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Human-Computer Interaction Perspectives on Small and Medium-Sized Enterprises Financing Mode and Structure Analysis Using Artificial Intelligence

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Abstract. This research investigates the application of Human-Computer Interaction (HCI) perspectives in analyzing financing modes and structures for small and medium-sized enterprises (SMEs) through artificial intelligence (AI). SMEs face unique challenges in accessing financial resources, often due to limited information and traditional financing barriers. This study emphasizes the role of HCI in enhancing user experience and decision-making processes in financial tools designed for SMEs. This paper attempts to analyze the financing scale, financing structure, and financing methods of listed companies in China's small and medium-sized enterprises through empirical research on the financing efficiency of listed companies in China's small and medium-sized enterprises, and analyze the factors that affect the financing efficiency of listed companies in China's small and medium-sized enterprises, to provide effective countermeasures and suggestions for improving the financing efficiency of small and medium-sized enterprises. Finally, the system is implemented and tested. Experimental data show that the clustering reasoning algorithm proposed in this paper is improved by 9.34%. It can effectively solve the problems of nonstandard data and complex index sets in the credit rating process of small and medium-sized enterprises.

Keywords: Artificial intelligence; Small and medium-sized enterprises; Financing structure; Human-Computer Interaction
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1 INTRODUCTION

Since the reform and opening up, after more than 30 years of development, China's small and medium-sized enterprises have shown a good trend of vigorous growth, especially in the process of the gradual establishment and improvement of the socialist market economic system and in the social background of large-scale restructuring of state-owned enterprises, small and medium-sized

enterprises have developed rapidly, and have become an essential pillar of the national economy and the main force of economic construction [18]. According to the 2018 annual report on China's innovation and entrepreneurship, by the end of 2018, there were 77.469 million market players across the country, of which 4.439 million were newly registered enterprises in 2018, an increase of 21.6% over 2015. [7],[6]. The rapid growth of SMEs in the e-commerce sector highlights the need to understand their financing dynamics and the critical role of Human-Computer Interaction (HCI) in this process. This study uses data mining technology and HCI principles to analyze SME financing modes and structures within the e-commerce landscape. Techniques like classification, regression, and association rule mining, combined with HCI frameworks, help categorize financing modes, analyze structures, and uncover hidden patterns specific to e-commerce SMEs. Our research provides actionable insights for policymakers, financial institutions, and SMEs, making informed decision-making easier and fostering a supportive financing environment for e-commerce SMEs through enhanced Human-Computer Interaction. Improve the efficiency of loan approval and innovate financial products and services. Improve the property mortgage system and the method for identifying loan collateral, and adopt movable property, accounts receivable, warehouse receipts, pledge of equity and intellectual property rights, etc., to alleviate the contradiction of insufficient mortgage and pledge of loans for SMEs [19]. At the same time, however, the shortage of funds for small and medium-sized enterprises, a common problem in developed and developing countries, has also become a global problem that plagues the economic and theoretical circles, business circles, and relevant government departments in various countries [13]. How to alleviate the information asymmetry between financial institutions and SMEs and reduce the adverse selection of financial institutions in credit activities has attracted more and more attention of experts, scholars, and people in the industry [3] under the circumstances that the existing information disclosure system of SMEs is lacking, the information disclosure platform of SMEs is backward, and the willingness to disclose information is extremely low. Presently, domestic analysis and suggestions in this field focus on two aspects. The first is system construction, which establishes and improves the information disclosure system of small and medium-sized enterprises and strengthens the supervision of information disclosure of small and medium-sized enterprises. The second is system construction, which improves China's social credit system. At the same time, it plays a vital role in increasing government tax revenue and solving urban employment problems. The research idea of this paper is to solve the financing problem of small and medium-sized scientific and technological enterprises by reading a large number of relevant references and analyzing the causes of financing difficulties in detail and sincerely [10].

In recent years, Internet information technologies such as the Internet, cloud computing, and big data have developed rapidly and deeply penetrated and intervened in the traditional financial industry, resulting in a new financial ecosystem called "Internet Finance." The emergence and development of Internet Finance have widened the financial and ecological fields' boundaries, improved financial services' coverage, and provided favorable development opportunities for improving small and micro enterprises' financial and ecological environment [17]. The spirit of the Internet is sharing, openness, decentralization, and inclusiveness. Internet finance also embodies the spirit of the Internet. Internet finance also promotes them, forming a virtuous circle [4]. In the future, the real economy and financial activities will be highly integrated through the Internet. Based on exhaustively combing the financing theory of small and medium-sized enterprises, the author combines the financing structure, financing behavior, and financing efficiency of small and medium-sized enterprises and analyzes the financing status of small and medium-sized enterprises in China in connection with the actual situation of foreign countries [16]. Then, the three-dimensional perspective of the causes is carried out, mainly from five aspects: a fundamental theoretical problem (information asymmetry theory), a neglected practical problem (insufficient capital of small and medium-sized enterprises), an important reason ("national treatment" problem), a problem that has not been systematically discussed clearly (the systematic exertion of the government's role), and a problem that needs to be treated objectively and rationally (the

quality of small and medium-sized enterprises). Based on this analysis framework, this paper discusses the countermeasures to solve the financing difficulties of small and medium-sized enterprises from a more systematic and practical angle.

The core part of this paper is the path analysis to solve this financial dilemma, which is more comprehensive and targeted than the previous research results and puts forward some novel viewpoints: (1) analyzing the credit demand and characteristics of SMEs; (2) Establish the enterprise credit rating scheme of Daqing Sub-branch of China Construction Bank; (3) Applying the fuzzy rule control algorithm in data mining technology to the customer credit risk evaluation system of the banking industry; (4) The systematic exertion of the government's role is the premise and guarantee to solve the problem. This paper tries to follow the clues of these "points," "from point to point," and genuinely realize the ultimate goal of optimizing the financing structure, standardizing the financing behavior, and improving the financing efficiency of small and medium-sized enterprises in China, to solve the financing difficulties of small and medium-sized enterprises fundamentally.

2 RELATED WORK

Scholars have conducted extensive research, and it is considered that the information asymmetry between Chinese small and medium-sized enterprise managers and Chinese financial institutions is the most fundamental factor affecting enterprises' financing difficulties.

When comparing stock financing and bank lending, Serrasqueiro Z formally used the concept of financing efficiency. He pointed out that "the concept of efficiency in economics refers to the relationship between cost and income. As an institutional arrangement, financing includes transaction efficiency and allocation efficiency. The former refers to the ability of this kind of financing to provide investors with financial resources at the lowest cost. The latter refers to its ability to allocate scarce capital to investors who make optimal' productive' use, which is equivalent to Tobin's functional efficiency "[15]. Lu believes that corporate financing efficiency refers to the size of borrowing capacity. The low efficiency of enterprise financing is a prominent feature of China's economic operation. The improvement of financing efficiency of state-owned enterprises not only depends on the cultivation and improvement of the money market and capital market but also becomes an essential factor for the comprehensive function of the financial market to some extent [11]. Barbero J L, starting from the profit-seeking nature of funds, points out that the financing process of enterprises is essentially a process of resource allocation in the form of capital supply and demand because the profit-seeking nature of funds urges it to continually flow to individual enterprises with higher yields [2]. María-José Palacín-Sánchez believes that corporate financing efficiency refers to the ability to integrate funds with the lowest cost and risk and bring the highest profit to the enterprise by using integrated funds based on different corporate governance structure models [12]. Hahn S B has quantitatively studied the solutions to the financing difficulties of small and medium-sized enterprises in China. They collected a lot of theoretical knowledge, mainly including information economics and incomplete information dynamic games, and constructed a comprehensive signal model that can highlight the actual quality of SMEs, thus realizing quantitative analysis [5]. Regis pointed out that information asymmetry may cause many problems in the financing process of SMEs, among which adverse selection and moral hazard are the most prominent. In the final analysis, the reason for the phenomenon mentioned above is the lack of credit ability of enterprises, which is mainly manifested in the following factors: the scale of small and medium-sized enterprises is relatively small, the strength in all aspects is weak, and the operational risk is high, and the default behavior is severe. All these factors will seriously lead investors to dare not quickly get involved in financing small and medium-sized enterprises [14]. Zhou Y pointed out that the information asymmetry caused by the management mode of small and medium-sized enterprises is the most important factor causing the financing difficulties of enterprises at present [20]. I pointed out that in indirect

financing, due to the various advantages of large enterprises, China's larger financial institutions are more willing to provide services to such enterprises. Due to the benefits of the information obtained, China's small and medium-sized financial institutions are more inclined to offer various financial services for SMEs [9]. Di has conducted in-depth research on the financing of SMEs. He believes that the financing of SMEs in China has its unique characteristics: loan mortgage, heterogeneity, reduction of transaction costs, etc., all of which will increase the credit obtained by SMEs [8]. Annadurai K put forward three factors that affect SMEs' financing behavior: government policies, corporate financial indicators, and the banking system. He used 12 measurable variables to build the related structural equation model. The results of running the model show that the order of influence on the financing behavior of SMEs in China is enterprise financial indicators, government policies, and the banking system [1].

3 METHODOLOGY

3.1 Data Mining Technology Combined with Clustering Algorithm to Analyze the Financing Mode of Small and Medium-Sized Enterprises

Data mining is the product of the combination of multiple disciplines and technologies. Its purpose is to combine artificial intelligence, machine learning, neural networks, statistics, pattern recognition, and database technology, and the computer automatically finds unknown information or patterns with potential application value from the existing data (database or data warehouse). It solves the problem of "data explosion but poor knowledge." After more than ten years of efforts, the research focus of data mining has gradually shifted from discovery methods to system applications, focusing on integrating multiple discovery strategies and technologies and the mutual penetration between various disciplines. Data mining technology has been widely used in banking systems in recent years. With the rapid development of bank informatization, a large number of business data has been produced, and these data are usually relatively complete, reliable, and high-quality. Through data mining and analysis, we can find data patterns and characteristics. Then, we can see the financial and business interests of a customer, consumer group, or organization and observe the changing trends of the financial market. The application of data mining in the banking field mainly includes the following four aspects: (1) bank customer relationship management; (2) Bank risk management; (3) Bank credit rating evaluation; (4) Analysis and prediction of banking services.

Five methods are commonly used in Data Mining: classification, estimation and prediction, association rules, clustering, and visualization. This paper mainly uses the k-means algorithm in clustering, cart decision tree in classification, apriori in association rules, and association rule algorithm.

Clustering divides a data set into classes where elements in the same class are similar, and those in different classes are dissimilar. Cluster analysis uses sample similarity to classify data sets. Incorporating Human-Computer Interaction (HCI) principles makes the clustering process more intuitive and user-friendly. HCI techniques help visualize and interpret the classes, enhancing user interaction and improving decision-making based on the clustering results. In e-commerce, utilizing HCI principles ensures that clustering outcomes are accessible and practical for SMEs, enabling them to understand better and leverage their financing structures. Integrating Human-Computer Interaction in e-commerce clustering fosters more effective data analysis and supports strategic decision-making. The characteristics of actual data and the similarity between data. Clustering analysis has many advantages. It can be directly used for data mining, and the characteristics of each class can be obtained according to the clustering analysis results. The data processed in this paper are all numerical, and there is no classified data. Therefore, the k-means

algorithm, suitable for numerical data clustering, is used for classification as a preprocessing step for further analysis. The above three steps are cycled until the criterion function converges.

3.2 Optimization of Enterprise Financing Structure Based on K-MEANS Clustering

China's small and medium-sized enterprises (SMEs) are crucial to economic and social progress. Supporting the growth of SMEs is vital for maintaining a stable and fast-paced national economy and ensuring the well-being of the people and social stability. To this end, state-owned commercial and joint-stock banks must establish dedicated institutions catering to small businesses' financial needs. It is imperative to enhance the credit system for SMEs, increase the availability of medium and long-term loans, streamline loan approval processes, and foster innovation in financial products and services. Additionally, improvements should be made in the property mortgage system and loan collateral identification methods. Embracing diverse forms of collateral, such as movable property, accounts receivable, warehouse receipts, equity, and intellectual property rights, can help alleviate the challenge of insufficient mortgage and collateral options for SME loans. Differentiated regulatory policies should be implemented to govern commercial banks engaged in SME lending. However, the need for clear and unified laws and regulations explicitly addressing credit ratings for small enterprises poses obstacles. There are legal gaps in the collection of credit information by the government and financial institutions, inadequate legal oversight in the credit evaluation industry, and a need for more regulations regarding the quantity and quality of personnel involved in credit rating management.

Furthermore, information asymmetry creates commercial credit risks that impede the progress of Chinese SMEs. The credit rating institutions for SMEs in China operate as social intermediaries and lack administrative authority to enforce credit evaluations. Many SMEs need a better credit mindset, solely pursuing immediate profits and exhibiting limited enthusiasm for participating in credit evaluation. Some even exploit the absence of legal norms to evade bank loans and default on enterprise loans. In light of the comprehensive analysis of credit risks faced by SMEs, it is essential to enhance the ability to identify and measure credit risk among small enterprise clients and elevate banks' risk-return management. Drawing on the experience of other Chinese banks in mitigating credit risk investment, it establishes a credit rating model for assessing the credit risk of SMEs. The model leverages data mining technology and expert evaluations to assign initial weights to indicators such as the quality of business operators, financial stability, enterprise growth, and social responsibility. By calculating the items of the risk credit rating model, the bank can obtain credit risk evaluation results, thus averting potential financial risks. The credit risk control strategy of small and medium-sized enterprises is shown in Figure 1.

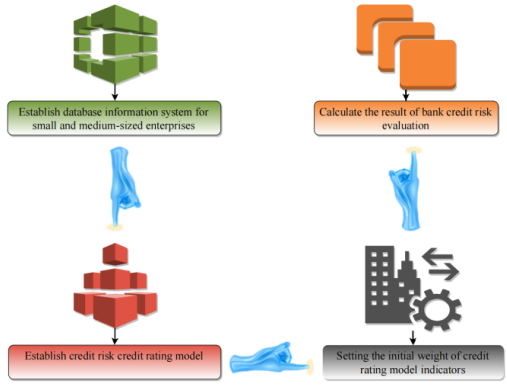

Figure 1: Credit risk control strategy for small and medium-sized enterprises.

This study uses data mining technology and expert comprehensive evaluation to give the initial value of the credit risk credit rating model, an essential improvement in the rating technology and method of small enterprise customer credit rating. The degree of risk quantification and predictive interpretation have also greatly improved.

With the development of massive database technology and the maturity of data mining technology, its application in various industries is becoming increasingly extensive, and there are many successful cases. Figure 2 shows the general flow of data mining applications. Data mining aims to find valuable rules from massive data to guide production practice. Therefore, industry demand, business data analysis, and effective decision mode extraction are the core and value of data mining tasks, as shown in Figure 2.

Figure 2: General process of data mining application.

Bank of China's SME credit risk analysis, data preparation, model establishment, and model evaluation are the main tasks of this study. After constructing the credit risk credit rating model of small and medium-sized enterprises, it is necessary to form the initial values of risk components of enterprises according to their conditions. Therefore, this paper adopts a fuzzy rule algorithm in data mining, uses the K-MEANS clustering algorithm to get the initial value of credit risk credit rating model, and then calculates the risk credit rating model to get the evaluation result of bank credit risk, thus avoiding the hidden danger of financial risk. The application process of K-MEANS clustering algorithm in credit risk management of small and medium-sized enterprises can be summarized as follows: (1) The items in the credit rating model are divided into quantitative indicators and qualitative indicators to form a cluster set; (2) According to the daily accumulated conditional growth values of the managers' quality, economic strength, solvency, enterprise growth, social responsibility, etc. of each small and medium-sized enterprise recorded in the database, and combining with the personal enterprise credit rating experience of experts, the weights of each index in the enterprise rating model are set; (3) reading the clustering rules for clustering reasoning, and calculating the credit rating score of SMEs; (4) By calculating the risk credit rating model, the bank credit risk evaluation results can be obtained, and then the hidden dangers of financial risks can be avoided. The processing flow chart of the K-MEANS clustering algorithm in credit risk management of small and medium-sized enterprises is shown in Figure 3.

3.3 Panel Model Analysis of the Factors Affecting the Financing of Small and Medium-Sized Enterprises

According to statistics, by the end of 2017, the number of small and medium-sized enterprises nationwide had reached 316498, accounting for 97.2% of all enterprises, creating more than 80% of employment opportunities, and the total output value accounted for 60% of all enterprises.

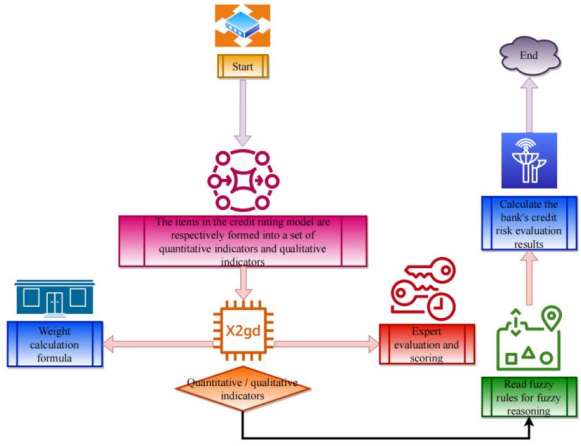

Figure 3: K-MEANS clustering algorithm processing flow chart in credit risk management of small and medium-sized enterprises.

The system design adopts the following strategies to manage user rating indicators dynamically. According to the new trend of corporate credit risk in each fiscal year, timely addition, deletion, and adjustment of rating indicators, and optimization and adjustment of the rating model according to previous rating history, the rating model is close to users' actual credit. The Internet provides rich data resources for people. Still, because of the complex data structure on the Internet, including spatial data mining and multimedia data mining, the Internet data is processed by a unified data format such as XML format structure and then calculated by a data mining algorithm. In addition, since data mining involves the user's information privacy, the data in the database can be observed from different angles and levels, so it is essential to protect the security and confidentiality of information data. The research on data privacy based on data mining is also a hotspot for data mining.

Clustering is used to find common internal data patterns among data sample objects from the data set. Search for the connection of value existence between samples. In cluster analysis, the samples in a cluster set are analyzed and processed as an object. The fuzzy clustering (BezdekJC, HathawayRJ, 1987)(FCM) algorithm is the primary fuzzy clustering method. The principle of this method is to calculate the membership degree between the samples and each class through the fuzzy membership function and establish the uncertainty description of the samples in the class. Define the dimension sample set: the center of the class, the membership degree of the first sample belonging to the class, and the target classification number. The membership function calculation formula is as follows:

$$u_i(x_j) = \frac{(1/\left\|x_j - c_i\right\|^2)^{1/(b-1)}}{\sum_{i=1}^{c}(1/\left\|x_j - c_j\right\|^2)^{1/(b-1)}} \tag{1}$$

$$\sum_{i=1}^{c} u_i(x_j) = 1 \tag{2}$$

Where $b$is is the weighted index, the distance from the sample to the classification center.

When the membership function is calculated, the new clustering center is calculated

$$c_i = \frac{\sum_{j=1}^{n} \left[u_i(x_j)\right]^b x_j}{\sum_{j=1}^{n} \left[u_i(x_j)\right]^b} \tag{3}$$

Define the convergence function of the clustering index as:

$$J_f = \sum_{i=1}^{c} \sum_{j=1}^{n} \left[u_i(x_j)\right]^b \left\| x_j - c_j \right\|^2 \tag{4}$$

In this paper, based on the Euclidean distance membership degree of classical fuzzy C-means clustering, a new membership degree is defined by statistical function, and the standard distribution model estimates the initial parameters of the clustering center. Through the new membership function clustering analysis, the data sets of enterprise credit indicators are divided into classes with similar characteristics. This method can fully use historical database information; the simulation example proves this method is effective.

Define the D-dimensional sample set $X = x_1, x_2, \ldots, x_n$ hypothesis $X \in N_d(\mu, \sum)$, And define the maximum likelihood function:

$$L(\mu,\Sigma) = \prod_{i=1}^{n} \frac{1}{(2\pi)^{dn/2} \left|\Sigma\right|^{n/2}} \exp\left\{-\frac{1}{2}\sum_{i=1}^{n} (X-\mu)^T \sum^{-1} (X-\mu)\right\} \tag{5}$$

Derive both sides of equation (5)

$$InL(\mu,\Sigma) = -\frac{1}{2} PnIn(2\pi) - \frac{n}{2} In \sum_{i=1}^{n} (X-\mu)^T \sum^{-1} (X-\mu) \tag{6}$$

Because (6) is a monotonic function, the derivative of (6) obtains the extreme values of μ and Σ, and the maximum likelihood estimators of μ and Σ are obtained.

$$\frac{\partial InL(\mu,\Sigma)}{\partial \mu} = \sum_{i=1}^{n} \Sigma^{-1}(X_i - \mu) = o \tag{7}$$

$$\frac{\partial InL\ \mu,\Sigma}{\partial \mu} = -\frac{n}{2}\Sigma - 1 + \frac{1}{2}\ X_i - \mu\ \ (X_i - \mu)T(\Sigma - 1)2\ = 0 \tag{8}$$

The maximum likelihood estimator of the sum can be obtained from (7) and (8) as follows

$$\hat{\mu} = \frac{1}{n}\sum_{i=1}^{n} X_i = \overline{X} \tag{9}$$

$$\hat{\Sigma} = \frac{1}{n}\sum_{i=1}^{n} (X_i - \overline{X})(X_i - \overline{X})^T = \frac{1}{n} S \tag{10}$$

The traditional FCM algorithm calculates the membership degree using the Euclidean distance method. This method has a good effect on spherical data sets. Still, in practical applications, the data sets are often randomly distributed in space, and the center calculation method based on Euclidean distance is easily affected by noise points.

4 RESULT ANALYSIS AND DISCUSSION

From the perspective of information protection and system security of rating enterprises, this system runs in the internal LAN of banks, adopts C/S architecture, uses WindowsXP+SQLServer2005 development environment, and uses VisualStudio2005C# language to develop the system. The complexity of the fuzzy reasoning algorithm is related to the rules' size and nesting level. Still, it has little impact on the system's performance, so it can be implemented on general PC hardware platforms. Table 1 shows the software and hardware environment of the system, as shown in Table 1.

Deploy	*Explain*
CPU	*Intel(R)Core2Quad*
Internal storage	*2GB*
Operating system	*WindowsXP/SP3*
Database Management System (DBMS)	*Microsoft SQL Server 2005*
Programming tools	*Microsoft Visual Studio 2005C#*

Table 1: System operating environment.

Reliability can be regarded as a necessary condition of validity but not a sufficient condition. After completing the reliability analysis of the constructed variables, it is essential to analyze the validity of the variables. As a subjective evaluation index, content validity is used to evaluate the degree to which the content of the scale reflects the merits of a specific measurement task. We can judge the validity of content by checking the project production process. The measurement items used in this study are formed by referring to the empirical research of previous scholars and combining the practical experience of interviews with senior executives of enterprises and banks. Therefore, the content validity of the structural variables used in this study is high. In this paper, iris classic test data is selected, MATLAB writes the improved fuzzy C-means algorithm, and the simulation test is run. The clustering results are verified by simulation results and Dunn and Xiebieni clustering validity indexes, and the optimal number of clustering centers is determined. It is also verified that the improved fuzzy C-means algorithm is better than the classical algorithm in clustering on classical data sets. Figure 4 and Figure 5 are the clustering simulation results of FCM and the improved algorithm when the number of clustering classes C=3, respectively.

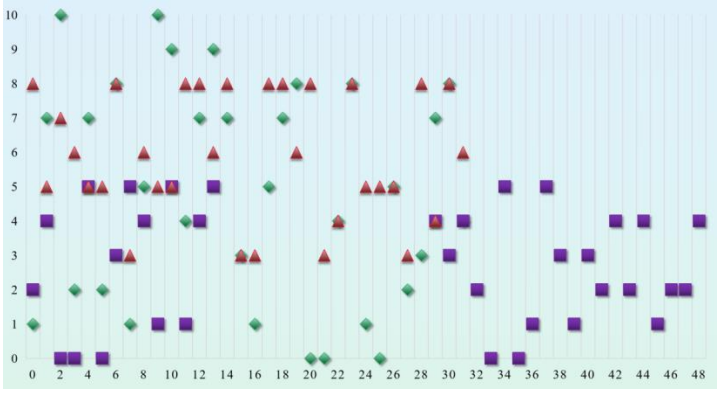

Figure 4: C=3 K-means clustering algorithm simulation effect diagram.

The hexagon in Figure 4 and Figure 5 represents the cluster center. By comparison, the distribution types in Figure 5 are more similar, and the cluster center is more uniform among all kinds of distributions. The Figure 4 K-MEANS clustering effect diagram is spherical, while the

Figure 5 clustering effect diagram is standard. According to the law of large numbers, when the amount of data increases, this distribution is more in line with practical application. The cluster validity test index is shown in Figure 6.

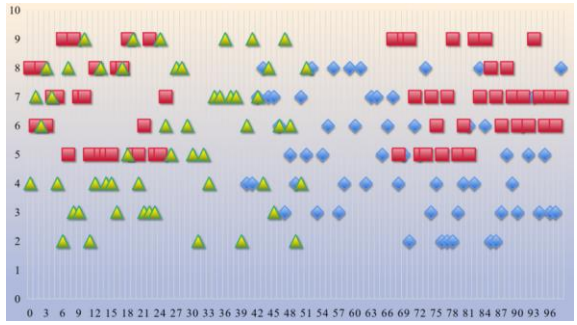

Figure 5: C=3 simulation effect of improved algorithm.

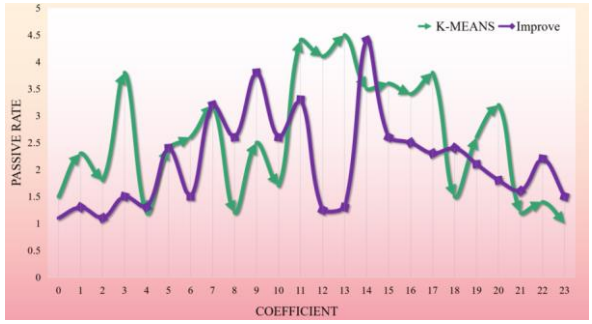

Figure 6: C=3 clustering validity index.

Generally speaking, the financing efficiency of listed companies in China's small and medium-sized enterprises is at a low level; that is, most enterprises fail to achieve both technical and scale efficiency in capital utilization, which indicates that the financing scale of most enterprises is not in the same state as the scale returns, that is, the best state of enterprises, which means that the financing scale of enterprises has not reached the best state. Most enterprises need to use the incorporated funds to maximize their output effectively. The comprehensive technical efficiency is slightly lower than the pure technical efficiency, as shown in Table 2.

Small and medium-sized listed companies	*CR is effective (comprehensive technical efficiency is effective)*		*BC is effective (pure technical efficiency is effective)*		*Small and medium-sized listed companies*	*CR is effective (comprehensive technical efficiency is effective)*	
	Number of enterprises	*Proportion (%)*	*Number of enterprises*	*Proportion (%)*		*Number of enterprises*	*Proportion (%)*
Relatively effective	*13*	*5.12*	*54*	*23.16*	*Relatively effective*	*13*	*5.12*
Relatively invalid	*234*	*94.13*	*200*	*76.52*	*Relatively invalid*	*234*	*94.13*

Table 2: Calculation results of comprehensive technical efficiency and pure technical efficiency.

The above data results are summarized in Table 3 to reflect the distribution of efficiency values of listed companies in China's SME board.

Distribution of financing efficiency of small and medium-sized listed companies	*CR (Comprehensive Technical Efficiency) Distribution*		*BC (Pure Technical Efficiency) Distribution*	
	Number of enterprises	*Proportion (%)*	*Number of enterprises*	*Proportion (%)*
1	*13*	*5.22*	*53*	*20.21*
0~8	*11*	*4.13*	*46*	*34.46*
0.6~0.2	*91*	*18.45*	*154*	*35.12*
0.2~0.8	*15*	*17.46*	*167*	*18.72*
0.4~0.2	*125*	*3*	*240*	*0.749*
0.8~0.1	*215*	*41.642*	*14*	*0.785*

Table 3: Distribution table of financing efficiency of listed companies on SME board.

According to Table 3, the distribution of the comprehensive technical efficiency of China's listed companies on the SME board in the substantial efficiency range of 0.8 ~ 1 is only 9.19%. The number of enterprises concentrated in the low-efficiency range of 0 ~ 0.6 is as high as 77.75%; most enterprises are in a low-efficiency state.

In this part, the author first uses the k-means algorithm and the converted dynamic, comprehensive evaluation value of small and medium-sized enterprise indicators to cluster the Listed Small and medium-sized enterprises to determine which listed enterprises are more successful in financing. Then, by constructing a cart classification regression tree, we find the main factors affecting SME financing behavior's success. Finally, using apriori association rules, we see the financial indicators that appear simultaneously as the success of enterprise financing. The k-means algorithm is used to cluster all listed small and medium-sized enterprises. In the clustering process, the short-term interest-bearing debt ratio Y1 and asset-liability ratio Y2 are input variables. Because the more significant the converted cross-sectional data is, the better. Therefore, enterprises with larger Y1 are more successful in financing. Here, the cluster number is set to 4. According to the value of Y1, the four types of enterprises are successful financing, relatively successful financing, general financing, and less successful financing. Therefore, after the model is established, it is necessary to evaluate it to get more reasonable, more complete, and more accurate decision-making information. The diagonal of the income graph represents the expected response of the whole sample if the model is not used, and the steeper the curve, the higher the gain. Figures 7 and 8 are the income graphs of the regional model and the regional model, respectively. The curve shows that the increase in sample size can improve the response rate based on the degree of gain. It can be seen from the model income graph that the model set in this paper has a high significance for improving the overall correction, as shown in Figure 7 and Figure 8.

According to the classified K-Means modeling results, whether an enterprise can get more loans is closely related to the following financial indicators: X9 cash ratio of operating income, X18 growth rate of total assets, and X19 asset guarantee value. According to the front panel model analysis, among these three important variables, the coefficient of X9 is negative, and the other two coefficients are positive. From the enterprise's point of view, if the cash ratio of operating income is high, the cash flow of the enterprise will be sufficient, and the capital chain of the enterprise will not be broken, so there is no need to go to the bank for short-term interest-bearing loan financing; The higher growth rate of total assets and the guaranteed value of investments will increase the confidence of banks in enterprises, so they are willing to grant them short-term loans.

Therefore, the enterprise's ability to affect small and medium-sized enterprises' financing is based on its accumulation, growth, and guarantee ability.

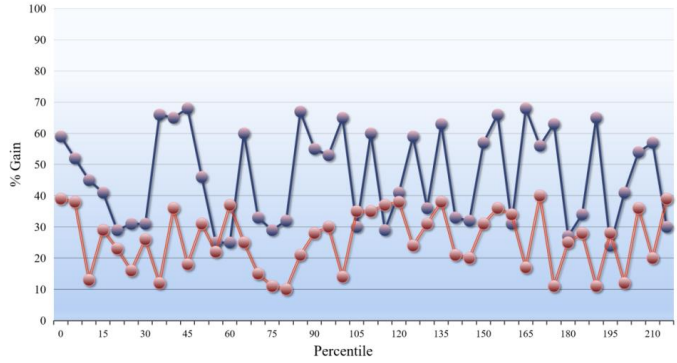

Figure 7: Income map of modelling regardless of region.

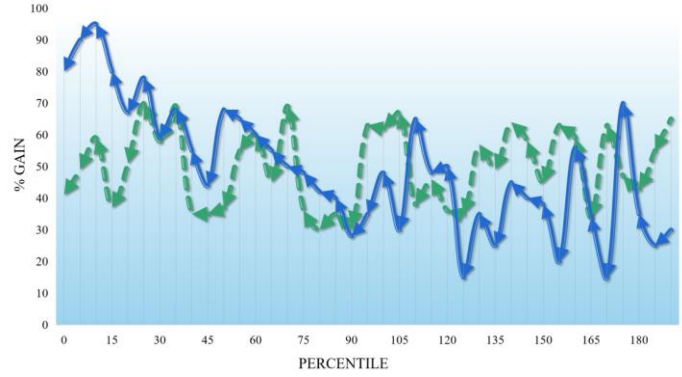

Figure 8: Regional modelling revenue map.

Therefore, relying on the SME board to solve SMEs' listing and financing problems is a realistic and practical choice. Carry out "new and old planning" on the SME board as soon as possible and explore the new share issuance mechanism under the condition of total circulation. At the same time, we should speed up the construction and innovation of the basic system of the SME board. Based on summarizing the development rules and characteristics of small and medium-sized enterprises, formulate the issuance audit standards different from those of traditional enterprises, focusing on the research and development capabilities, scientific and technological content, profitability, and growth potential of small and medium-sized enterprises. Set up a "green channel" for issuing and listing small and medium-sized enterprises with independent innovation ability. Under the framework of existing laws and regulations, for small and medium-sized enterprises with strong independent innovation ability, better profitability and growth, and meet the conditions for issuance and listing, establish an efficient and fast financing mechanism, simplify the audit procedures as much as possible, and provide speedier financing convenience. The refinancing audit adopts the filing system for high-quality small and medium-sized enterprises listed. Encourage innovation in financial products, improve financing methods for small and medium-sized enterprises, including corporate bonds, convertible bonds, and warrants, and support high-quality small and medium-sized enterprises to accelerate their development and become better and more robust by using the capital market. Small and medium-sized enterprises need to strengthen their

financial management system, establish and improve the enterprise financial budget decision-making system, strengthen the management of internal capital operation, restrict the internal capital operation of enterprises, standardize their business behavior, and improve their financial management ability. Regarding capital occupation, we should maintain the liquidity of assets and profitability, considering the relationship between the two, to prevent too much capital from being used for fixed assets, resulting in insufficient liquidity. According to the different situations of the decentralization and flexibility of the production and operation of small and medium-sized enterprises, we should formulate preferential policies to support small and medium-sized enterprises and appropriately increase the credit line for small and medium-sized enterprises with promising development, rising reputation, standardized management trend, high scientific and technological content, and more advanced technical level, so that their handling banks can flexibly lend within the credit line.

5 CONCLUSIONS

Small and medium-sized enterprises are important in China's economic and social development. However, they are responsible for credit evaluation due to their small scale, sizeable macroeconomic impact, irregular financial situation, and many other factors. Based on the existing research on the financing structure of SMEs and the analysis of the current situation of SMEs in China, This paper constructs a multi-factor model of the financing structure decisions of SMEs from the perspective of behavioral corporate finance. It analyzes the managers' factors that affect the financing structure of SMEs in the e-commerce sector. Cluster analysis, as a primary data mining method, takes the enterprise historical credit information data of various institutions integrated through the Internet as the model base of data mining. Incorporating Human-Computer Interaction (HCI) principles makes the analysis process more intuitive and user-friendly. HCI techniques facilitate better visualization and interpretation of clustering results, enhancing user interaction and improving decision-making. This integration of HCI within the e-commerce context ensures that SMEs can effectively understand and leverage their financing structures for strategic advantage. Through unsupervised fractional data analysis, the enterprise credit is classified and screened by finding hidden information. Because of the vast amount of data in Internet integration, this paper improves the clustering model algorithm, which is more effective than the traditional K-MEANS algorithm, and the effect is more convincing when the amount of data is significant. Based on an in-depth analysis of credit risk composition and data mining technology of small and medium-sized enterprises, this paper proposes to develop a credit rating system for small and medium-sized enterprises using the K-MEANS clustering algorithm.

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