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*Research Article*

# Visual Display Method of Enterprise Internal Control Information Based on Cluster Analysis Algorithm

**Ranhong Cui and Hengguo Ma**

*School of Management, Guilin University of Aerospace Technology, Guilin 541004, China*

Correspondence should be addressed to Hengguo Ma; mhg@guat.edu.cn

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In the face of today's fast updating and wide variety of word segmentation, it is difficult to accurately identify the keyword segmentation in the enterprise's internal control information. Therefore, a visual display method of enterprise internal control information based on cluster analysis algorithm is proposed. Fully considering the characteristics of enterprise internal control, on the basis of clarifying the visual display process of enterprise internal control information, the visual display coefficient of enterprise internal control information is optimized based on cluster analysis algorithm. By optimizing the visual display value, the visual display parameter fusion of enterprise internal control information is realized. The dimension of enterprise internal control information is reduced, and the mean value of color difference between pixels is used to ensure the separability of visual display images, so as to realize the visual display of enterprise internal control information. The experimental results show that the proposed method can accurately identify the enterprise internal control information, which shows that the practical application ability of this method has been improved.

## 1. Introduction

At this stage, under the Internet environment, the internal control of Chinese enterprises will encounter more complex problems [1]. The Internet internal control ecological environment has changed the processing mode, production and operation mode, internal control concept, and process of enterprise business. Compared with the traditional internal control environment, the operation of modern enterprises depends more on information system. Enterprise internal control has become "internal control using information system" and "control of information system" [2, 3]. At this time, information system is not only the technology and means of internal control, but also the object and content of internal control. While information technology improves the efficiency of internal control with its characteristics of realizing the rapid transmission of information, the risks it brings may also affect the efficiency of enterprise internal control [4]. Therefore, in the Internet environment, enterprises need to innovate the internal control system to adapt to new problems such as difficult choices in massive data processing.

In order to better understand the current practice of enterprise professionals in data mining workflow. Reference [5] conducted semistructured interviews with 13 data analysts. Based on the respondents' responses, the discussion on challenges and opportunities produced a list of 10 insights and compared them with the closest related work. Reference [6] makes a visual analysis of the current papers on enterprise information disclosure in China by using the method of knowledge map. It can be learned that scholars' research directions are mainly corporate social responsibility information disclosure, corporate carbon information disclosure, corporate environmental information disclosure, corporate accounting information disclosure, voluntary information disclosure, and so on and mainly based on the empirical study of its antecedents. Reference [7] based on the knowledge map theory, using the visualization software CiteSpace V, makes a statistical analysis of 2246 documents in the field of corporate social responsibility information disclosure from 2004 to 2019. This paper studies the distribution of corporate social responsibility information disclosure literature from the aspects of time, region,

institutions, and journals. Through the analysis of keywords and emerging words, this paper summarizes the research hotspots and frontiers in this field and comes to the conclusion that the research focus is on performance, corporate governance, and sustainability. The frontier mainly includes disclosure quality, new influencing factors, profit quality, and assurance statement. Reference [8] studies the data accumulated for a long time in the process of safety management of manufacturing enterprises and reported in pure text or digital form. After the statistics, extraction, integration, and refining of safety management data, it is displayed in a visual way, and the graphical report is used to strengthen the comparison of data, so as to output prediction and early warning for the potential safety risks that will or have occurred, so as to enable decision makers to master important information not efficiently know the important details.

In order to further ensure the quality of enterprise internal information disclosure, this paper proposes a visual display method of enterprise internal control information based on cluster analysis algorithm. On the basis of clarifying the visual display process of enterprise internal control information, the cluster analysis algorithm is used to cluster the enterprise internal control information. By optimizing the visual display parameters and other steps, combined with the pixel processing method, the visual display of enterprise internal control information is realized.

## 2. Cluster Analysis Algorithm Principle

Cluster analysis is an ideal multivariate statistical technique, which mainly includes hierarchical clustering method and iterative clustering method [9]. Cluster analysis, also known as group analysis and point group analysis, is a multivariate statistical method to study classification. In this paper, the whole display process is defined as particle clustering process.

In the particle algorithm [10], by introducing the big data computing environment, the calculation scene is upgraded to the clustering calculation between data and visual display coefficients. Through the continuous clustering optimization of visual display coefficients, the offset control ability of coefficient nonlinear quantum relationship between each link is improved, the clustering convergence between data is improved, and the control accuracy of the whole process is increased. The specific clustering analysis algorithm principle is as follows:

The number of cluster analysis population composition of display parameters in $M$-dimensional space is defined as $m$, which are arranged according to a certain relationship, and the corresponding disturbance sequence is obtained through cluster transformation. Therefore, it can be seen that the accuracy of cluster transformation is affected by the composition coefficient of disturbance sequence. Based on this relationship, the visual display coefficient optimization problem is transformed into a multiobjective clustering problem, and the display coefficient population in the cluster analysis space can be described as follows:

$$F(x) = \gamma f_i(x) + g(x), \tag{1}$$

where $f_i(x)$ represents the optimization objective of display coefficient, $g(x)$ represents the nonlinear offset period of the visual display coefficient, and $\gamma$ stands for optimization constraint.

In order to control over fitting in the optimization process, the concept of chaotic particle swarm disturbance [11] is introduced to calculate the dominant characteristics of the cluster center corresponding to the optimization variable $x$.

$$\dot{x} = \frac{g(x)}{2\mu}, \tag{2}$$

where $\mu$ represents the disturbance coefficient. At the same time, considering that the optimization of the whole visual display coefficient will be affected by the distribution difference, there will be a local optimization problem of particles. Therefore, the characteristic coefficient of the calculation process is set as the vector relationship coefficient $\lambda$, and its archive is marked as $X_i$. The function expression of the process can be described as follows:

$$X_i = f_i(x) - \lambda(1 - \dot{x}). \tag{3}$$

Define the clustering parameter of the optimization coefficient as $X_{\text{new}i}$. If $X_{\text{new}i} < X_i$, search the correct probability of the clustering value in the optimization coefficient interval to obtain the optimization execution function:

$$\begin{aligned} O_\alpha &= \alpha + a(\alpha - \beta), \\ O_\beta &= \beta + b(\alpha - \beta), \\ 0 &< a, b < 1, \end{aligned} \tag{4}$$

where $\alpha$ and $\beta$ represent the optimization convergence function between the visual display coefficients in the clustering optimization process and $a$ and $b$ represent the number of particle swarm hops. After the search, the corresponding coefficients of the particle swarm with visual display coefficients are updated according to the particle swarm hop mechanism. The particle swarm hop update mechanism [12] is shown in Figure 1.

In the process of updating, the particle replacement space position in the cluster space can be described as follows:

$$G_{\text{best}_i}(x+1) = f_i\left(P_{\text{best}_i}(x)\right), \tag{5}$$

where $P_{\text{best}_i}(x)$ represents the particle position in the cluster space. The replaced parameters correspond to the mapping relationship in the enterprise internal control information display process. According to the optimal clustering relationship function [13], there is an optimal order in the vector center. By completing the iterative calculation of the update process in the meme group, the update iterative order of the optimal function relationship can be obtained. The calculation relationship function is as follows:

$$W = \text{dig}\left(\max G_{\text{best}_i}(x+1)\right). \tag{6}$$

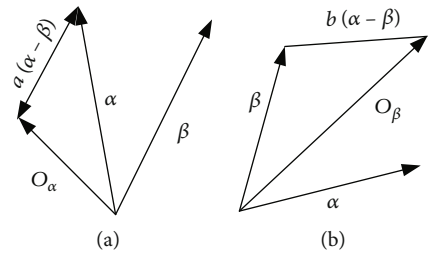


Figure 1: Particle swarm hop update mechanism.

Further, it can be calculated that the fitness function between the visual display coefficients in the cluster analysis space is as follows:

$$w = W(t)\lambda(1 - \dot{x}). \tag{7}$$

On the basis of optimizing the visual display coefficient, the display value of the optimized output is visually calculated to meet the control requirements of the visual system. According to the characteristics that clustering optimization can analyze and evaluate uncertain parameters, the visual original matrix of clustering optimization data is defined as follows:

$$\begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1m} \\ x_{21} & x_{22} & \cdots & x_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ x_{n1} & x_{n2} & \cdots & x_{mn} \end{bmatrix}. \tag{8}$$

Reconstruct the group order of all the optimized feature groups with $m$ pointing object, and define the visualization function relationship of the reconstructed group order data as follows:

$$B = \{x_1, x_2, \cdots, x_m\}. \tag{9}$$

According to the above process, based on the principle of cluster analysis algorithm, the visual display coefficient of enterprise internal control information is optimized.

## 3. Necessity Analysis of Visual Display of Enterprise Internal Control Information

*3.1. Current Situation of Enterprise Internal Control.* The management level of the enterprise financial department is the premise and foundation of doing a good job in enterprise internal control, which plays a particularly important role in realizing the sustainable development of enterprises. Therefore, taking the financial department as an example, this paper analyzes the current situation of enterprise internal control.

(1) Data error continuity

The financial management of enterprises has high requirements for accounting entry. If the entry is wrong, it will affect the later calculation, statistics, and other work contents of accounting work. After the accounting work in the enterprise is computerized [14], the financial management staff need to effectively process and supervise the computer. In case of errors and errors, they need to timely record the data and report the accounting books, statements, and other documents to ensure the accuracy of accounting data in the enterprise. A safe and healthy financial management environment in an enterprise can ensure the management of accounting internal control and the accuracy of fund audit in an enterprise. The computerized operation mode of accounting work makes the financial management of enterprises more efficient. However, the continuous use of computerization will lead to continuous errors in accounting data and the risk of information leakage, which seriously affects the security and stability of financial management in enterprises.

(2) Data confidentiality and security

The traditional accounting data preservation and management is based on the manual bookkeeping method with low confidentiality and security of accounting data. Accounting work includes vouchers, entries, account books, accounting statements, and other work contents, while manual bookkeeping is prone to errors in data storage and data management. The work error of manual bookkeeping will cause problems such as forgery, tampering, and cheating of accounting data [15]. Compared with manual bookkeeping, the working mode of accounting informatization has a certain improvement in the storage and management of accounting data. In enterprises under the background of informatization, the financial data storage and management method of accounting work is electronic password and password. Under normal circumstances, the above methods have strong security and confidentiality. However, if the password and password are leaked, the accounting data will also be stolen, which will seriously affect the stable operation of accounting work in enterprises. Improving the confidentiality and security of information-based accounting data is an important part of the stable operation of financial management in enterprises.

(3) There are network security problems

In the information age, not only do people rely more and more on the Internet in their life and work, but the information-based accounting work mode also depends on the Internet. Once there are network security problems in the information-based accounting work, it will seriously

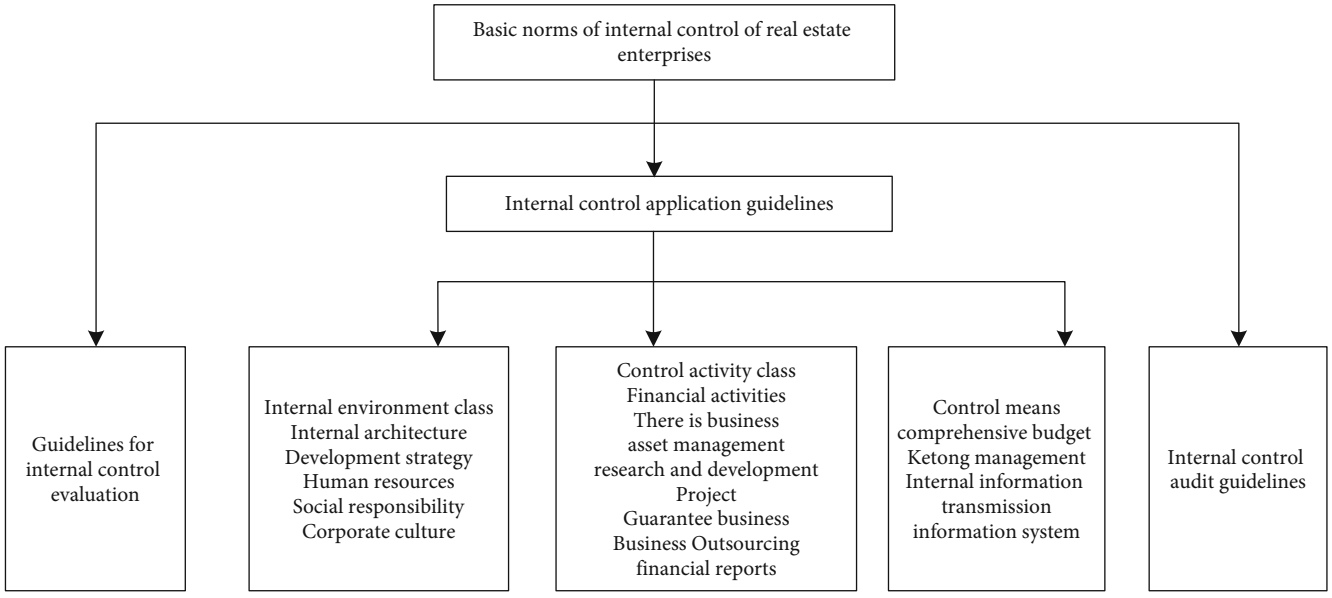


Figure 2: Basic norms of enterprise internal control.

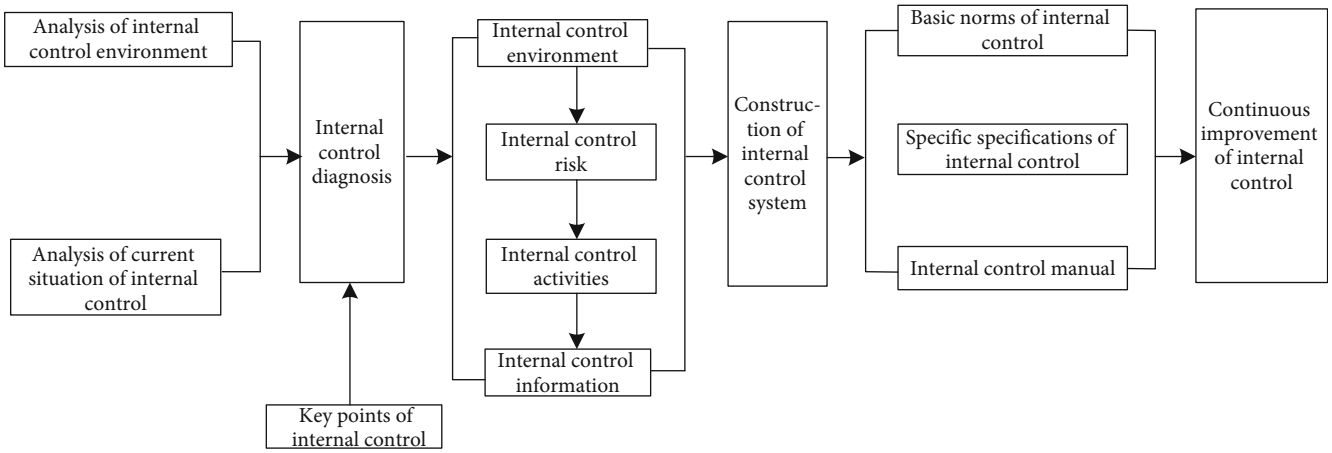


Figure 3: System framework with risk management as the direction of enterprise internal control.

affect the stable operation of accounting work. In the daily work of information-based accounting, the dissemination of accounting information has high requirements for network security, because accounting work often uses the Internet to operate and store enterprise funds and core information. When viruses appear on the Internet, they will threaten the security and stability of enterprise financial management [16], causing crises such as fund theft and information leakage. If there is no effective network prevention and control means for information-based accounting in the enterprise, once the network security problem occurs in the information-based accounting, in addition to the loss of funds and information, it may also lead to the paralysis of the enterprise network and affect the smooth progress of the enterprise work.

*3.2. Basic Norms of Enterprise Internal Control.* With the rapid development of market economies, enterprises continue to pursue stable development on the basis of high profits and high returns. How to better create benefits for themselves and improve benefits has become the ultimate goal of enterprise business activities. Taking the real estate enterprise as an example, due to its special enterprise nature, it also puts forward higher requirements for its internal control management. Therefore, its basic norms of internal control also have enterprise characteristics different from other industries. The specific norms are shown in Figure 2.

It can be seen from Figure 2 that the internal control process of real estate enterprises needs to meet both internal and external factors. On the basis of following the policy guidelines and audit guidelines, realize the enterprise internal control from the aspects of network environment, financial activities, and audit activities.

With the transformation of enterprises from single operation to fine and professional operation, some problems have also appeared in their internal control, which seriously

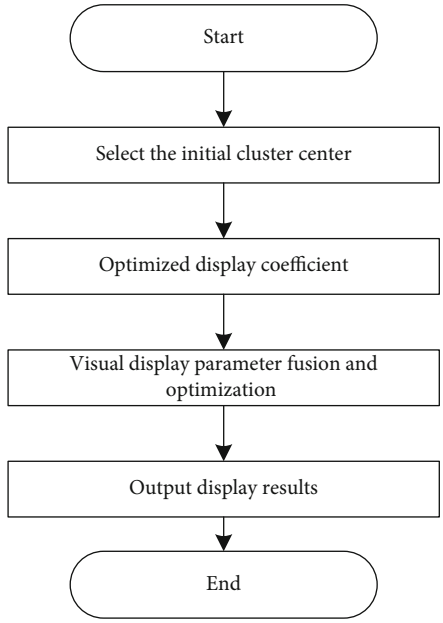


Figure 4: Visual display process of enterprise internal control information.

restricts the normal development of enterprises [17]. Aiming at the management problems in the process of enterprise internal control, this paper establishes a system framework with enterprise risk management as the direction of internal control and a system framework based on the basic principles of internal control to control the risk problems in enterprise business activities. The system framework is shown in Figure 3.

As can be seen from Figure 3, the internal control of the enterprise after the risk occurs can be summarized into two stages. First, at the initial stage of enterprise development, determine the market pattern and target customer group of development projects in the region. The second is the stable period of commercial real estate development and its investment decision-making stage, which is mainly to determine the development direction of the project and the later development cost. If the foundation is not laid well in both risk management stages, it will lead to enterprise decision-making mistakes, which will bring the risk of failure to the project.

*3.3. Visual Display Process of Enterprise Internal Control Information.* According to the above analysis, when studying the visual display method of enterprise internal control information based on the cluster analysis algorithm, this paper mainly takes the key participles in the enterprise internal control information text as the clustering center in the cluster analysis algorithm, identifies the enterprise internal control information in turn, and realizes the visual display based on this. The specific display process is shown in Figure 4.

As can be seen from Figure 4, the visual display of enterprise internal control information includes four steps: selecting the initial cluster center, optimizing the visualization coefficient, integrating and optimizing the visualization display parameters, and outputting the visualization results. The following identification process will gradually realize the visual display of enterprise internal control information.

## 4. Visual Display of Enterprise Internal Control Information

*4.1. Analysis of Enterprise Internal Control Factors.* The board of directors is usually composed of the board members of an enterprise, which controls the affairs of an enterprise and affects the operation efficiency of the enterprise. The size of the board of directors has a certain impact on the decision-making process mechanism of the board of directors and the effect of the board of directors. The board of directors usually organically combines with the structure of the enterprise and the environment faced by the enterprise with the gradual improvement of the enterprise. The proposal of the five elements of the enterprise and the change of the order have changed the pattern of the enterprise's internal control. The evolution table of the elements of the enterprise's internal control is shown in Table 1.

*4.2. Visual Integration of Optimization Parameters and Logistics Display Optimization Quantity.* Based on the optimization results of the above calculation parameters, all the obtained optimization coefficients and visual parameters are fused to enable them to participate in the display and calculation in the form of system parameters in the C language environment. In order to ensure better mutual adaptation, matching, and fusion between optimization parameters, taking advantage of the slow convergence of the minimum value of clustering, in the process of global hybrid calculation, c-means clustering is transformed into fusion clustering of different parameter relations through clustering leapfrog algorithm [18], so as to make the global parameter hybrid process more search capable and improve the overall visual display accuracy and accuracy.

The specific implementation steps are as follows:

*Step 1: parameter normalization*: set the total population obtained by the optimization coefficient as $N$ and the number of cluster fusion as $n$. At the same time, define the membership relationship in the transformation and fusion process as the original matrix, complete the membership division according to the clustering characteristics before transformation, calculate and obtain the cluster conversion center between the optimization quantity and the relationship quantity according to formula (6), complete the parameter mapping, and code it according to the leapfrog clustering hybrid algorithm [19].

Hybrid leapfrog algorithm [20] is a heuristic computing technology, which has the strongest advantage of global search ability. The hybrid leapfrog algorithm is used to carry out local search, so as to obtain the optimal solution and the best enterprise internal control information display scheme.

Display scheme code

The internal control information of several enterprises is displayed and distributed to the server, the frog individual of the hybrid leapfrog algorithm is used to encode the scheme, and the optimal solution is found in the way of optimization.

Table 1: Evolution of internal control elements of enterprises.

| Development stage | Specific stage | Number of elements | Specific elements |
|---|---|---|---|
| Embryonic internal control period | Internal check | Single element | Internal containment |
| | Internal accounting control stage | One element | Accounting control |
| Audit technology oriented internal control period | Internal control system stage | Two elements | Accounting control and management control |
| | Internal control structure stage | Three elements | Control environment, accounting system and control procedure |
| | Internal control framework stage | Five elements | Control environment, risk assessment, control activities, information and communication, internal supervision |
| Management oriented internal control period | Risk management framework stage | Eight elements | Internal environment, goal setting, transaction identification, risk assessment, risk response, control activities, information and communication, monitoring |
| | New internal control framework stage | Five elements | Control environment, risk assessment, control activities, information and communication, monitoring |

When the enterprise internal control information display contains 3 resources and 5 tasks, its total code $\chi$ is expressed as follows: $\chi = [2.3, 3.2, 2.5, 1.8, 2.0]$. After decoding, it is expressed as $\chi = [2, 3, 2, 1, 2]$.

According to the decoding expression, the frog individual schedules the first task, the third task and the fifth task to resource 2, and task 2 and task 4 are scheduled to resource 3 for execution.

*Step 2: relationship quantity conversion matching*: complete the frog group matching between the original clustering parameters and the relationship quantity according to the calculation results of formula (10) [21], obtain the adaptation function of each individual according to the matching degree, and arrange the individuals corresponding to the adaptation function in descending order.

The task should be completed within an appropriate time after scheduling, so it is necessary to set the fitness function, which is defined as follows:

$$\text{Fitness}(\chi) = 1 + \frac{T(\chi) - T(\chi_i^b)}{T(\chi) - T(\chi_i^w)}, \tag{10}$$

where $\text{Fitness}(\chi)$ represents fitness function, $T$ represents time, $\chi_i^b$ represents the display scheme with the slowest execution speed, and $\chi_i^w$ represents the display scheme with the fastest execution speed.

In step 3, the update particles are brought into each individual of the relationship conversion quantity [22, 23], and the update of the conversion clustering frog population is completed. The worst individual and region of the population species are obtained according to the update effect, and the number of iterations of the individual or region is increased until the update is completed.

In step 4, the updated frog population is defined as a new population, and the optimal solution of the new population is calculated.

Step 5 repeats steps 2 to 5. When the number of iterations reaches the maximum, the corresponding global coefficient is the cluster conversion center, indicating that the cluster conversion is successful, that is, the data fusion is successful, and the optimal scheme for the visual display of the enterprise's internal control information is obtained. The scheme is used to visually display the enterprise's internal control information.

*4.3. Optimize the Visual Display Scheme.* On the basis of Section 3.2, optimize the visualization scheme of enterprise internal control information.

Keeping the clustering feature indicates that the maximum distance difference between each pixel of the visual display image is related to the difference between each display coefficient of the enterprise's internal control information. This feature is evaluated by the clustering matrix correlation $\rho$ between each pixel of the two sets of data. The closer the $\rho$ value is to 1, the better the visual display image distance maintains the feature. In the real operation, in order to reduce the computational complexity of the method, the dimension of the evaluation data can be reduced in advance. The analytical formula of the correlation coefficient is as follows:

$$\rho = \frac{(X^T Y) - \bar{X}\bar{Y}}{\text{std}(X)\text{std}(Y)}, \tag{11}$$

where the clustering matrix $X$ represents the Euclidean distance between each display coefficient vector in the enterprise's internal control information. The clustering matrix $Y$ represents the Euclidean distance of the visual display image in CIELAB space [24]; $|X|$ represents the cardinality of $X$, $\bar{X}$ and $\bar{Y}$ represent the average of $X$ and $Y$, respectively, and $\text{std}(X)$ represents the standard deviation of $X$.

In order to better fit the display coefficient characteristics and visual characteristics, the clustering matrix $X$ is

Table 2: Simulation parameter setting.

| Parameter type | Value |
|---|---|
| Simulation area | 240 × 240 |
| Number of node topologies | 20 |
| Routing and forwarding protocol | IEE802.15.4 |
| Enterprise internal control information characteristic distribution variable | 1200 |
| Address resolution | 12.4 |
| Location of nodes | (0, 0) |

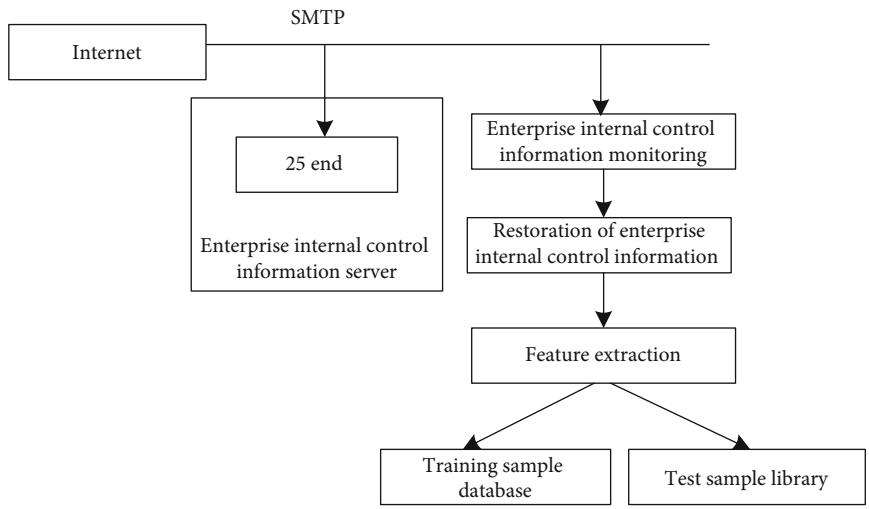


Figure 5: Selection of enterprise internal control information samples.

expressed as the display coefficient angle between each display coefficient. The derivation formula of the display angle $\theta$ is as follows:

$$\theta = \cos^{-1} \sum_{i=1}^{n} t_i r_i, \tag{12}$$

where $t$ and $r$, respectively, represent two display coefficient vectors with length $n$.

Separability refers to that the generated color visual display image has high interpixel-specific contrast and interclass separability. This property can be evaluated by the mean $\delta$ of color differences between pixels [25, 26]. The higher the $\delta$ value, the more prominent the difference between each pixel of the visual display image and the stronger the separability. It is described as follows:

$$\delta = \delta |Y||Y|_1, \tag{13}$$

where $|Y|_1$ and $|Y|$ represent the norm and cardinality of $Y$ in turn.

In order to make the enterprise internal control information have the visual perception function when it is visualized in low dimension, but also have more available information and good visual effect, in this paper, the overall goal of visualization means is to maximize the separability of the result visualization display image on the premise of excellent display characteristics between the result visualization display image and each pixel of the enterprise's internal control information.

Set the initial HSI to $I(s, k)$, $s$ represents the spatial azimuth coordinates of the display coefficient vector, and $k$ represents the number of bands. Optimize the initial enterprise internal control information to CIELAB space with symmetrical perceptual characteristics, and define the visual display image as $U$; then, the optimization scheme of pixels in $U$ is as follows:

$$U = \delta \min \eta_{s,t} - \varphi(u_s, u_t), \tag{14}$$

where $\eta_{s,t}$ represents the display coefficient angle between the high-dimensional display coefficient data in the azimuth of $s$ and $t$ and $\varphi(u_s, u_t)$ represents the distance correlation between two pixels in the azimuth of $s$ and $t$ of the low-dimensional visual display image.

When the overflow distortion of color space conversion is not higher than 3%, in order to ensure the maximum separability of visual display image $U$, each pixel point needs to be distributed in color space as much as possible. In order to achieve the abovementioned global design objectives and achieve the visual description of the color visual display image of enterprise internal control information, the optimization method is divided into four steps: clarify the two-dimensional chromaticity coordinates of each category end

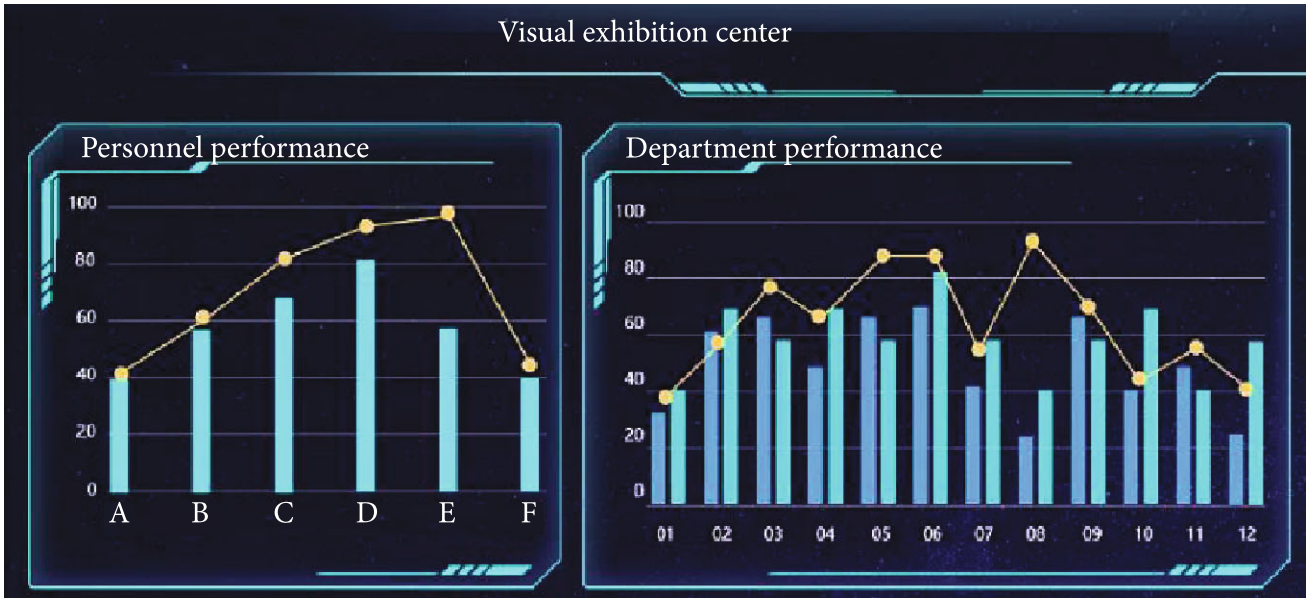


Figure 6: Visual effect display.

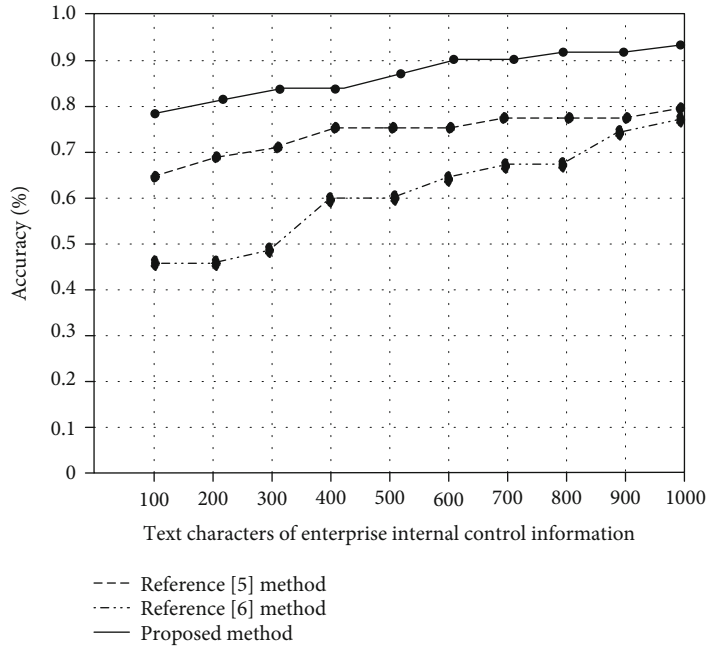


Figure 7: Experimental results of keyword extraction accuracy by different recognition methods.

element; specify the brightness of each end element; color and highlight mixed pixels; locally optimize and correct the color visual display image.

## 5. Experimental Research

Considering that references [5, 6] have great advantages in enterprise internal control information processing, this paper designs experiments as a comparative method to verify the comprehensive effectiveness of the proposed visual display method of enterprise internal control information.

*5.1. Experimental Preparation.* The visual display method is designed with Visual C + + and MATLAB. The Simulink tool is used to read the enterprise internal control information, extract the characteristic component of the information, and set the coverage of the enterprise internal control node to $240 \times 240$, the node scale is set to 300 cm, the optimal control points are 10, and the information communication coverage radius of the output node is $r = 1.5$. Other simulation parameter settings are shown in Table 2.

In the experimental research on the visual display method of enterprise internal control information, a large number of enterprise internal control information sample

Table 3: Comparison results of information utilization.

| Test sample type | Information utilization/(%) | | |
|---|---|---|---|
| | Proposed method | Reference [5] method | Reference [6] method |
| a | 96.8 | 93.4 | 94.5 |
| b | 97.4 | 93.2 | 95.3 |
| c | 98.1 | 93.7 | 95.7 |
| d | 99.2 | 94.3 | 94.8 |
| e | 96.3 | 93.1 | 94.0 |
| f | 97.7 | 93.2 | 95.5 |
| g | 98.5 | 94.1 | 94.3 |

Table 4: Relationship between response time and dimension.

| Dimension | Response time/(s) | | |
|---|---|---|---|
| | Proposed method | Reference [5] method | Reference [6] method |
| 20 | 78 | 85 | 89 |
| 30 | 80 | 88 | 93 |
| 40 | 83 | 92 | 98 |
| 50 | 85 | 96 | 104 |
| 60 | 88 | 100 | 110 |
| 70 | 91 | 105 | 116 |
| 80 | 94 | 108 | 122 |
| 90 | 97 | 112 | 127 |
| 100 | 101 | 117 | 134 |
| Average value/(s) | 88.56 | 100.33 | 110.22 |

data are used, which comes from the enterprise internal control information server in the network center. In order to be closer to the truth and correctly reflect the proportion of enterprise internal control information and legal enterprise internal control information on the network as much as possible, in the experimental preparation, the enterprise internal control information sample is selected by multiple random sampling. The monitoring point is in the same network segment as the enterprise internal control information server. Monitor the 25 port of the enterprise internal control information server. After analyzing the monitored content through SMTP protocol, restore the enterprise internal control information and extract the characteristic information of the enterprise internal control information sample. Establish training sample database and test sample database. The process of selecting enterprise internal control information samples is shown in Figure 5.

Set the sampling frequency of enterprise internal control information in the sampling space as 30 Hz, the cluster analysis center corresponding to the time volume as 20 s, and the sample data scale as 20 MB~1.5 GB. Take 20 MB as the sample group division index, in which the sample group $N$ contains a total of 42081 particle swarm. In the process of particle swarm clustering in which the sample data is extracted, the global space search dimension value is stable at 50, and the particle swarm movement probability corresponding to the sample data is about 0.36. The number of iterations of sampling is set to 6000.

The experiment is carried out under the above parameter settings, and the specific results are as follows.

### 5.2. Result Analysis

(1) Visual effect display of this method

According to the above parameter settings, taking an enterprise as an example, the proposed method is used to visually display its internal performance information, and the display results are shown in Figure 6.

It can be seen from Figure 6 that the proposed method can effectively extract the internal performance information of the enterprise by using the cluster analysis method and display it in the terminal interface, which has a certain effectiveness.

(2) Accuracy of keyword extraction of enterprise internal control information

In the visual display of enterprise internal control information, extracting the keywords of enterprise internal control information text is a key step. In the experimental research, different visual display methods of enterprise internal control information are used to extract the keywords of enterprise internal control information text. The extraction of keywords is closely related to the length of the text, and the number of characters of enterprise internal control information text is taken as the variable, and calculate the accuracy of keywords extracted by different recognition methods. The experimental results are shown in Figure 7.

As can be seen from the results in Figure 7, with the gradual increase in the number of characters of enterprise internal control information text, the keyword extraction accuracy of the two conventional methods is only between 0.4 and 0.8, and the result accuracy of the proposed enterprise internal control information visual display method is between 0.8 and 1.0. In contrast, the keyword extraction of the proposed enterprise internal control information visual display method based on cluster analysis algorithm is more accurate.

(3) Information utilization

During the visual display of internal information of the enterprise, it is necessary to improve its information utilization rate as much as possible and display more useful information for users. Therefore, the information utilization rate is set as the evaluation index, and the internal control information of the enterprise includes a~g seven different types of data. The specific experimental comparison results are given in Table 3.

According to the experimental data in Table 3, although the information utilization rate of the two conventional methods is higher than 93%, the information utilization rate of the proposed method is significantly higher, and the maximum information utilization rate can reach 98.5%. The main reason is that the proposed method integrates the

internal control information of the enterprise, eliminates useless information, and comprehensively improves the information utilization rate.

(4) Visual display time

The data dimension will have a certain impact on the response time of the whole method. The following experimental tests compare the response time of three different methods and the change relationship between dimensions. The specific experimental comparison results are shown in Table 4:

By analyzing the experimental data in Table 4, it can be seen that when the data dimension continues to increase, the response time of different data visualization methods shows a straight-line upward trend. However, compared with the other two methods, the response time of the proposed method is significantly lower, and the average response time is 88.56 s. The main reason is that in the process of data visualization research, the comprehensive performance of the whole method is effectively improved by clustering the internal control information of the enterprise.

## 6. Conclusion

The deepening of national informatization makes the internal control information of enterprises more and more flooded, which brings great trouble to users and enterprises. Therefore, this situation can be alleviated by identifying the internal control information of enterprises. In this paper, according to the word segmentation characteristics of enterprise internal control information, other enterprise internal control information in the enterprise internal control information set is identified. In this process, with the help of the real-time discrimination ability of cluster analysis algorithm, the purpose of identifying enterprise internal control information is achieved. On this basis, the visual display of enterprise internal control information is realized by optimizing the visual display coefficient, parameter visual fusion, and other processes. In the next research process, we will focus on the balance between the accuracy and efficiency of enterprise internal control information clustering. In order to cluster the internal control information of enterprises with high precision, speed up the clustering speed and optimize the visual display effect.

## Data Availability

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Conflicts of Interest

The authors declared that they have no conflicts of interest regarding this work.

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## References

[1] H. Lixin, Y. Cheng, C. Xinsheng, and L. Na, "Research on internet enterprises' internal control of procurement business," *Management Review*, vol. 33, no. 10, pp. 325–339, 2021.

[2] W. U. Wenrui, "Feasibility recommendations for applying the internal enterprise controls in the financial sharing model," *Value Engineering*, vol. 41, no. 10, pp. 50–52, 2022.

[3] S. I. Chang, L. M. Chang, and J. C. Liao, "Risk factors of enterprise internal control under the Internet of Things governance: a qualitative research approach," *Information & Management*, vol. 57, no. 6, article 103335, 2020.

[4] L. Yeyu, "Analysis of internal control of construction enterprises based on risk management," *Value Engineering*, vol. 40, no. 36, pp. 28–30, 2021.

[5] A. Milani, F. V. Paulovich, and I. H. Manssour, "Visualization in the preprocessing phase: getting insights from enterprise professionals," *Information Visualization*, vol. 19, no. 4, pp. 273–287, 2020.

[6] T. Hong and J. Chunyuan, "Visual analysis of corporate information disclosure research in China based on mapping knowledge domain," *Information Science*, vol. 38, no. 12, pp. 98–104, 2020.

[7] X. Liying, J. Dan, C. Yongjie, and C. Shuzhen, "Visual analysis on knowledge map of information disclosure of corporate social responsibility," *Science & Technology and Economy*, vol. 33, no. 3, pp. 16–20, 2020.

[8] M. Xianglong and B. Yingjie, "Application research on the safety information management visualization system take the safety control system of manufacturing enterprises as an example," *Modern Informationn Technology*, vol. 5, no. 6, pp. 141–143, 2021.

[9] A. Kaur and Y. Kumar, "A multi-objective vibrating particle system algorithm for data clustering," *Pattern Analysis and Applications*, vol. 25, no. 1, pp. 209–239, 2022.

[10] L. Xiaohong, Z. Renlong, and S. Miyuan, "Quantum hybrid particle swarm optimization based on cloud model and its application," *Statistics and Decision*, vol. 37, no. 3, pp. 54–58, 2021.

[11] F. Han, M. Zheng, and Q. Ling, "An improved multiobjective particle swarm optimization algorithm based on tripartite competition mechanism," *Applied Intelligence*, vol. 52, no. 5, pp. 5784–5816, 2022.

[12] M. Yimin, G. Dejin, L. Liefa, and C. Zhigang, "Parallel division clustering algorithm based on spark framework and ASPSO," *Journal on Communications*, vol. 43, no. 3, pp. 148–163, 2022.

[13] W. K. Peprah and I. O. Amponsem, "The impact of computerization on financial reporting practice: the perspectives of international non-government organizations," *Open Journal of Accounting*, vol. 10, no. 3, pp. 105–110, 2021.

[14] H. Chau and K. Liu, "Development of accounting practice in industrial era," *Journal La Bisecoman*, vol. 1, no. 6, pp. 1–12, 2020.

[15] O. O. Sosnovska and M. O. Zhytar, "The elements of methodology of the economic security management of enterprise," *Business Inform*, vol. 10, no. 513, pp. 204–213, 2020.

[16] S. Xiaoting, "Internal control problems and safeguard measures of leather enterprises. China," *Leather*, vol. 50, no. 8, 2021.

[17] W. Xiang, "Xie Shengjun. Simulation of fast mining algorithms for low-dimensional redundant data in weighted social networks. Computer," *SIMULATION*, vol. 38, no. 8, 2021.

[18] X. Zhihong, Y. Tian, Y. Wenjie, and B. Lihua, "Collaborative filtering recommendation based on fuzzy clustering and improved shuffled frog leaping algorithm," *Application Research of Computers*, vol. 35, no. 10, pp. 2908–2911, 2018.

[19] S. Xiaoning, C. Qingzhou, P. Hongli, Y. Xuan, and H. Yao, "A three phases shuffled frog leaping framework for multi objective combinatorial optimization," *Control and Decision*, vol. 37, no. 4, pp. 973–981, 2022.

[20] N. Kumar, S. K. Mahato, and A. K. Bhunia, "A new QPSO based hybrid algorithm for constrained optimization problems via tournamenting process," *Soft Computing*, vol. 24, no. 15, pp. 11365–11379, 2020.

[21] W. Linjing, N. Lulu, B. Guo, H. Zhenxing, and G. Shirun, "K-mediods cluster mining and parallel optimization based on shuffled frog leaping algorithm," *Computer Science*, vol. 47, no. 10, 2020.

[22] C. Zhao and D. Guo, "Particle swarm optimization algorithm with self-organizing mapping for Nash equilibrium strategy in application of multiobjective optimization," *IEEE Transactions on Neural Networks and Learning Systems*, vol. 32, no. 11, pp. 5179–5193, 2020.

[23] Y. Zhang and Z. Jin, "Quantum-behaved particle swarm optimization with generalized space transformation search," *Soft Computing*, vol. 24, no. 19, pp. 14981–14997, 2020.

[24] D. Hongyan and W. Shitong, "Nearest feature space embedding method based on nonlinear distance metric," *Journal of Frontiers of Computer Science & Technology*, vol. 11, no. 9, pp. 1461–1473, 2017.

[25] W. Wang, "A reversible data hiding algorithm based on bidirectional difference expansion," *Multimedia Tools and Applications*, vol. 79, no. 9-10, pp. 5965–5988, 2020.

[26] M. Liu, X. Liu, X. Dong et al., "An improved spatiotemporal data fusion method using surface heterogeneity information based on ESTARFM," *Remote Sensing*, vol. 12, no. 21, p. 3673, 2020.