmful gases and smoke.

2. ADDITIVE POLYURETHANE FLAME RETARDANT

Flame retardant polyurethane foam can be divided into additive flame-retardant polyurethane foam and reactive flame-retardant polyurethane foam according to the relationship between flame retardant and foam. Reactive flame-retardant polyurethane foam adds specific flame-retardant groups to the polyurethane branched chain chemically to achieve flame retardant effect. The foam obtained by this method has excellent flame-retardant effect and little influence on the physical properties of foams in all aspects, but the introduction of flame-retardant groups is difficult to develop and the process is complex.

Additive flame-retardant polyurethane foam distributes the flame retardant evenly in the foam group by physical doping without chemical change. Compared with the reaction type, the preparation process is simpler, cheaper, the reaction scheme is easy to design and implement, and the addition direction of flame retardants available for selection is also diverse [2].

The flame-retardant principle of adding polyurethane flame retardant is to reduce the oxygen concentration by forming a flame-retardant layer on the surface of polyurethane and producing non-combustible gas. At the same time, the decomposition absorbs a large amount of heat, fixing the surface combustibles so that the combustibles do not occur droplet phenomenon. The application of such methods is also widespread, and the research progress of several common addition directions of added flame-retardant polyurethane foam is discussed below.

2.1 Hydroxide flame retardant

Hydroxide type flame retardants are a kind of highly effective inorganic additive flame retardants without halogen group elements. Its flame-retardant mechanism is: when the hydroxide is heated, it will decompose, absorb a large amount of heat, and decompose to produce a large amount of water vapor to dilute the oxygen on the surface of the combustible. At the same time, the oxide with high melting point is attached to the surface of the fuel, which can prevent the combustion of the fuel. In the whole process of flame retardant, metal hydroxides usually have no harmful substances. The decomposition products can absorb smoke and toxic gases produced by matrix combustion while flame retardant. It is a new environmentally friendly and efficient inorganic additive flame retardant.

Ai [3] and his team used tetraborate phenoxycyclophosphazene (CP-6B) and magnesium hydroxide (MH) at South China University of Science and Engineering. We studied the flame-retardant modification of organic and inorganic, and finally obtained epoxy resin with better flame retardant and heat resistance. The results show that the LOI of the resin

reaches 31.9% and reaches the V-0 level of vertical combustion; Zhen[4] of Sichuan University prepared the flame retardant of high flame retardant and high thermal stability by mixing intumescent flame retardant (IFR) with organic layered nanoparticles (montmorillonite)(OMMT) and layered double hydroxyl (OLDH); Shan[5] and his team prepared the $Na(H_3O)_2\{Ni_4(OH)_4(HPO_4)_3(H_2PO_4)\}$(NaNiP) layer by hydrothermal method using nickel phosphate and $Ni(OH)(PO_4)^{2-}$, and doped it into PU, and the flame retardant foam with the highest oxygen index of 32% and vertical combustion V-0 level was obtained.

2.2 Borate flame retardant

Boron based flame retardants are widely used in flame retardant materials. Among them, inorganic boron-based flame retardants play an important role in additive flame-retardant field. The principles of flame retardancy are various. One of them has the effect of flame retardancy and synergism. In most epoxy resins and some unsaturated polyester systems, it can cooperate with other inorganic materials to change the thermal decomposition pathway of combustible materials. It can effectively save the cost of materials and reduce the amount of smoke when burning materials; In addition, borate flame retardant can form a layer of glass like substance with high melting point on the surface after high temperature, which can reduce the droplet phenomenon of burning objects and effectively reduce the probability of secondary fire caused by droplet.

Borate flame retardants also have great research direction in polyurethane flame-retardant modification. A new rigid polyurethane foam flame retardant coating was developed by Japanese scientist Tsuyumoto Isao[6] using mixture of amorphous sodium polyborate (SPB) and a variety of polysaccharides. Moreover, the RPUF coating was applied on the surface of the object for 10 mm, and the temperature of the back side was only about 100-160 ℃ after being burned by a 100 mm butane flame for more than 12 minutes; Das[7] and his team produced a very thin metal boride nanosheet by combining boron with magnesium. The metal boride nano sheet was added to the epoxy resin and found that it had good flame retardancy. The strengthening index of the flame retardant was not only superior to graphene and its analogues, but also superior to other flame-retardant nanotubes under the same loading conditions; Yin[8] and his team studied the preparation of a new type of black phosphorus boron nitride waterborne polyurethane composite with black phosphorus (BP) and hexagonal boron nitride (BN) nanosheets as materials. The flame-retardant composite was added to polyurethane for foaming. It was found that the LOI of the flame-retardant polyurethane composites increased from 21.7% to 33.8%. At the same time, by adjusting the amount of flame retardant, the peak heat release rate and total heat release rate of polyurethane can be reduced by 50.94% and 23.92% respectively; some researchers start from the coating to study the flame retardant of polyurethane. Qiu[9] and others by using layer by layer assembly method, a new type of six party boron nitride (h-BN) nano filled flame retardant material was prepared on the surface of flexible polyurethane foam. The method not only improves the fire safety of the flexible polyurethane foam, but also adjusts the microstructure and composition of the coating flexibly by changing the concentration of the h-BN dispersion.

2.3 Modified Graphite Flame Retardant

Expandable graphite (EG) is a kind of chemical phase formed between carbon atoms and intercalated by acids, alkali metals, salts, and other chemicals under appropriate conditions. When heated to a proper temperature, the intercalated chemical phase will decompose rapidly, expand rapidly between graphite layers, and produce a large amount of gas. EG is a good physical expansion flame retardant, which has the characteristics of halogen-free and environmental protection. However, there are two problems to be solved in flame retardant addition of EG: First, the "popcorn effect" is that the expandable graphite is stacked in layers, which makes the graphite layer easy to fall off and loose under the influence of external temperature, so that the flame retardant graphite is easy to fall off and drop when heated, which weakens the flame retardant performance and smoke suppression performance of the material; second, the interfacial compatibility between inorganic flake EG and polyurethane is poor, which makes it difficult to uniformly doped EG into polyurethane (PU), and the basic mechanical properties of the doped materials will be reduced.

Many researchers have modified EG to improve its properties in PU. Wang [10] and his team prepared EG and ATH composite particles with core-shell structure by wrapping expanded graphite particles (EG) with inorganic nano aluminum hydroxide (ATH). The expansibility of the composite particles increased from 163ml/g to 197ml/g. When the composite particles were blended into the polyurethane foam, the oxygen index of the foam increased to 29.6%, which was also higher than that of the physical doped EG and ATH 27.5%. At the same time, it has remarkable effect on reducing the emission of smoke and toxic gas, and is particularly friendly to the environment; Ren Fujian[11] and others also studied the combination of EG with phosphoric acid three ethyl ester (TEP) and three - (beta chloroethyl) phosphate (TCEP), and obtained the rigid polyurethane foam with oxygen index of 33.3% and 31.7% respectively. Zheng [12] and others prepared intumescent halogen-free flame retardant based on cellulose by introducing phosphate group and melamine group into the structure of cellulose. Based on the flame retardant, a new flame retardant polyurethane foam with a residual carbon content of more than 43% and an oxygen index of 31.5% was prepared; Lee[13] compounded multi-layer expanded graphite with multi-walled carbon nanotubes to form intumescent flame-retardant polyketide nanocomposites and mentioned that the composite material can increase its flame retardant and self-extinguishing properties, which has positive significance to reduce the heat release and smoke generation during the combustion process of polymer materials; Liu[14]

successfully synthesized a novel phosphorus nitrogen flame retardant, zirconium amino triphosphate (ZrAMP), by compounding amino trimethyl phosphoric acid (AMP) with $ZrOCl \cdot 8H_2O$. Polyurethane foam was prepared by synergistic addition of expandable graphite into rigid polyurethane foam. The polyurethane foam with UL-94 grade, limiting oxygen index of 30.5%, higher strength and lower thermal conductivity was obtained.

2.4 Nitrogen-Phosphorus flame retardant

Nitrogen phosphorus flame retardant is also a kind of flame retardant often doped in polyurethane flame-retardant modification. It not only overcomes the problem that halogen flame retardants emit toxic and corrosive gases, but also improves the mechanical and mechanical properties of the materials after doping most inorganic flame retardants. The principle of phosphorus-based flame retardant on polyurethane is to form a layer of isolation film on the surface of polyurethane to block the contact between air and polyurethane, to achieve the flame-retardant effect. There are two main ways to form isolation membrane, one is that the flame retardant acts as a dehydrating agent at high temperature to form a carbon layer on the surface of polyurethane at high temperature; the other is that the flame retardant forms a dense glass like substance which is not easy to volatilize at high temperature, which is wrapped in the surface layer of polyurethane to isolate the air so as to achieve the flame retardant effect. Phosphorus flame retardants are mainly composed of red phosphorus, ammonium polyphosphate, ammonium dihydrogen polyphosphate and phenanthrene.

The flame retardant principle of nitrogen flame retardant is that when the flame retardant is heated, it will emit noncombustible gases such as ammonia, nitrogen, nitrogen oxides and water vapor, the production of these gases not only takes away a lot of heat, but also reduces the oxygen concentration on the surface of polyurethane foam, another part of the flame retardant can also produce a dense carbon layer on the surface. So, the polyurethane can achieve the flame-retardant effect. The common nitrogen flame retardants are melamine, dicyandiamide, guanidine salt and their derivatives.

Many scholars also have a lot of research on nitrogen and phosphorus flame retardants, and the specific aspects of the research also have their own unique points. Zhao Kuimin[15] prepared polyurethane microencapsulated ammonium polyphosphate (MAPP) by in-situ polymerization, Flame retardant polyurethane elastomer was prepared by melt blending. It was found that in order to achieve good flame-retardant effect, the amount of MAPP should be at least 25wt%; Qian [16] and others by linking the phosphoric phenanthrene compound (TGD) with the RPUF matrix, flame retardant polyurethane foam with fast self-quenching, high limiting oxygen index, low heat release, residue and continuous quenching has been obtained. In order to solve the fire safety of RPUF thermal insulation material, a new effective way is put forward; Han [17] and his team used organic clay (OMMT) and N, N-bis (2-hydroxyethyl) amino methylene phosphonate (DBHP) as raw materials, flame retardant rigid polyurethane foam (FR-RPUFS) was prepared by free foaming method. The flame-retardant polyurethane foam prepared by this method has better oxygen index, flame retardancy and carbon recovery than that of single flame retardant. Ding [18] and others has synthesized a new type of flame-retardant polyol based on castor oil (CO) containing phosphorus and nitrogen. A great flame-retardant polyurethane foam has been prepared through reaction.

2.5 Other types of flame retardants

Antimony trioxide is a kind of metal oxide flame retardant. It is usually combined with other flame retardants to form a compound flame retardant, which produces synergistic effect. The flame-retardant mechanism of different compounding methods is also different. For example, when antimony trioxide is compounded with nitrogen flame retardant, the compound flame retardant can absorb a lot of heat and produce noncombustible gas, so as to achieve the flame retardant effect; When antimony trioxide is compounded with halogen elements, the compound can quench the active free radicals produced during combustion, so as to achieve the flame retardant effect. With the improvement of people's quality of life, in order to pursue more environmental protection, biological modified flame retardant also began to float into the public's vision. Flame retardants such as ionic biological starch-based flame retardants [19] synthesized from water starch, vegetable acid and melamine, and liquefied products extracted from rice straw were also used in the study of polyurethane flame retardants. In addition, with the popularity of nanotechnology, many scholars have done a lot of research on flame retardant properties of nano materials.

3 EXPECTATION

Polyurethane materials have a wide range of applications and become more and more important in production and life. However, its extremely flammable properties limit its application. Therefore, it is of great practical significance to carry out flame retardant modification. With the concept of green economy and sustainable development deeply rooted in the hearts of the people, the development prospect of additive polyurethane flame retardant will be more and more broad. Inorganic additive flame retardant will continue to provide research direction for polyurethane flame-retardant research because of its non-combustible, green, and economic characteristics.

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The Research on The Influencing Factors of Regional Economic Vitality

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Abstract: In recent years, the economy of all parts of the country has developed rapidly. Under the condition of the coexistence of opportunities and challenges, the regional economic vitality has become the index of regional competition. Because the promotion of regional economic vitality is not only related to a single factor, so there is no reasonable and effective way to improve the economic vitality, so how to grasp the key factors and quickly enhance the regional economic vitality has become a common social problem all over the country. This paper summarizes and analyzes the data and influencing factors analyzed in the first three parts, and puts forward some reasonable and effective suggestions for the development of Tianjin according to the actual situation and form prediction.
Keywords: Enterprise Vitality Index; Enterprise Extinction Rate; Big Data Analysis

1.AN EXPLORATION OF THE INFLUENCING FACTORS OF REGIONAL ECONOMIC VITALITY

Because the economic vitality is affected by many factors eight more important influencing factors are identified, that is, the total amount and composition of energy consumption (W1), fixed asset investment price index (W2), the per capita consumption expenditure of urban residents (W3), the total import and export trade of the Customs and Excise Department (W4), state of the ecological environment (good days) (W5), the proportion of the tertiary industry (total 100) (W6), population (tens of millions) (W7), enterprise vitality index (W8). The relevant data for 2010-2018 were investigated and converted into line pipe index and then calculate the relevant weights and get the economy. The relation between vigor and it is $Y=\Sigma 8\ Wi \times fi$

Influence factor is its corresponding weight. Tianjin is selected as the object of analysis, because it has a good industrial material foundation between Tianjin and Beijing and Bohai Sea, and has developed into the top industrial city in the whole country. However, with the development of the times, Tianjin's economic structure must change, so it takes the change of resident population, the change of resident population growth rate and the final consumption expenditure as the evaluation index. The short-term and long-term impact of economic policy transformation on Tianjin's economic vitality [1-6].

Based on guesswork, the factors that are guessed are investigated one by one to obtain the relevant data and then simply process it to be converted to relevant.

Table1: The index=Data for the year/Data of the last year

Column 1	Environmental conditions (good days)	Total energy consumption	Fixed asset investment	Per capita consumption expenditure of urban residents	Percentage of the tertiary industry	Total Customs Imports and Exports	Population	Corporate vitality	GDP
2010	103.81	101.2	109.55	109.55	99.24	126.76	102.27	106.81	120.65
2011	104.16	101.73	112.5	107.94	99.39	127.82	100.65	104.63	119.78
2012	102.28	95.07	107.94	119.46	102.19	94.3	100.64	107.2	108.23
2013	103.91	99.6	119.46	108.24	102.51	108.57	100.61	119.74	106.83
2014	99.46	100.3	108.24	108.53	103.13	109.11	100.2	114.56	103.36
2015	102.7	97.8	108.53	108.63	108.08	85.97	101.04	118.72	101.19
2016	108.94	101.42	108.63	108.63	103.9	90.56	100.24	124.57	106.64
2017	97.58	107.34	107.82	107.82	105.08	106.83	101.52	146.12	107.43

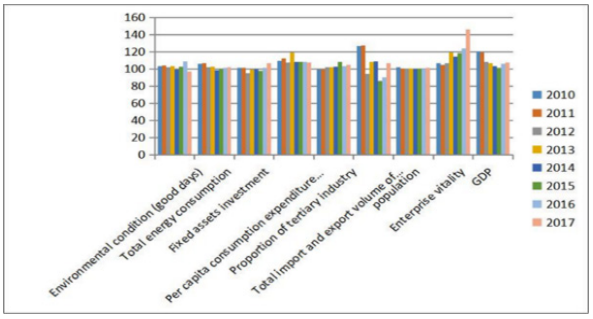

Figure1: Development trend of GDP and other factors from 2010 to 2017

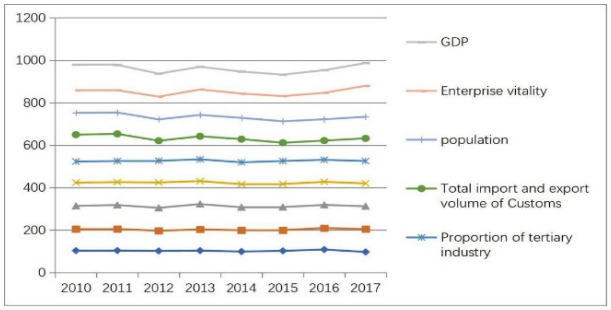

Figure 2: Comparison of GDP development trend and other factors in Tianjin from 2010 to 2017

In order to make it easy to observe the trend of different

factors and the degree to which the trend of economic vitality is fit, the following stacked line chart is produced. Observation can be found, enterprise vitality has the greatest impact on it, population and customs trade volume is second, so it is concluded that if we want to improve economic vitality, it is necessary to vigorously improve the vitality of enterprises, encourage enterprise development, encourage import and export trade.

From the perspective of population and enterprise vitality, both are positively related to economic vitality, and the degree of enterprise vitality is high. Finally, a model of the relationship between economic vitality and influencers is drawn: $Y= \Sigma^{8} W_i \times f_i$

Analysis of the impact of economic policy transformation in Tianjin: Tianjin is rich in natural resources. First, oil resources, Tianjin has Bohai and Dagang two key development of oil and gas fields, proven oil geological reserves of 40 billion tons, oil field area of more than 1 00 square kilometers. Second, sea salt resources, Tianjin has about 153.3 km of coastline, china's famous sea salt region, the long reed salt farm is located here. Third, mineral resources, metal mineral types rich in quality, and the high value of minable. Fourth, geothermal resources, with buried shallow water quality is good characteristics, has been identified the total amount of lo and medium-temperature geothermal resources and the degree of development and utilization in the world. Through some of the above descriptions, we can basically see that Tianjin has a good material foundation in industry, for the future development of Tianjin has laid a basic pace.

But with the development of the times, Tianjin's traditional industry began to be out of touch with society its extensive development and environmental pollution and waste of resources made people begin to reflect on this way of development, while the depletion of resources also forced the original industrial civilization of the big city had to start to choose their own way - to transform the way of economic development.

In recent years, Tianjin has embarked on a radical economic policy transformation, that is, from the secondary industry to the tertiary industry."

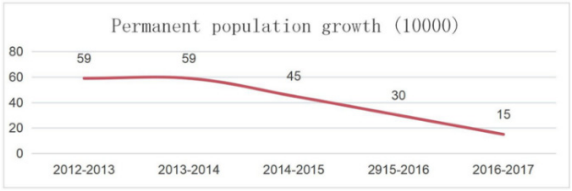

Figure 3: Permanent population growth trend (unit: 10000)

As a result of the transformation of traditional industries, most of the traditional industries closed down, or a large number of layoffs to a new type of industry, the original resident population faced unemployment, economic vitality was affected, some of the resident population chose to leave Tianjin to other places to earn a living, resulting in the decline of the resident population in Tianjin, but also to a certain extent affected the wage level of workers, The decline of workers' consumption ability, insufficient consumption level and lack of consumption vitality have reduced the pull effect on the economy, which has affected the speed of Tianjin's economic development.

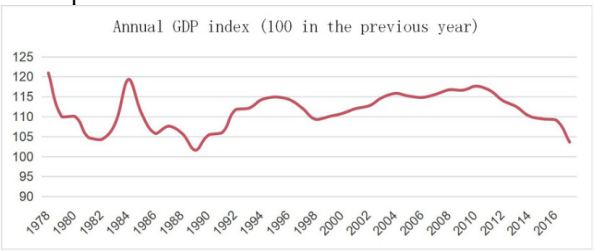

Figure 4: Annual GDP index (100 in the previous year)

2. GDP AND SUSTAINABLE DEVELOPMENT OF TIANJIN

From this figure, Tianjin's economy in 2000 to 2012 is a continuous development, because at this time, Tianjin's secondary industry is developing rapidly, the proportion of the highest, the rapid development of traditional industries, increased a large number of jobs attracting a large number of foreign people to come to work, This has also boosted the consumption of Tianjin and promoted the development of Tianjin's economy. But in 2013, with the change and reform of national policies, traditional heavy polluting enterprises were banned according to law, other traditional industries were also restricted, Tianjin's economic development capacity began to decline, and the decline rate is faster, not conducive to the further development of the city.

But on the other hand, after the ban on the transformation of the secondary industry, Tianjin's environment has been greatly improved, but also to Tianjin resource depletion to provide a buffer time, the waste rate of resources greatly reduced. At the same time, the government's policy will also force enterprises to reform, improve their resource utilization rate.

Table 2: GDP Report for the First Quarter of 2013

Gross regional product	1-3	±%
1. Regional GROSS domestic product (RMB 100 million)	2915.85	12.5
Primary	20.26	3.4
Secondary industry	1624.81	12.3
Industrial	1520.92	12.3
Construction	103.89	13.0
Tertiary industry	1270.78	12.8
Transport, warehousing, and postal services	186.71	10.1
Wholesale and retail	382.68	13.3
Accommodation and catering	29.57	3.5
Finance	216.04	16.9
Real Estate	59.59	15.6
Other services	396.19	11.7
2. Three-time industry share (%)		
Primary	0.7	
Secondary industry	55.7	
Tertiary industry	43.6	

Note: According to the National Economic Industry Classification (GB/T4754-2017), primary industry refers to agriculture, forestry, animal husbandry, fisheries (excluding agriculture, forestry, animal husbandry, fisheries specialty and ancillary activities); The absolute value of the gross domestic product is calculated at current prices and the growth rate is at constant prices.

At this time, I can consider the impact of economic transformation from a long-term perspective, first, from a macro point of view, Tianjin's traditional industrial transformation is not a loss to Tianjin, although the early caused a lot of negative impact, but finally came back to say that when the traditional industrial transformation success, the development of modern industry, It can not only absorb a large number of talents to promote economic development, promote the overall optimization and upgrading of Tianjin industry, improve the overall quality of Tianjin, but also re-drive the development of upstream and downstream industries, and in a positive, optimized, economical way to drive. Micro-level, Tianjin industry to get a detailed change, improve working conditions, higher wage levels, these will improve the enthusiasm and efficiency of workers.

3.RESEARCH ON THE DEVELOPMENT OF TERTIARY INDUSTRY IN TIANJIN

Next from the above table can be seen, Tianjin's economic transformation policy is relatively successful implementation, from his GROSS domestic product table we can see that Tianjin's tertiary industry has exceeded the secondary industry, stable leader, this is a leap forward in development. The tertiary industry covers all aspects, including the continuous improvement of the social security system. Raise the standard of unemployment insurance treatment, the standard of basic pension subsidy for urban and rural residents, the standard of living allowance for urban and rural elderly, promote the expansion of the scale of medical insurance, and substantially raise the basic medical insurance emergency reimbursement limit. By the end of the year, the number of people participating in basic medical insurance in the city was 11.1672 million, an increase of 282.7 million over the end of the previous year; 20, 000, an increase of 319, 000; 3, 234, 400 people participating in unemployment insurance for urban workers, an increase of 121, 400.

The level of social assistance services continues to improve. Raise the standards of urban and rural low-security, low-income families, special hardship support, pension sparing for the elderly object, and build 30day care centers for the elderly, with medical care combined to cover more than 95% of the old-age institutions. The annual medical assistance to participate in basic medical insurance 2996 million people, direct medical assistance 726.6 million people, medical assistance funds spent 646 million yuan. Subsidies for water, electricity and gas were granted to 62, 000 eligible persons with disabilities.

Moreover, tourism is developing rapidly. The annual number of inbound tourists was 1.9831 million of which 1.7598 million were foreigners, and foreign exchange revenue from inbound tourism was US$1.110 billion.

The volume of postal and telecommunications business has multiplied. The total volume of postal and telecommunications business for the year was RMB85.105 billion, an increase of 1.1 times. Among them, the total telecommunication business amounted to 73.571 billion yuan, an increase of 1.4 times an acceleration of 73.4 percentage points over the previous year. Mobile Internet users 1421 2018, the city's financial industry added value of 196.689 billion yuan, an increase of 7.2%.

The balance of financial deposits and loans has continued to grow. At the end of the year, the balance of foreign currency deposits of financial institutions (including foreign capital) in the city was RMB309.8317 billion, an increase of RMB4.236 billion over the beginning of the previous year, an increase of 0.1% over the end of the previous year, and the balance of loans was RMB3408.490 billion, an increase of RMB243.909 billion, or 7.9%.

The stock exchange has developed steadily. In 2018, the city added 18 new domestic and foreign listings and new three-board listed enterprises, a cumulative total of 259. At the end of the year, 5.1678 million securities accounts were accounted for, an increase of 8.2% over the end of the previous year.

The insurance market is developing steadily. The original insurance premium income for the whole year was RMB55, 998 million, down 0.9% from the previous year. Among them, personal insurance premium income was RMB41.554 billion, a decrease of 1.9%, and property insurance premium income was RMB14.444 billion, an increase of 2.0%. Among them, personal insurance compensation was RMB8, 375 million, an increase of 3.1%, and property insurance compensation was RMB8, 039 million, an increase of 8.5%.

From these aspects we can’t be difficult to draw from, the tertiary industry in promoting economic development in the huge role, as well as a strong thrust, it has a more strong than the first two production to stimulate economic development capacity, but also make up for the transformation of the secondary industry led to job losses.

4.APPLYING SUGGESTIONS RESTATEMENT OF THE CONCLUSIONS

The most important trend of fitting with the economic income curve of Hebei Province, which is the influence factor of economic vitality in Hebei Province, which is first parted by this part, is that the total import and export of customs is an important factor affecting the regional economic development. At the same time, the first part data can be seen, population and business vitality change trend is also positively related to the change of regional economic vitality. That is to be concluded that the trend of total import and export of customs and the changing trend of population and enterprise vitality is an important positive and related factor to improve the vitality of the regional economy.

The second part of this part on the transformation of Economic Policy in Tianjin shows that the tendency from industry and other secondary industries to services and other tertiary industries is conducive to the development of regional economic vitality in the long run, and intelligent development has the advantages of energy saving, light pollution, labor consumption and so on, which, on the whole, has a positive impact on improving regional economic vitality. This is the conclusion of the second part

Tianjin's extensive development is gradually out of touch

with China's high-speed modernization. In recent years, Tianjin has embarked on a radical economic policy transformation, that is, from the secondary industry to the tertiary industry. But the decline in traditional industries has also had several negative effects, such as a reduction in population and job losses, which have contributed to a decline in regional economic dynamism.

Proposals:According to the conclusions of parts I and III, as an important hub connecting domestic and foreign countries, connecting the north and the south, and communicating the east and west, Tianjin is an important outlet for neighboring inland countries, and Tianjin can rely on its superior geographical conditions to continuously develop its regional economy through the two aspects of total import and export and enterprise vitality.

First, vigorously develop international scientific and technological exchanges and cooperation, improve the level of enterprise technology. Establish multi-level channels of cooperation, relying on scientific and technological exchanges and cooperation and industrialization center, the direction of scientific and technological cooperation to the old industrial base adjustment and transformation.

Secondly, expand the scale of enterprise enhance market control. Based on scientific analysis and rational planning, we will build horizontal integration and vertical integration of enterprises and expand the scale of operation. In this process, enterprises should try to break regional boundaries for capita l export, cross-regional and cross-border operations.

Third, extensive cooperation with transnational capital. We will accelerate the corporate restructuring of large and medium-sized state-owned enterprises, set up an open property rights market, set up various types of Sino-foreign joint ventures and exchange intermediaries, and promote cooperation with multinational companies based on some enterprises with good basis for cooperation, high technical level and fast progress in industrialization.

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Research on Air Quality Evaluation Based on Decision Tree Model

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Abstract: Air quality is a hot issue that people are concerned about at present, so how to objectively evaluate and analyze air quality is particularly important. This paper firstly determines the important indexes that affect air quality, then collects the air related data of a day in 2020, adopts CART algorithm and uses decision tree to fit the related data. The minimum threshold of information gain was determined as 0.045 by using the grid search optimization method, and finally the model of decision tree was obtained. The model can effectively classify the air quality and has certain reference value for People's Daily activities and government decision-making.

Keywords: Decision tree; The Gini coefficient; Grid search; Air quality

1. INTRODUCTION

Air quality affects people's work efficiency and health. Many scholars have studied air quality issues. Li Bochen et al. [1] conducted evaluation experiments on air quality in closed environments with the modular design idea, and obtained an effective air quality evaluation algorithm. Huang Xuan [2] et al. used BP neural network to predict the air quality of Hefei city and obtained an effective air quality prediction model. This paper first collects the main indicators that affect air quality, and then establishes a decision tree model to evaluate air quality based on the characteristics of the classification rules generated by the decision tree, which are highly accurate and very flexible. It is of great significance to the timely decision-making of relevant departments.

2. INTRODUCTION TO DECISION TREE

Decision tree algorithm is a data classification algorithm based on predictive variables. Several decision tree algorithms are introduced as follows: ID3 algorithm [3] takes the declining speed of information entropy as the criteria for selecting test attributes, that is, the attributes with the highest information gain that have not been used to be divided at each node as the criteria for dividing.C4.5 algorithm is an extension of ID3 algorithm, using information gain rate, and can process non-discrete, incomplete data. CART algorithm refers to the gini coefficient used to classify and select the decision tree, and the more complex the data and the more variables, the more significant the superiority of the algorithm will be.

3. THE DATA RESOURCE

The air quality data comes from the real-time data of six air pollutants (PM2.5, PM10, CO, NO_2, SO_2, $O_{3\text{-}1h}$, $O_{3\text{-}8h}$) in 365 regions of China on a certain day in 2020. The data are shown in the table below.

Table 1 Real-time pollution index data of 365 regions in China

Area	PM2.5	PM10	CO	NO_2	SO_2	O_3-1h	O_3-8h	air quality
1 Linzhi	4	17	0.35	6	4	52	36	excellent
2Tacheng	13	21	0.3	9	1	36	38	excellent
…	…	…	…	…	…	…	…	…
364Jinzhou	110	89	1.22	77	22	22	40	Mild contamination

In this paper, the data set is divided into training set and test set. The training set, accounting for 70% of the total data set, is used to build the prediction model of the decision tree, and the remaining 30% data set is used to test the accuracy of the model.

4. CONSTRUCTION OF DECISION TREE

4.1 FEATURE SELECTION CRITERIA

There are three criteria for feature selection, namely information gain, information gain rate and Gini index. Suppose that the selected attribute has a value of, is, and all the samples with values of on the attribute value are denoted as, representing the information entropy of the event. The information gain algorithm selects the feature with the largest information entropy change before and after the data set partition as the splitting node. It is defined as:

$$Gain(D,a) = Ent(D) - \sum_{j=1}^{K} \frac{D_{ij}}{D} Ent(D_{ij})$$

The maximum feature of the entropy before information gain/partition is selected as the split point. The formula is as follows:

$$Gini(D) = \sum_{x \in X} P(x)(1-P(x)) = 1 - \sum_{x \in X} P(x)^2$$

Among them, the smaller the data is, the higher the data

purity is. Since its calculation does not require logarithmic operation and is more efficient, CART algorithm is selected in this paper.

4.2 MODEL OPTIMIZATION

In order to reduce the over-fitting phenomenon in the process of decision tree learning. The grid search algorithm is used to find the minimum threshold for stopping the recursive process. Grid search algorithm is an exhaustive search method for specifying parameter values. It can automatically adjust the optimal parameter combination and find the optimal threshold which can prevent overfitting. The minimum threshold value of the information gain finally found is 0.045, the final score of the model is 0.838, and the selected algorithm is CART algorithm. Finally, the optimized decision tree model is obtained.

4.3 DECISION TREE MODEL

Using the Graphviz tool, the decision tree is generated as shown in Figure 3 below:

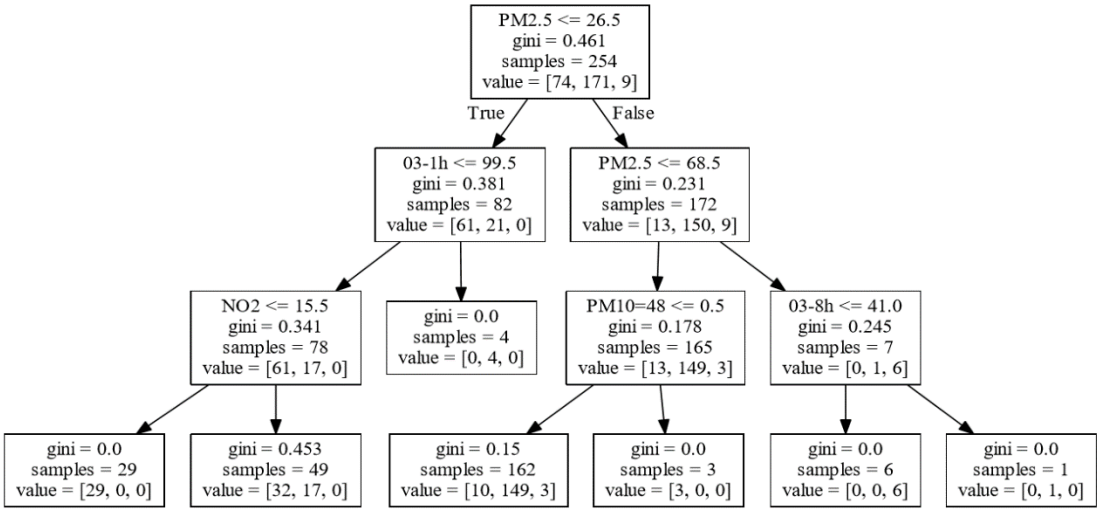

Fig 1 Air quality evaluation decision tree model

5. CONCLUSION

In this paper, six pollution indexes are selected to evaluate air quality, and air quality is evaluated by CART algorithm. Compared with other classification learning algorithms, this algorithm has the advantages of being relatively simple and not subject to data scaling. However, this paper still has limitations in air quality assessment, because other air pollution indicators also have a certain impact on air quality, so a more effective air quality assessment model is still to be further studied.

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Research on Hybrid Curriculum Evaluation System Based on Fuzzy Comprehensive Evaluation

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Abstract:The implementation of mixed teaching mode has put forward the concept of core literacy to The Times, and the evaluation of the effect and quality of education has attracted more and more attention.The descriptive statistics of the student's achievement in a certain subject is made for example, and the general performance of the student's learning index is obtained.The final score and comprehensive score of this subject are selected, and the students of this subject are classified by systematic clustering, and the approximate spatial distribution of students' scores is obtained.Multiple linear regression model is used to determine the indexes which have great influence on the comprehensive scores.Finally, the performance indexes of teachers and students are selected, and the multi-layer fuzzy comprehensive evaluation is used to evaluate the mixed classroom teaching system with teachers and students, and the conclusion that the teaching quality needs to be improved under this mode is obtained.

Keywords: Operational research; Evaluation of teaching quality; Multiple linear regression model; System clustering; Fuzzy comprehensive evaluation

1. INTRODUCTION

Since 2013, our country for hybrid class appeared a rapid growth in the number of related research, mixed classroom teaching quickly became a hot research topic in the field of education technology in our country, the related teaching practice extensively developed, and the research is significant and has characteristics of education in China has carried out a series of local practice, put forward such as "flip", "turn the campus", "classroom flip" wait for a variety of patterns.The traditional teaching mode is gradually replaced by the new mixed classroom teaching mode, and how the new mixed classroom teaching quality is an important research topic to improve and perfect the education system and promote the development of the education industry [1-6].

In information-based teaching environment, teachers and students behavior of a large number of electronic data were recorded and stored, this article from the students and teachers' teaching online and offline obtained from statistical data, analysis the behavior characteristics of teachers and students in network teaching environment and its distribution characteristics, and the system under the system of teaching evaluation system is established for the evaluation, the conclusion obtained in this mode of teaching quality, hope that through study on this question, can help people to meet and understand more hybrid system in the existing problems and current situation of classroom teaching, teaching strategy for teachers in colleges and universities informationization provides empirical basis.The data in this paper are from the statistics of the results of some courses in the course of learning by the Academic Affairs Office of North China University of Science and Technology [7-11].

2. EMPIRICAL PROCESS OF MIXED CLASSROOM RESEARCH

2.1DESCRIPTIVE STATISTICS

Using STATA to conduct descriptive statistics on variables, the following Table 1 is obtained:

As shown in the above table:

(1) The completion rate of task point and video task is 20% on average, and the average length of video task is not long, indicating that students do not have enough time to study and their learning enthusiasm is not high.

(2) In the chapter, the completion rate of the test was 17% and the completion rate of the homework reached 80%, indicating the prevalence of after-class tutoring.

(3) The completion rate and sign-in rate are both very high. The comparison of the above data shows that most students participate in the test, but the actual learning effect is not good. The comprehensive average score can also prove this point.

2.2REGRESSION ANALYSIS

We choose to study in the table pathophysiological points for task completion mission, video point task number, video task completion, the students watch the video task point time (minutes), chapter number test is complete, chapter test completion, chapters test score, homework, homework completion, homework grade point averages, test completed, completion test, study visits, signed in complete number, sign in to completion, discussion, the total number of posts, curriculum integration, the final exam scores for the independent variable comprehensive scores as the dependent variable, multiple linear regression using stata software, Table 2:

Tab. 1 Descriptive statistics of variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Task point completion rate	92	0.216983	0.299733	0	0.9947
Video task completion rate	92	0.202295	0.347073	0	1
Video task completed in minutes	92	93.92174	223.2532	0	1268.3
Section test completion rate	92	0.174517	0.296807	0	0.9861
Operation completion rate	92	0.829173	0.108478	0.5714	1
Test completion rate	92	0.972826	0.086575	0.5	1
Sign-in completion rate	92	0.870494	0.098104	0.3077	1
Comprehensive performance	92	43.69446	20.38436	20.37	98.09
Final exam results	92	77.86261	14.18598	28	97.5

Tab.2 Regression Data 1

Comprehensive performance	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
Task point completion rate	22965.66	8688.763	2.64	0.01	5656.761	40274.57
Video task point completion rate	-20946.2	13769.63	-1.52	0.132	-48376.7	6484.303
Section test completion rate	-11185.2	11319.46	-0.99	0.326	-33734.7	11364.38
Operation completion rate	-28868.1	8291.03	-3.48	0.001	-45384.7	-12351.5
Sign-in completion rate	-0.70285	3.653516	-0.19	0.848	-7.98103	6.575324
Final exam results	0.043255	0.01605	2.7	0.009	0.011282	0.075228
_cons	2.647669	3.504283	0.76	0.452	-4.33322	9.628559

Based on the above data:

(1) Prob>F is 0, so the heteroskedasticity test shows that the model is valid, R =0.9913, indicating that the fitting degree is very good, and the search for influencing factors on comprehensive scores is relatively complete.

(2) Under the assumption that the confidence interval is 95%, the independent variables that have a great impact on the overall score can be found through the observation of the table: the number of task points completed, the completion rate of task points, the number of homework completed, the completion rate of homework, the number of exam completed, the number of study visits, the total number of discussions, and the final exam results.

2.3 CLUSTERING ANALYSIS

Here, the pathophysiological academic record is taken as an example. The comprehensive score and final score are taken as independent variables. SPSS software is used to conduct systematic clustering for students, and the optimal number of clustering is determined according to the elbow rule.

Sum of the distortion degree of each class: the distortion degree of each class is equal to the sum of the squares of the center of gravity of the class and the distance between its internal members;

Let's say we divide n samples into K categories ($K \leq$ n-1, There are at least two elements in a class)

C_k is used to represent the k class(k=1, 2, ⋯ , K), and the location of such center is denoted as u_k. Then, the distortion degree of the k class is:

$$\sum_{i \in C_k} |x_i - u_k|^2 \quad (0.1)$$

Define the total degree of distortion for all categories:

$$J = \sum_{k=1}^{K} \sum_{i \in C_k} |x_i - u_k|^2 \quad (0.2)$$

This is shown in Figure 2.

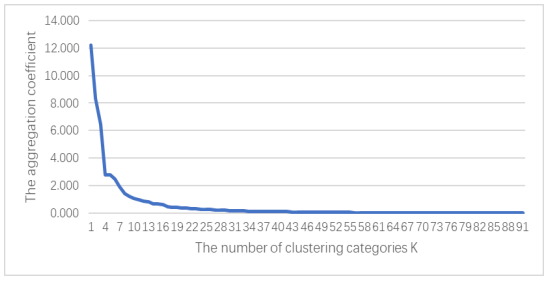

Fig. 2 Cluster category number and coefficient graph

According to the analysis of the figure above:

(1) According to the line graph of polymerization coefficient, when the number of categories is greater than 7, the decline trend of the line is slow, so the number of categories can be set to 7.

(2) It can be seen from the figure that when K value goes from 1 to 7, the distortion degree changes the most.

After exceeding 7, the distortion degree changes significantly.

Therefore, the elbow can be determined as K=7, i.e. the category is set as 7.

After that, the comprehensive scores after clustering and final exam scores were transformed into scatter plots by SPSS graphic builder, as shown in the following Figure 3:

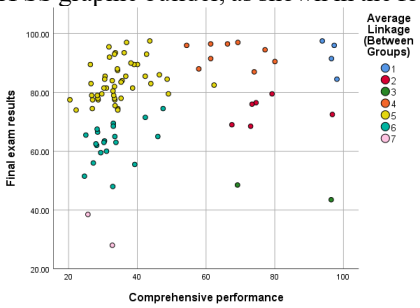

Fig. 3 The result of clustering is scatter graph

The following conclusions can be drawn from the figure:

(1) Most of them have comprehensive scores between 20

and 40, a small part of them between 60 and 80, and a small part of them above 80.
(2) Most of them scored 80 in the final exam, with roughly equal Numbers of those above and below.
(3) The closer to the upper right corner of the coordinate system, the better the academic performance, and the closer to the lower left corner, the worse the academic performance.
(4) The first category has the best academic performance, the seventh category has the worst academic performance, the sixth category is slightly worse than the fifth category, and the fourth category is close to the second category.

2.4 THE ESTABLISHMENT OF THE EVALUATION SYSTEM

Through the analysis of the data, several valuable variables are extracted. The other variables have more value of 0, which can reflect less information, so this paper will not be simplified.
The first-level index gives weight to 0.5, reflecting the equality between teachers and students. After that, the entropy weight method is used to determine the weight of each second-level index, which is an objective weighting method. The less the variation degree of the index is, the less the information it reflects, and the lower the corresponding weight should be. Compared with the traditional expert weighting and analytic hierarchy process, this method reduces the error caused by subjective weighting. Obtained weight Table 3:

Tab.3 Weight table

Level indicators	First-level index weight	The secondary indicators	Secondary index weight	The total weight
B1	0.5	B11	0.2033	0.1017
		B12	0.1814	0.0907
		B13	0.2434	0.1217
		B14	0.2046	0.1023
		B15	0.1674	0.0837
B2	0.5	B21	0.2023	0.1012
		B22	0.3248	0.1624
		B23	0.4730	0.2365

According to the table, the weight difference of each independent variable is not large, indicating that the weight of each factor is relatively stable.
The following is the definition of membership: for the number of teachers' discussions, teachers' posts, published homework, teachers' replies and students' discussions, 0-5 should be considered as below, 5-10 should be considered as medium, 10-15 should be good, and more than 15 should be excellent.For, 0-5 is defined as subtractive;For homework review rate, 0-0.3 is below, 0.3-0.6 is medium, 0.6-0.9 is good, and 0.9 or above is excellent.For learning visits, 0-750 is considered as low, 750-1500 as medium, 1500-2000 as good, and above 2000 as excellent.The number of participants is 0-10, 10-20 is medium, 20-25 is good, and greater than 25 is excellent.Table 4 is obtained after excel histogram drawing and summary:

Tab. 4 Membership degree of each index

Level indicators	The secondary indicators	membership			
		excellent	good	medium	inferior
Teacher performance (B1)	Number of Teacher discussions (B11)	0.034	0.025	0.031	0.908
	Number of Teacher posts (B12)	0.020	0.009	0.029	0.942
	Number of jobs published (B13)	0.005	0.011	0.049	0.934
	Number of teacher replies (B14)	0.024	0.001	0.012	0.963
	Homework review rate (B15)	0.068	0.009	0.010	0.914
Student initiative in Learning (B2)	Learning visits (B21)	0.186	0.052	0.104	0.659
	Number of Student discussions (B22)	0.140	0.014	0.013	0.833
	Number of Participants (B23)	0.163	0.006	0.004	0.827

The first-level fuzzy comprehensive evaluation of the data in the above table can be obtained as follows:
$B_1 = A_1.R_1 = (0.0281 \quad 0.0111 \quad 0.0276 \quad 0.9328)$ (0.3)
$B_2 = A_2.R_2 = (0.1602 \quad 0.0179 \quad 0.0272 \quad 0.7950)$ (0.4)
Then, the second-level fuzzy comprehensive evaluation can be obtained as follows:
$B = A.R = (0.0942 \quad 0.0145 \quad 0.0274 \quad 0.8639)$ (0.5)
According to the principle of maximum membership, the teaching effect under this mode is inferior.

3. CONCLUSIONS

Through the above research, it is found that the main influencing factors of students' grades include: the number of task points completed, the completion rate of task points, the number of homework completed, the completion rate of homework, the number of exams completed, the number of study visits, the total number of discussions, and the final exam results.

Under the mixed teaching system, students who want to improve their overall scores can focus on improving the completion rate of tasks, the number of assignments submitted, the number of discussions and the final exam scores.

Teachers' teaching behaviors involved in fuzzy comprehensive evaluation show that teachers' participation is not very positive, such as:

Teachers discuss the number almost 90% concentration between 0 to 5, teachers post number generally is also concentrated between 0 to 5, discuss the enthusiasm is not high, publish job number mostly between 0 to 5, urged to the student effect is not very strong, for the students' ability of self governance requirements higher than reality, can not meet the corresponding teaching effect, release rate and assignments and homework reviews number is mostly concentrated in the low range, can teachers consider college to cultivate students' self-study ability and exercise the students' self-study ability.

The visits of students are relatively normal, and the number of discussions and assignments completed by students are less, indicating that students' self-control ability needs to be improved.

In a word, the teaching quality under the current mixed teaching system is not high, teachers and students are less active, and students' self-control and self-study ability is not as strong as imagined.

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Research on How to Improve Regional Economic Vitality

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Abstract: In recent years, regional comprehensive competitiveness has been continuously strengthened, especially the regional economic vitality, and some regions have also introduced related policies, but the richness of resources in different regions and the effectiveness of policy implementation are also different. Against this background, how to seize key factors to improve the regional economy Vitality has become an important subject. In this paper, the histogram and line graph model and linear regression equation prediction are used to analyze the population of Hebei Province. Finally, through the rational use of the proposed scheme, effectively grasping the key factors has improved the economic vitality of Hebei Province. Then through the establishment of pie chart, the comparison between before and after the industrial development is made and the conclusion is drawn. Finally, different parameters are given different weights to measure the economic vitality of different cities.

Keywords: Economic Vitality; Give Weight; Linear Regression Equation Prediction

1. INTRODUCTION

Regional economic vitality is an important component of regional comprehensive competitiveness. How to provide regional economic vitality is a matter of great concern to various countries and regions. In recent years, in order to improve regional economic vitality, different regions have introduced different policies to stimulate economic vitality. However, due to the different endowments of resources in different regions, the emphasis on improving economic vitality in each region is different, and the effects are different in different regions. This problem has not been better solved. How to take advantage of resources in different regions, such as population. The advantages such as the number, the number of enterprises, and industrial resources play a vital role in enhancing the regional economic vitality [1-4].

At this stage, the growth rate of China's GDP is decreasing year by year, and the growth rate is getting smaller and smaller; the growth rate of the secondary industry has generally declined in the first three quarters of 2019, and the growth rate of the tertiary industry has remained balanced, and has not shown a large Regional economic vitality is an important guarantee for improving the national economy, so it is imperative to effectively increase regional economic vitality.

The following issues need to be addressed now:

Taking Hebei Province as an example, find suitable factors that affect the economic vitality of Hebei Province, establish reasonable indicators, analyze the development trends of different factors in recent years, and predict future development trends.

Find the appropriate data for the survey and analyze the short- and long-term effects of economic policy transition on the economic vitality of Hebei Province.

Select the appropriate indicator system, establish a model to analyze economic development.

2.MODEL ESTABLISHMENT AND SOLUTION

2.1 Establishment and Solution of Linear Regression Model

Use Excel to input data, and then make a line chart. Make a line chart according to the survey data, as shown in figure 1.

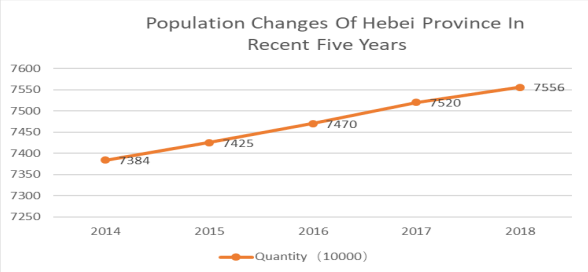

Figure 1: Popolation Changes of Hebei Province in Recent Five Years

According to formula $\begin{cases} \hat{b}=\frac{\sum_{i=1}^{n}(x_i-\bar{x})(y_i-\bar{y})}{\sum_{i=1}^{n}(x_i-\bar{x})^2}=\frac{\sum_{i=1}^{n}x_iy_i-n\bar{x}\bar{y}}{\sum_{i=1}^{n}x_i^2-n\bar{x}^2} \\ \hat{a}=\bar{y}-\hat{b}\bar{x} \end{cases}$

$\hat{a}=\bar{y}-\hat{b}\bar{x}$

$\hat{y}=\hat{b}x+\hat{a}$

We get b = 43.9 and a = -81031.4. Then we get the regression equation as y = 43.9x-81031.4

Then use the formula $r=\frac{\sum xy-\frac{\sum x\sum y}{N}}{\sqrt{(\sum x^2-\frac{(\sum x)^2}{N})(\sum y^2-\frac{(\sum y)^2}{N})}}$ to calculate its correlation strength, and finally use python to calculate the result r = 0.9991357767191454 <1, but it is not much different from 1, indicating that the correlation is strong. Finally, use MATLAB to make an equation that predicts the populations in the next 5 years, as shown in figure 2.

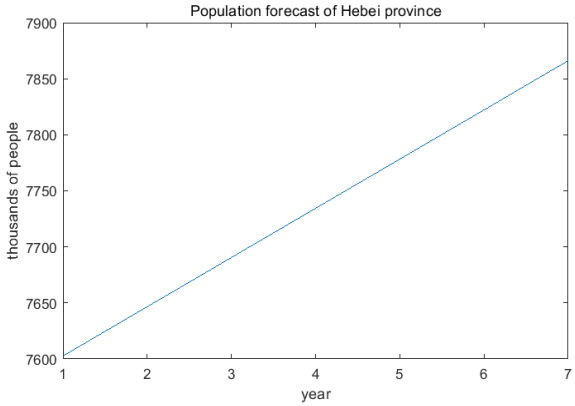

Figure 2: Population forecast of Hebei province

2.2 Comparative analysis of data before and after age structure pie chart

Use the Excel table tool to make a comparison between the pie chart of the population structure of Hebei Province in 2010 and the pie chart of 2016, as shown in figure 3 and 4, to analyze the proportion of the young and middle-aged population before and after, and then judge the development of future economic vitality.

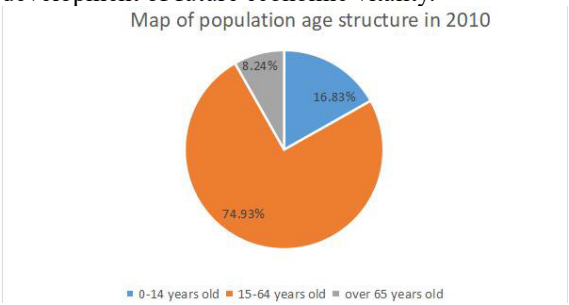

Figure 3: Map of population age structure in 2010

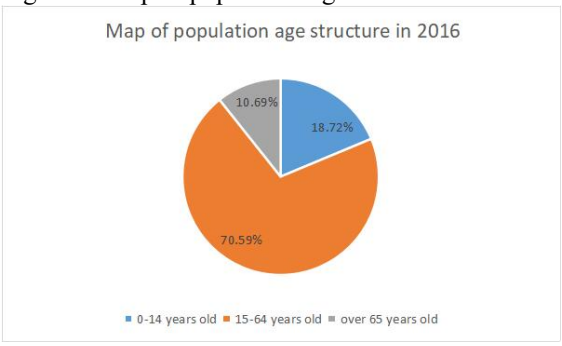

Figure 4: Map of population age structure in 2016

Through comparison, we will find that the proportion of the population aged 15-64 has declined, so it is important to introduce some measures to increase the population, especially the young and middle-aged population.

2.3 Table data comparison chart and analysis

Use the excel table tool to make a comparative analysis of the number of new enterprises in Hebei, Beijing, Shanghai, Guangzhou, and other more developed cities from 2018 to 2019 and the number of surviving companies in 2019, as shown in figure 5, and then draw conclusions.

The number of new enterprises in Hebei Province in 2018-2019 is larger than that in Guangzhou, but there is still a slight gap compared to Beijing and Shanghai, which can indicate that Hebei Province still has great potential to increase the number of more enterprises to strengthen Hebei Province. The regional economic vitality.

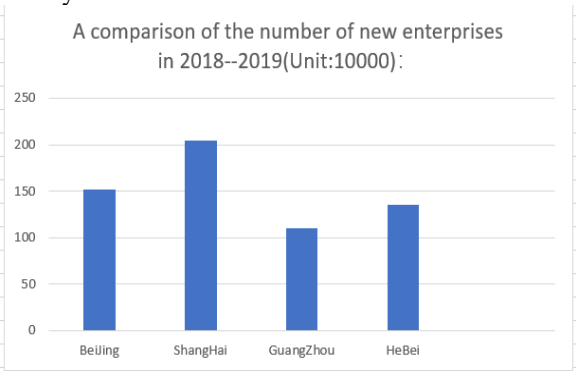

Figure 5: A comparison of the number of new enterprises in 2018-2019

We surveyed the number of surviving age enterprises in 2019, as shown in figure 6.

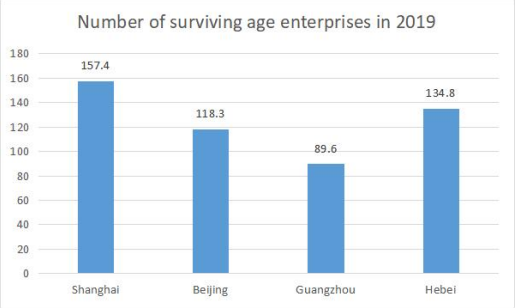

Figure 6: Number of surviving age enterprises in 2019

From the figure, we can see that the number of surviving enterprises in Hebei Province ranks second among the three major cities in Beijing, Shanghai, and Guangzhou. Hebei Province is still a city with potential, and the number of surviving enterprises is considerable. The number of Hebei enterprises can continue to grow steadily, continuously increase new enterprises, encourage entrepreneurship, provide entrepreneurial capital support, equity incentives, equity and dividend incentives, employee shareholding and three system reforms, etc., and effectively stimulate the vitality of the enterprise.

2.4 Establishing Pie Charts and Analysis of Different Industries in Hebei Province

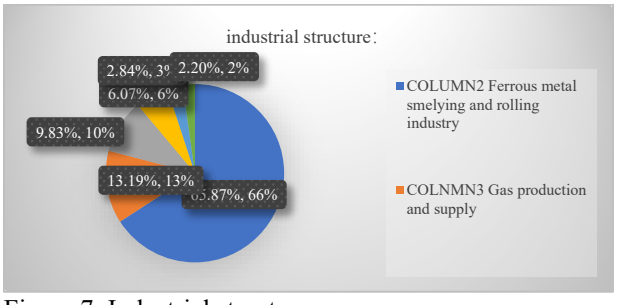

Figure 7: Industrial structure

Taking Hebei Province as an example, pie charts and column charts for different industry types in Hebei Province are established, and the pie chart and column chart are analyzed, as shown in Figure 7.

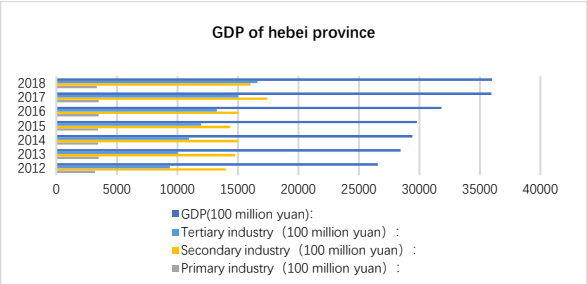

Figure 8: GDP of Hebei province

It can be seen from the figure that the metal industry and its processing industry in Hebei Province are relatively developed, GDP is mainly maintained by the primary industry and the secondary industry. The tertiary industry service industry and the science and technology industry have not developed very well, so the development of high-tech Industry is still the breakthrough point of economic growth in Hebei Province. According to this model, the impact of economic policy transition in the short and long term is analyzed:

In the short term, the higher proportion of the metal industry and its processing industry will bring higher economic benefits to the Hebei Province, making Hebei's economy continue to grow at a certain level, but the increase will not be very large, because resources are always limited.

2.5 Use table data to weight and establish appropriate indicators to measure economic vitality indicators

Considering the unilateral influence on economic vitality, one-sided weighted method is adopted to measure the economic vitality of Hebei Province, and the accuracy of economic vitality indicators is enhanced. Also, because the number of GDP and NEEQ companies has a greater impact on economic vitality than the population Larger, with enterprises, talents have the potential to increase income. Table 1shows the population of several representative cities in Hebei Province, GDP and the number of new third board enterprises.

Table 1: Population, GDP and Enterprises of Hebei Province in 2018

Population size (10000)		GDP (100 million)	New third broad enterprises
Shijiazhuang	1015.12	6082.60	27
Tangshan	784.36	6955.00	12
Baoding	1042.53	3589.80	16
Heng shui	461.5	1558.70	5
Qinhuangdao	309.46	1635.56	6
Zhangjiakou	442.51	1536.60	3

Next, the population, the number of NEEQ companies, and GDP are weighted differently, and use the table tool calculates their proportion and sorts them to get the final ranking. Use the formula $c = p \times \omega_1 + n \times \omega_2 + g \times \omega_3$ to calculate the comprehensive score, as shown in Table 2.

Table 2: Weighted ranking of different cities

terms	Population proportion	New third broad enterprises proportion	GDP	Comprehensive score	Comprehensive ranking
Index weight	0.2	0.4	0.4		
Shijiazhuang	0.25	0.391	0.285	0.32052	1
Tangshan	0.193	0.175	0.325	0.2386	2
Baoding	0.257	0.232	0.168	0.2114	3
Heng shui	0.114	0.072	0.073	0.08099	4
Qinhuangdao	0.076	0.087	0.077	0.08078	5
Zhangjiakou	0.11	0.043	0.072	0.06819	6

3.CONCLUSIONS

Through the above three problems and the process of model establishment and solution, the following solutions are available:

Let go of the comprehensive implementation policy for two children, encourage fertility, increase the proportion of young and middle-aged people, and constantly improve the age structure;

Retain local talents in Hebei Province, so that talents can play a greater role in their hometown, such as providing entrepreneurial funding support, increasing various welfare policies, and increasing originality for the economic vitality of Hebei Province;

Increasing the number of enterprises, while also allowing existing enterprises to thrive, provide entrepreneurs with financial support, and reduce steps to attract investment.

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Analysis of Library Building Design Based on The Concept of Green Building

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Abstract: Library is a symbol of urbanization in the present era. The external shape of the library is more elegant and solemn, and the interior also pays more attention to the convenience and comfort. In the design, we need to pay attention to the enjoyment of architectural art beauty, and at the same time, we need to make the layout of the library more scientific and applicable, and meet the needs of the public reading. As a public building with huge flow of people, the library needs to consume a lot of energy when it is open, which is not in line with the characteristics of green building advocated at present. Therefore, in order to implement the concept of environmental protection, it is necessary to integrate the design of library building with the concept of green building. At the same time, the library is also a cultural building, and it needs to reflect the scientific concept of humanistic care and people-oriented. Therefore, this paper mainly analyzes and discusses the library design under the concept of green building.
Keywords: Green building; Library; Design

1.INTRODUCTION

As a public building in the city, library can not only be used for reading and collection, but also a place for people to improve themselves in leisure time. It plays a very important role in the development of current social civilization. With the continuous development and progress of the current social era, many cities have greatly improved the level of museum management and technical level. But at the same time, in order to comply with the development requirements of the current green building, we need to keep pace with the pace of the times to realize the construction of green ecological concept, and gradually build up the green ecological system in this process. This kind of construction concept can better realize the construction of green ecological civilization atmosphere and the implementation of environmental protection concept.

2. THE SIGNIFICANCE OF BUILDING A GREEN LIBRARY BUILDING

Green is a color with vitality and health, which not only represents fresh and harmonious, but also a symbol of hope, and green also represents greening and ecology. In the current background of the times, the scientific concept of development and the sustainable development of ecological environment are very important. And in the era of more advocating energy conservation and environmental protection, green library has become a trend of current development, but also a necessary requirement of building a harmonious society. The construction of green library can also promote the realization of sustainable development strategy. The realization of green library can better reflect the concept of people-oriented, but also improve the level of the library and the internal and external image of the library. At the same time, it also improves the green concept of librarians and readers, which is a necessary measure to realize the concept of environmental protection.

The realization of the concept of green building of library is the requirement of the continuous development of society, and it is also a new type of green culture, which can derive cultural ecology and information dissemination ecology, and ultimately realize the sustainable development of scientific development concept and academic ecology.

3. DESIGN POINTS OF GREEN BUILDING DESIGN IN LIBRARY BUILDING

In the library building, the design of green building needs to meet the following requirements: firstly, the terrain should be used reasonably to give full play to its advantages; secondly, in the design process, the design of energy consumption equipment should be reduced as much as possible, and the construction technology should be used to realize the environmental comfort; the internal air conditioning system should be reasonably designed; and the lighting should be natural as far as possible Daylighting, reduce the energy consumption of lighting; do a good job in indoor and outdoor greening work [1].

4. THE CHARACTERISTICS OF LIBRARY GREEN BUILDING

4.1 Focus on energy conservation

Energy saving is the main content of green building. In the design, we need to make more use of green vegetation, increase the indoor natural ventilation, and use natural light and solar energy to reduce energy consumption. At the same time, it is also necessary to arrange the time reasonably when opening the library, to save water and electricity energy as much as possible based on meeting the readers' reading needs.

4.2 Pay attention to the authenticity and health of literature content

The literature of the library is the core of the library, in which there are very rich literature information. The library not only needs to have a very rich real collection, but also has a very simple virtual collection [2]. In the construction of green library, it is necessary to continuously screen and identify these massive books

and information, retain healthy and valuable information, and provide readers with more healthy authentic literature.

4.3 Pay attention to environmental protection

The environment of the library is also very important. In the construction of a green library, it is necessary to ensure that the temperature and humidity in the library are suitable for readers to read. At the same time, attention should be paid to the selection of decoration materials to ensure the health and pollution-free environment in the library. In the daily opening of the library, adequate sterilization and disinfection should be ensured to ensure the smooth environment and air in the library.

4.4 Pay attention to service concept

Readers are the center of the library. In the process of construction, we need to pay attention to the needs of readers and simplify the borrowing procedures as much as possible. In the process of readers borrowing, the staff also need to have higher quality and noble sentiment to form a unique library culture.

5. THE APPLICATION OF GREEN BUILDING DESIGN IN LIBRARY BUILDING

5.1 Beautify the internal and external environment of the library

In the interior environment, more pleasant decoration can be carried out, and some bonsai and flowers can be placed. The interior decoration of the museum should be more concise and elegant. Materials that meet the requirements of market environment protection should be selected for decoration. High quality floor glue should be used to reduce indoor noise. At the same time, open layout should be adopted to design reading area. In the design of outdoor environment, we should try our best to ensure its ecological, combine the surrounding environment and landscape design, plant some trees around, the design reflects the harmony of natural landscape and human landscape.

5.2 "Greening" people's way of thinking and behavior

With the continuous development of the times, people's life is also gradually digital and information, which puts forward higher requirements and standards for Librarians' knowledge and skills and computer level, and requires librarians to have good professional ethics and ecological ethics at the same time of work, and to protect the ecological construction of ecology by acting [4].

5.3 Establish people-oriented service concept

The service for readers is the key content of library development. The purchase of literature and the design of layout are all around the needs of readers. In the current stage of library development, the service means of science and technology and information technology are more required, and the humanization and personalization of staff service are also needed by readers. The current development goal of library is to realize more humanized and comfortable management and service mode, and realize more convenient service in the process of Library development.

5.4 Control and eliminate information garbage and information pollution

In the construction of green library network, it is necessary to eliminate the obstacles of document information exchange, effectively eliminate the information garbage and pollution in the network, implement effective filtering, thoroughly purify the network environment, and establish a civilized and healthy website. At the same time, it is necessary to regulate and control the network information reasonably to realize the construction of green network. In the process of library development, it is also necessary to improve the readers' network use skills and morality to avoid illegal and immoral behaviors.

6.CONCLUSION

To sum up, under the current requirements of the times, people's awareness of environmental protection is gradually enhanced, and the construction of green library is also the key way to realize the "people-oriented" green service concept. In the design process, it is necessary to strictly follow the concept of green building to fully realize the maximum role of green library.

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Application of Artificial Intelligence in Big Data Era

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Abstract: With the development and progress of society, China's science and technology is also in the stage of rapid development. The development of science and technology has promoted the progress of society and people's life. While science and technology improve people's living standards, the application of information technology in various fields has also changed the social information media and communication speed. Artificial intelligence technology based on computer network technology has further promoted industrial innovation and social technological innovation. The emergence of artificial intelligence has further enriched the application field of computer network technology. From the perspective of the application of artificial intelligence to computer network technology, this paper aims to effectively solve the problems existing in computer network technology, and provide more intelligent and humanized social services for human beings.
Keywords: Artificial intelligence; Computer network technology; Analysis and exploration

1.INTRODUCTION

The application and popularization of information technology and the development of emerging technologies such as big data, cloud processing and artificial intelligence under the support of information technology are widely used in various industries. The innovation of technology has injected strong impetus to social development and industrial innovation. The influence of modern industry in information technology and emerging technology is moving towards the direction of intelligence. The idea of artificial intelligence science breaks through the limit of the processing ability of conventional computer information technology, and makes the modern computer technology obtain new achievements in information collection, processing, and processing. As the carrier of artificial intelligence, computer network technology has made breakthrough progress in some precision work under the operation of artificial intelligence, which creates new opportunities for the progress and development of society.

2. INTERPRETATION OF CHARACTERISTICS OF BIG DATA ERA AND CONNOTATION OF ARTIFICIAL INTELLIGENCE

After entering the information network era, modern society benefits from the extensive use of information technology. Only with the support of information technology can the era of big data come in advance. Big data technology is not only a superficial explanation. Big data technology not only has many data sets and types. And these contents have strong pertinence to the object. Big data technology generally has several obvious characteristics. First, there are many types of data owned by big data itself. The data content of big data technology is complex, and the data in various fields are covered. The amount of big data is also relatively objective. With the development of information technology, the channels of big data collection have become chaotic. Secondly, the storage and capacity of big data is huge. The total capacity is about 10TB. Finally, the authenticity of the information contained in big data is high. In the background of big data era, the types of big data information are complex and diverse. This information covers all aspects of society and human life. As some information involves personal privacy, it is necessary to analyze, process and process the information under the premise of ensuring information security, to realize the requirements of precision of big data information [1].

Artificial intelligence was initially seen as a thinking machine. It is a new technology that people realize through the computer network technology and give the machine human thinking mode. Machines endowed with the ability to think can help people deal with dangerous and complex tasks. As the carrier of artificial intelligence, computer network technology needs to use this technology to simulate human thinking process and way. Through the mode of self-study to form a unique thinking ability.

3. APPLICATION OF ARTIFICIAL INTELLIGENCE IN COMPUTER NETWORK TECHNOLOGY

3.1 Application of artificial intelligence technology in network security management

The application of artificial intelligence in network security is mainly reflected in three aspects. The first choice is to enhance the ability of intrusion detection. For the operating system of computer network, each system is a relatively independent individual. The system completes all the work through the information interaction. In order to provide a safe working environment of computer network. Through the intrusion detection system, it filters out the dangerous and worthless data information for the system, so as to ensure the security and reliability of the user network environment. Network intrusion detection system (NIDS), as the first line of defense for users' security

network environment, can observe the flow of information with the support of artificial intelligence technology. The second is to enhance the effectiveness of the firewall. Compared with the common network firewall technology, the intelligent firewall can detect the harmfulness and value of data like human beings. Then the data information is analyzed and classified according to certain standards. And then block all kinds of data information which is not suitable for users' network security environment. The effective implementation of this technology can also effectively resist the attacks of hackers and network viruses. At the same time, it improves the efficiency of data transmission and ensures the user's safe and stable network environment. Finally, the ability of spam recognition and processing is enhanced. The application of artificial intelligence in mail processing can effectively improve the user's email acceptance status. It can help users to automatically classify useless and dangerous mails after receiving them. Through the identification and scanning of e-mail content, we can know which e-mails are useless, classify the spam, and facilitate the centralized and unified processing of users [2].

3.2 Application of artificial intelligence technology in system evaluation and network management

The advent of the era of big data has changed the industrial structure of the Internet and created preconditions for the realization of artificial intelligence technology. The application of artificial intelligence technology in computer network management can establish a network integrated management system by integrating expert knowledge base and comprehensive technology. Network environment is in the dynamic development, in order to achieve dynamic intelligent management system, it is necessary to add expert system in artificial intelligence. So that the system can manage and judge the data information according to the experience and knowledge of experts in the expert system. To improve the data processing efficiency of system evaluation.

3.3 Application of artificial intelligence technology in agent management

Agent system is a kind of operating system management software. It is to regard each knowledge base as the processing basis of data and information. According to the comparison with the answers and knowledge points in the test database, the analysis and processing of data information are completed. The software is mainly composed of agent communication, knowledge base and database. The application of artificial intelligence technology in agent management can create a convenient information retrieval function for users. Its essence is that users search keywords, and then agent management can accurately find the information users need by identifying their information. This retrieval method greatly shortens the time required for information retrieval. At the same time, it also improves the accuracy of information retrieval to a great extent. It can help office workers to reduce work pressure and burden, but also to meet the learning needs of students. Artificial intelligence can continuously learn and adjust according to the types and needs of users, to better meet the needs of users [3].

3.4 Application of artificial intelligence technology in safety management

Computer network system often appears system vulnerabilities in the process of updating. These vulnerabilities will become the target of hacker and virus attack. The application of artificial intelligence technology can completely repair the loopholes of the system and protect the private information of users. Peers can also improve the effectiveness of firewalls. The intelligence of firewall can classify data information to a high level and avoid system vulnerability [4].

4. CONCLUSION

In general. The application of artificial intelligence in computer network technology optimizes the protection function of the system, improves the efficiency of information transmission, and ensures the network security environment of users.

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One Belt, One Road, Strategic Orientation, International Exchange, and Cooperation in Running Schools

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Abstract: Under one belt, one road, one of the "one belt, one road" construction path, the concept of "one belt and one road" education community has been presented to everyone's vision. In terms of international exchanges and cooperation, we have also met greater opportunities and challenges. In order to meet one's needs of one belt, one road, the universities also began to promote the harmonious development of regional education based on equality, tolerance, reciprocity, and activity. We should strengthen the spirit of cooperation, realize the sharing of educational resources, and protect the common feelings of the people. Therefore, this paper first puts forward the main problems to be explored, and then, combined with the actual development needs, constructs the construction path of international exchange and cooperation in running schools.
Key words: One belt one road; International exchange; Cooperation in running schools

1. QUESTIONS RAISED

Education is the foundation of a long-term plan. In recent years, with the continuous development of the education industry, the economic industry has also been a leap forward adjustment. With the expansion of the scale of colleges and universities, the number of educational students begins to decline, which hinders the further development and extension of colleges and universities. As one belt, one road, strategy oriented, effective international cooperation has become a booster for the extension of higher occupation education in China, [1]. Currently, if colleges and universities want to realize the transformation and development of international exchange and cooperation in essence, they need to further consider the main ideas of international exchange and cooperation in running schools. "One belt, one road" initiative has opened a new direction for international exchanges and cooperation among universities, enriched the connotation of cooperation in international cooperation and exchanges, and optimized the mechanism of international exchanges and cooperation in universities. However, in the process of practice, first, at the government level, there is a lack of strategic planning for the internationalization of education, a sound employment transfer system, a scientific vocational education system, and financial support from policies [2]. Secondly, the university itself. Lack of open school philosophy, lack of experience and path to promote international exchange and cooperation. It is difficult to obtain the cooperation intention of foreign universities due to the lack of their own strength. Moreover, many colleges and universities are too conservative and ignore their own education output, making international exchange and cooperation in a passive position. From the perspective of the main linkage, the folk forces are insufficient, the structure is not perfect, the overall planning is lacking, and the internal communication is lacking. In view of this one belt, one road, strategic orientation, how will universities implement the path of international exchange and cooperation in running schools? How will we firmly grasp the strategic opportunity of this country, with education as the foundation and talents as the key? It has become the focus of research under the current situation.

2. "ONE BELT, ONE ROAD" STRATEGY ORIENTED INTERNATIONAL EXCHANGE AND COOPERATION IN RUNNING SCHOOLS

2.1 Government level

First, it is necessary to formulate the strategic standards of education internationalization according to the actual situation of our country, and guide the work of national cooperation and exchange. From the perspective of strategic objectives, we should strengthen the coordination of our work and analyze the path of international development in combination with our own actual situation. Secondly, we need to build professional qualification certificate construction, strengthen the employment transfer system, and strengthen the internationalization. We should enhance the financial support, establish the evaluation system, and improve the quality of education. Select several excellent industries and construct the characteristic professional qualification system. The relevant personnel also need to strengthen the relationship with the Ministry of human resources and social security to improve the interoperability. After that, it is necessary to improve the professional friendship system and further promote the construction of international exchange and cooperation platform. From the perspective of international talent training, we should build in different levels, improve the strength of school running, and promote the development and extension of characteristics. Finally, we need to maximize the support of policy funds and encourage universities to

implement the construction of international exchange and cooperation [3]. We should strengthen the construction of self-study groups to enhance the international competitiveness in essence, so that more excellent students can have the opportunity for further study.

2.2 university level

First, it is necessary for university leaders to construct an open teaching concept in combination with their own actual situation. According to the needs of international talent market, reasonable allocation of resources, the development of corresponding training system. Secondly, colleges and universities need to choose a reasonable path to promote international exchange and cooperation. Combined with international communication experience, the focus of resource integration is analyzed. In addition to basic knowledge teaching, it is also necessary to employ foreign teachers to carry out the construction and training of language and customs. We should innovate the pattern of international exchange and cooperation, strengthen the construction of characteristic majors, and complete self innovation, to lay a good foundation for future education output. After that, we need to strengthen the connotation construction of colleges and universities. Improve the management value and break through the value guarantee. We should strengthen the international teaching staff, increase the channel construction, and extend to the direction of high-tech industries. To establish an international curriculum system, it is not only necessary to show national characteristics and ideology, but also to retain local characteristics based on internationalization [4]. Finally, colleges and universities need to combine their own actual situation, bold innovation, the implementation of education output. On the one hand, we need to expand the scale of overseas students. On the other hand, we need to try to run schools abroad and extend the corresponding implementation system. For example, "Confucius Institute", "Luban workshop", etc.

2.3 Main body linkage level

First, we need to reflect the main strength of non-governmental organizations, and increase the linkage between the government and universities. In other words, it is necessary for colleges and universities to combine their own actual needs, build an information management platform, use the corresponding information collection methods, maintain the dynamic construction foundation, and improve the practicality. From the perspective of open lens, professional training and service should be enhanced. For example: information consultation, follow-up dispute settlement and other contents belong to the category of folk services. Secondly, we need to embody the advantages of enterprises to enhance the efficiency of international communication. Colleges and universities need to take the initiative to request cooperation, and combine with the local economy to increase the national project cooperation. Under the linkage of diversified colleges and universities, resource sharing, coordinated development, and implementation of extension towards the direction of diversification. In addition, we also need to share internal academic resources, improve the sharing of bilingual teaching materials, and undertake scientific research projects. We should strengthen cooperation, enhance the international image, expand the national model of enrollment, and extend towards the implementation of international brand building. Then, it is necessary to integrate resources, upgrade economic structure, make reasonable planning, improve corresponding cooperation efficiency, and enhance corresponding cooperation quality based on local conditions. Finally, based on colleges and universities, we need to increase domestic construction and exchange, use advantages to drive strong international exchange trend, and increase the effective construction of leading role [5]. In addition, the relevant departments need to improve the measures of cooperative education, and build the exchange mechanism based on the credit system. In addition, for regions with relatively developed domestic economic and educational resources, they can be transported to less developed areas.

3.CONCLUSION

With the progress of one's society and the one strategic opportunity of "one belt, one road", universities also need to change their running ideas and enhance the innovative construction of models. We should broaden our horizons, deepen international exchanges and cooperation, revise the training mode of compound talents, implement the cooperation mode of "bringing in" and "going out", and establish the "Chinese brand" of vocational education.

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Research on The Method of Expanding the Scale of Hebei Football Under the Background of Campus Football

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Abstract: In the past five years, with the joint efforts of the education department and all walks of life, the development of Chinese campus football has made great progress, and the development of campus football is also an important part of China's football reform measures. As China's traditional sports province and football strong province, Hebei Province is actively through various measures to continuously expand the province's football sports scale, continue to revitalize the province's football cause, effectively boosting the promotion of China's football soft power.
Keywords: Campus football; Hebei football; Sports scale; Methods

1.INTRODUCTION

In recent years, under the personal deployment and promotion of Party and state leaders, the development momentum of campus football in China is rapid, which effectively promotes the development of sunshine sports activities and the scientific development of school sports [1]. In this context, Hebei Province and other strong football provinces have also issued strong measures to effectively promote the expansion and upgrading of football. Therefore, Hebei should continue to introduce more targeted and effective measures to promote the new development of football in this province.

2. ANALYSIS OF THE CURRENT SITUATION OF FOOTBALL DEVELOPMENT IN HEBEI PROVINCE UNDER THE BACKGROUND OF CAMPUS FOOTBALL

As a traditional football Province, Hebei has promoted the development of football by introducing various measures in recent years

2.1 New breakthroughs in the development of professional football

On June 3, 2016, Hebei issued the implementation plan for the reform and development of football in Hebei Province, which pointed out the direction for the development of football in Hebei Province. In recent years, with the efforts of all sectors of society and athletes, the development of professional football in Hebei Province has achieved remarkable results. In 2016, Hebei has two super teams, Shijiazhuang Yongchang and Hebei Huaxia happy, and Baoding Rongda The Hebei Huaxia happy team has always been a big team in the CSL. Based on the excellent League results of professional football, Hebei professional football market is also very popular in recent years. In the CSL League of Yongchang team in 2016 season, more than 20000 people attended the main court. After the happy team moved its home field to Langfang stadium, the average number of spectators on the field was over 20000 The number of seats has also exceeded 15000, which is enough to reflect the achievements of Hebei Professional Football Development in recent years.

2.2 Development of special events to a new level

In addition to the rapid development of professional competitions, in recent years, Hebei has also made great efforts to develop characteristic football games, which further enrich the daily life of the masses. In addition to the Provincial Games, the provincial youth games and provincial Championships, Hebei has also actively organized such distinctive football events as "mayor's Cup" and "Dudu Cup", whose scale and influence are also in In addition, more mass-based and interesting events such as "football Carnival" have been actively organized to enable more people and young people to participate in football.

2.3 New improvement of amateur football

Driven by professional football and all kinds of special events, Hebei Folk amateur football has also been in full swing in recent years. From 2007 to 2014, Hebei held city football invitational tournament for 8 consecutive years. In 2015, Hebei Football Association founded the Hebei Football Association Cup, which is a extracurricular event. At the same time, a series of amateur events such as 5-person system and 7-man system are also in various cities It has won the recognition of most football fans.

3. THE METHOD ANALYSIS OF EXPANDING THE SCALE OF HEBEI FOOTBALL UNDER THE BACKGROUND OF CAMPUS FOOTBALL

With the great support and development of campus football today, the following aspects should be emphasized in the development of football in Hebei Province

3.1 Continuously improve the standardization level of professional football clubs

Professional football clubs play an important leading role in the process of expanding football estimation and improving the influence of football. Therefore, Hebei football associations at all levels should give full play to the role of industry supervision, effectively improve the relevant rules and regulations, strengthen the self-

discipline management of professional football clubs, and improve the level of standardization; government departments at all levels should also actively create favorable conditions for policy We should encourage clubs to optimize the ownership structure and promote the continuous optimization of the talent structure of clubs, and effectively promote the improvement of the operation mode of professional football clubs and boost the scale of football in Hebei Province.

3.2 Reform promotes the development of campus football

Campus football is an important part of school physical education, which is of great significance to cultivate students' physique, exercise their will and transport reserve talents. Schools at all levels in Hebei should place the development of football in an important position in school physical education teaching, actively encourage schools with conditions to carry out the reform of football sports teaching, encourage schools at all levels to set up football teams with classes, departments and majors as the unit according to their own actual conditions, bring football training and competition results into the scope of students' comprehensive quality evaluation, and strive to promote campus football The development of sports, in addition, we should also actively improve the construction of football teachers, strive to provide the school with football teachers and coaches, and constantly improve the training and management level of campus football.

3.3 Vigorously promote the development of social football

Hebei is a province with large population and great potential for developing social football. Governments at all levels and football associations should fully adopt various means, actively guide and integrate various social and non-governmental forces, organize and carry out various amateur events mainly composed of the masses and football fans, and constantly expand the mass base for supporting the football cause and encouraging the development of the organizational cause. In order to support the development of non-governmental organizations and amateur football clubs that carry out various football sports through various policies and measures, scientifically and reasonably design and promote the establishment or development of various football related activities among cities, enterprises, and institutions. The Communist Youth League, trade union and other organizations should actively start from their own functions and work together to promote the development of amateur football.

3.4 Strengthen the reform of football talent training

Governments at all levels should take effective measures to cultivate the fertile soil for the growth of football talents and expand the growth space of football players. We should actively improve the selection mechanism of football players and cultivate excellent local football players through multiple channels. This measure should be carried out from campus football and amateur football. We should actively learn from the talent training methods of foreign football developed countries, focus on building a multi-level and diversified organizational training system, and give full play to sports colleges and universities in the process of football talent training In order to lay a solid talent foundation for the development and prosperity of football in the whole province, we should set up a football talent think tank in the province at the right time.

4.CONCLUSION

In a word, expanding the scale of Hebei football under the background of campus football is of great significance to promote the development of football in Hebei Province. In this process, all levels of government departments and industry associations should give full play to their due functions, and strive to solve the current problems in Hebei Province under the guidance of the "Hebei Province football medium and long term development plan (2016-2050)" and other relevant policies In the process of the development of football, there are long-term problems, such as the management system is not smooth, the lack of professional personnel, the lack of venues and facilities, and the lag of industrial development. Starting from the reform of football development system and mechanism, the improvement of professional football club development mode, the promotion of campus football, social football development and other aspects, to form a joint force, and strive to promote the great development of Hebei football.

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