Intelligent Classification System of Financial Statistics Information Based on Recurrent Neural Network

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Abstract. The establishment of the information classification system plays a pivotal role in the fiscal information disclosure system. The fiscal statistical information classification is the basis for compiling the fiscal information disclosure catalogue and the prerequisite for the construction of the fiscal information disclosure catalog system. In order to better realize the effective processing of financial information, this research proposes an intelligent classification system for financial statistics information based on recurrent neural networks. First, optimize the system hardware structure and calculate the information security to ensure the accuracy and safety of financial statistics. Finally, it is confirmed by experiments that the intelligent classification system of financial statistics information based on recurrent neural network works better in actual application.

Keywords: Neural network · Financial statistics · Information classification · Information security

1 Introduction

At present, the financial information is basically provided by departments. When it is necessary to search across departments, users must judge which information is related to their own needs and which departments are stored in, which makes the query more difficult [1–3]. Therefore, it is necessary to break the barriers set by departments, put all the information related to something together in the form of theme service, and put the judgment that users need to make before in the financial department as far as possible, so as to improve the efficiency of financial information query. This requires us to consider the standard of classification system to ensure the establishment of a unified and standardized financial information disclosure catalogue system, so as to fundamentally ensure the overall management and macro grasp of financial information disclosure [4, 5].

The promotion of fiscal information disclosure is an inevitable requirement for scientific governance, democratic governance, and governance according to law. It is also an important manifestation of promoting social democracy, improving the social legal system, and building a country under the rule of law. It also makes financial information resources known to the public, fully shared and effective by the society The only way

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to use. Many issues are involved in the implementation of fiscal information disclosure, and the research, compilation, and release of the fiscal information disclosure catalog is undoubtedly the foundation and core of the entire fiscal information disclosure work, and it is also a concrete manifestation of the implementation and implementation of the "Regulations." Therefore, the public financial information catalog has become an important part of the public financial information work. Among them, the information classification system and core metadata are the core and foundation of the catalog system.

Recurrent neural network is an effective artificial intelligence algorithm, which has powerful memory function, fast convergence speed and good fitting effect. Therefore, it is applied to this study.

Therefore, this paper intends to discuss the classification system of the public financial information catalogue. It provides the entrance of financial information query and plays an auxiliary and navigational role in user retrieval. With the gradual development of financial information disclosure, the following problems need to be studied and solved: how to break the restriction of financial information, the relationship between the stability requirements of information classification and the change of financial institutions, the continuous improvement of various classification approaches, and the efficiency of information classification.

This paper uses the recurrent neural network to generate independent text information packets, and adjusts the parameters of reinforcement learning while building the framework of generating confrontation network, so as to build the hardware execution environment of recognition system. On this basis, the embedded network framework is built. With the help of EEPROM chip and ld3320 chip circuit, the integration process of network data information identification implementation behavior is supervised, and the software execution environment of the system is built.

2 Design of Intelligent Classification System for Financial Statistics Information

2.1 Hardware Configuration of Intelligent Classification System for Financial Statistics

From the perspective of the development of the Internet, it is easier and more acceptable for people to find information using search engines than to browse through classification levels. However, this method also has shortcomings. In most cases, users do not know the specific name or content of the target file when searching for the required financial information, and users have different information needs. This requires information provision and service departments to describe the characteristics of the information in a multi-dimensional manner in order to provide users with multiple entries and facilitate users' browsing and inquiries [6–8]. And in information classification, different classification methods can also be used, such as subject classification, organization classification, genre classification, service object classification, etc.

This paper designs and proposes an intelligent classification system of financial statistics information based on recurrent neural network. Firstly, the overall design framework of the system is constructed, and the software function model is constructed according to different levels; finally, the rationality of the system design is analyzed.

The hardware of the recurrent neural network intelligent classification system for financial statistics information is designed based on the principle of recurrent neural network. The recurrent neural network provides a dynamic and easy-scalable way for resources under the network-related service program, and according to the needs of users, Big data is configured in a distributed manner, and based on the SOA component model system, the compatibility of the principle of recurrent neural network is increased, thereby improving the stability of automatic classification and processing of big data.

Cui-techpnxp270 technology processing platform is used as the core content of hardware configuration for intelligent classification of non intrusive information. The platform selects ers2.4 processing chip, pxan-2.4 model as configuration structure, and Intel casxalen embedded microprocessor as the core module, which effectively keeps the main frequency of image processing between 420–462 MHz. In order to better guarantee the performance of intelligent classification of non intrusive load information, pna2.6 microprocessor and Intel speed step dynamic monitoring technology are added to the system. In the process of designing the hardware configuration of the system, considering the universality and long-term characteristics of the intelligent classification of information, we need to consider its compatibility and ensure that the system can be upgraded to pnxa2.4–2.8 level, so as to optimize the core board, motherboard, processor, LCD serial port and other modules. The hardware block diagram of the financial information intelligent classification platform is shown in Fig. 1.

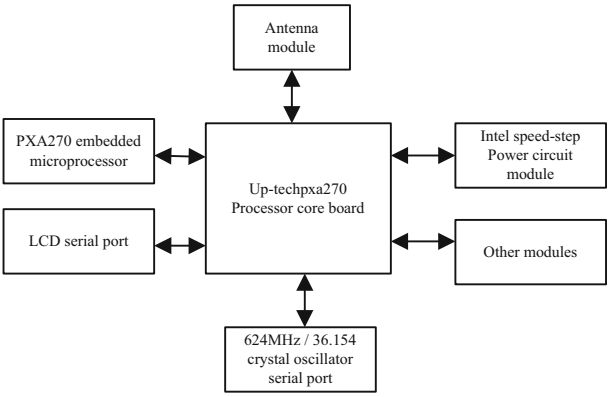

Fig. 1. System hardware block diagram

The design of data collector mainly includes the control chip of titanium network and single chip microcomputer, which transmits the collected data to the big data automatic processor through the interface of recurrent neural network principle. The power supply of the data collector generates 5 V voltage, which is transmitted to the voltage regulator above the MCU through the pin of the MCU, providing 3 V voltage for the work above the MCU [9, 10]. Then the 3 V voltage above the MCU is transmitted to other devices with the remaining 3 V power supply through the pin for its use. After the transmission of information and pin voltage, MCU exchanges information with other microcontrollers. After the circuit adjustment, the network signal based on the principle of recurrent neural

network is transmitted to the A/D converter above the MCU by using the pin of p25, and the network signal is converted into data through the A/D converter, so as to realize the acquisition of big data based on the principle of recurrent neural network.

The design requirements of the financial information intelligent classification system are fast information collection and large storage capacity. Based on the design requirements, the data processor is further optimized, and its structure is shown in Fig. 2.

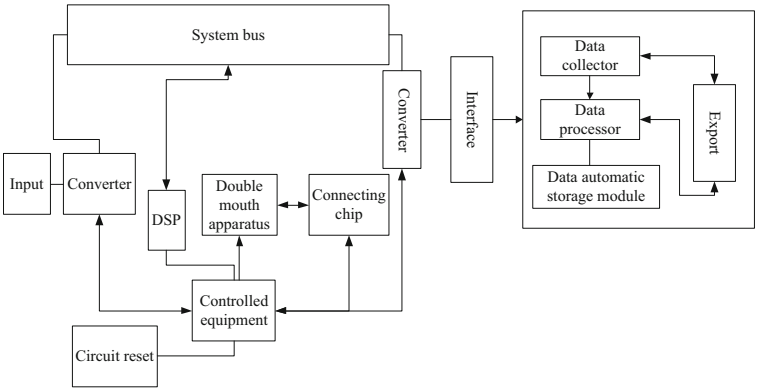

Fig. 2. Data processor architecture

It can be seen from Fig. 2 that the financial data processor mainly includes: bus transmission processor, connected circuit, control device, main control computer, external memory, and circuit reset. Detecting the memory occupancy ratio and CPU occupancy rate, the basic situation of the hardware configuration of related systems such as application servers and databases, and monitoring the operating status of the software platform can guarantee the quality of the system. The system configuration obtained by recording the detection indicators is shown in Table 1.

Table 1. Hardware configuration data of financial information classification

	Database The server	Application The server	Client
Number of CPUs	5	5	2
CPU type	–	–	P43.2G
Memory	16G	16G	512M
Hard disk	2 * 120G	2 * 320G	–
Network card	4 * 1000M	4 * 1000M	100M

Refer to the information in Table 2 and combine the multi-label classification technology to extract the relevant data of the various hardware configurations in the system

for comparison and analysis. The system data format can be optimized, and the deviations in the system data can be found in time to properly handle the financial information. In the overall structure of the system, the data input and output are designed based on the trigger device and the acquisition device. The data-triggered main line and the simulated main line jointly construct a data storage area, collect and transmit financial big data to the main control computer, and realize the system design through the data preprocessing module of the simulated main line. The main simulation route of fiscal big data is to transfer the fiscal big data in the classification system to the circular data buffer area through the dispatch of dynamic gain codes, and analyze it.

The design process of financial big data classification system is mainly: the signal flow of buffer and the signal flow transmitted by controller fuse with each other and flow to PCI bus. According to the scheduling of data management and the analysis of evaluator, the data signal is connected through QoS value. Its storage functions include:

(1) Apply the PCI bus to the processor of the external system controller for buffer operation.
(2) The data signal processing chip merges with the external storage space to realize the communication between humans and machines.
(3) Dynamic gain control refers to: the corresponding dynamic gain code is designed through the processor assigned by the computer to stabilize a large amount of data within a certain range.

The data storage module uses C8051F series MCU to complete the data storage. C8051F series of single-chip microcomputer set into a fully mixed SOC chip, its built-in flash memory program has a large storage space. The hardware working principle of C8051F series MCU and at45db80 is shown in Fig. 3.

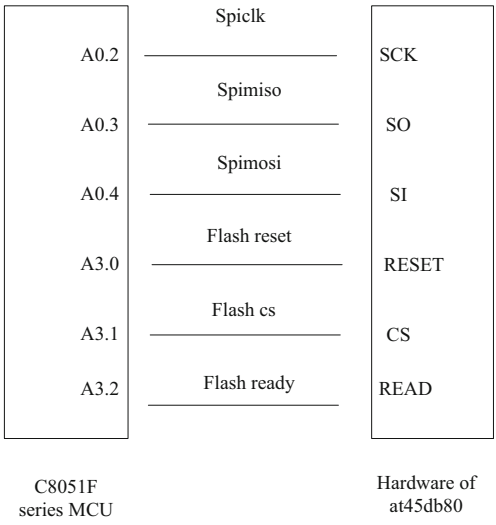

Fig. 3. SCM and hardware working principle diagram

It can be seen from Fig. 3 that the pins P0.2, p0.3 and P0.4 of C8051F series MCU are set as the main signal line of MoSi. Each main line is always connected with the hardware of at45db80 and the signal is output. Connect and reset the chips in the hardware of P3.0, P3.1, p3.2 and at45db80. C8051F series single chip microcomputer uses a one-time data storage with the memory opened instantaneously. The process is: first clear the representation of the serial peripheral interface, and then input bytes into the automatic storage of the data. If the detected serial peripheral interface is composed of at45db80 hardware, then the automatic data storage is finished.

According to the structure of the above-mentioned overall framework, the storage hardware is designed. The hardware modules mainly include: circuit synchronization, circuit reset, trigger device inside the module, circuit program loading, circuit storage interface. The circuit synchronization switch of the financial big data classification system should select a 12-bit sampling data module, and the modulated circuit should be subjected to dynamic gain feedback sampling. The linear dynamics of the classification system of financial big data can fluctuate in the range of −50–50 Bd. According to the characteristics of the Internet of Things environment, the functional module of automatic network interface is adopted, and the feedback dynamic gain module is designed. Based on this, the fiscal data storage sampling circuit diagram is optimized, and the specific structure is shown in Fig. 4.

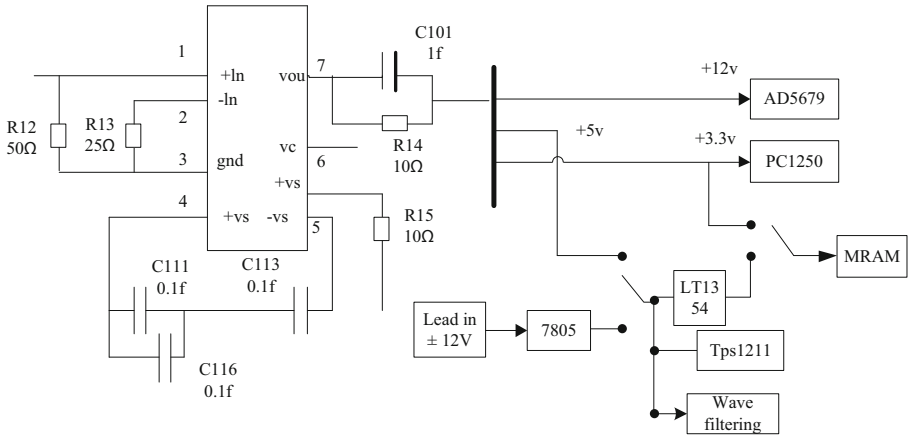

Fig. 4. Sampling circuit diagram of financial data storage

At the port of the clock circuit of the financial big data, the low-pass filter of the AD2014 4-stage switching power supply is placed, so that the output voltage has a certain degree of stability. Through the custom buffer function of the shared port, real-time classification between the host and big data transmission is realized.

The sampling circuit of the clock synchronization system based on financial big data storage can be designed to connect with the external IO device interface. The module of 12 bit sampling data set in the data channel is replaced by 16 bit, the bipolar sample input method of ±15 V is used, and the converter of EOC signal is used to convert tout into cnnst. The converted sequence code is used to realize the storage capacity expansion of

financial big data. The external interface of IO device uses the dynamic gain bidirectional channel of ad231 to control the circuit, and connects with the data of 95230a. Through the common power supply of external IO interface power supply and core power supply, the continuous storage of data is realized, so that the output waveform data has certain adaptive performance.

2.2 Optimization of Operating Algorithm of Financial Information Classification System

As we all know, once the financial information classification system is established, it should be relatively stable to facilitate use. With the development and progress of society, the management mode of government departments is constantly changing. Some departments will gradually develop and strengthen their functions, but some departments may gradually weaken or even disappear. At the same time, the merger of financial departments, the change of management scope and the change of document management system will affect the classification of financial information. This will cause difficulties or inconsistencies in the classification of new and old government information, which are the problems that need to be considered in our follow-up research.

In order to better meet the information needs of users, the operation algorithm optimization of the financial information classification system is designed. In the classification system, the most important should be the subject classification, but other classifications also need to be improved. In the description, the recursive neural network was used to label the financial information, such as name, subject, date of creation, genre, etc. Then use the neural network to identify the data and obtain the information of the dynamic control object, so as to solve the nonlinear problem in the traditional algorithm and realize the dynamic adjustment and optimization of the financial information. Figure 5 shows the block diagram of the designed recurrent neural network classification.

Using recurrent neural network method to classify financial information, on the one hand, we need to continue to improve and refine the subject classification, on the other hand, we also need to classify from other ways to facilitate users' search.

Financial information classification is similar to topic based text classification, which is a guided learning process. According to the pre-defined financial information classification system, the financial information classification is automatically determined. Therefore, the classification of financial information can be formally described as: given the class label set $C = \{c_1, c_2, \ldots c_m\}$ and financial information set $D = \{d_1, d_2, \ldots d_n\}$ of financial information, we can learn the relationship model $f : D \times C \rightarrow \{0, 1\}$ from the financial information set to the category set, and determine whether the new financial information f belongs to category c_i according to the relationship model d, that is:

$$f(d, c_i) = \begin{cases} 1 \; d \in c_i \\ 0 \; d \notin c_i \end{cases} \tag{1}$$

Most of the fiscal information classification research is a single label classification problem, at this time, the f function is a one-to-one mapping. There are also a few studies that regard it as a multi-label classification problem, and the corresponding f function is a one-to-many mapping.

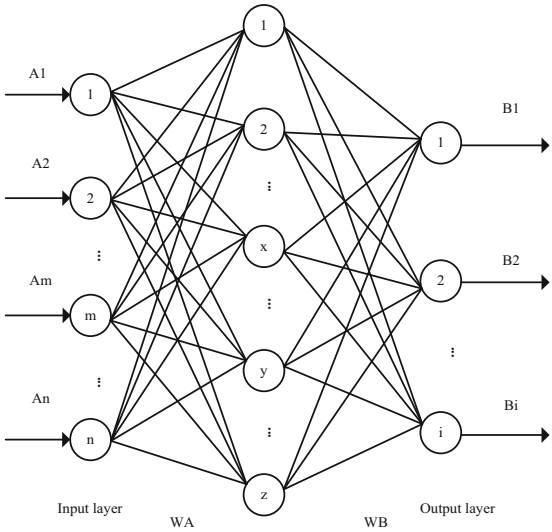

Fig. 5. Classification principle of recurrent neural network

Financial text classification studies the problem of single label classification. C represents all labeled financial information sets, and *cdt* represents a candidate feature word. If there is no *cdt* in C', the number of financial information. Before applying likelihood ratio test to feature selection, the following two hypotheses are examined:

$$(\text{H1}) : P(d \in C|cdt \in d) = p = P(d \in C|\overline{cdt} \in d) \tag{2}$$

$$(\text{H2}): P(d \in C|cdt \in d) = p_1 \neq p_2 = P(d \in C|\overline{cdt} \in d) \tag{3}$$

Assumption H_1 is the formalization of the independence assumption, which means that the appearance of *cdt* and the appearance of financial information d in financial information d are independent of each other. Hypothesis H_2 is the formalization of the non-independence hypothesis. If the appearance of p_1, p_2, and *cdt* is related to the appearance of d, then p_1 and p_2 can be calculated using maximum likelihood estimation, which are:

$$p = (f_{11} + f_{21})/(f_{11} + f_{12} + f_{21} + f_{22}) \tag{4}$$

$$p_1 = f_{11}/(f_{11} + f_{12}) \tag{5}$$

$$p_2 = f_{21}/(f_{21} + f_{22}) \tag{6}$$

If it is a Bernoulli event, then all the above hypotheses satisfy binomial distribution

$$b(p, k, n) = \binom{n}{k} p^k (1-p)^{n-k} f(d, c_i) \tag{7}$$

The logarithm of the likelihood ratio is:

$$\begin{aligned}\log\lambda &= \log\frac{L(H_1)}{L(H_2)} \\ &= \log\frac{b(p,f_{11},f_{11}+f_{12})*b(p,f_{21},f_{21}+f_{22})}{b(p_1,f_{11},f_{11}+f_{12})*b(p_2,f_{21},f_{21}+f_{22})}\end{aligned} \tag{8}$$

λ is only a concrete form of likelihood ratio, while $-2\log\lambda$ approximates x^2 distribution:

$$-2\log\lambda = \begin{cases} -2*lr & p_2 < p_1 \\ 0 & p_2 \geq p_1 \end{cases} \tag{9}$$

Among them:

$$\begin{aligned}lr &= (f_{11}+f_{21})\log p + (f_{12}+f_{22})\log(1-p) - f_{11}\log p_1 \\ &-f_{12}\log(1-p_1) - f_{21}\log p_2 - f_{22}\log(1-p_2)\end{aligned} \tag{10}$$

The larger the value of $-2\log\lambda$, the stronger the correlation between *cdt* and category C, and the better the ability to distinguish categories, the more helpful it is to distinguish C from C'.

$$l_{\text{avg}}(cdt) = \sum_{i=1}^{m} \Pr(c_i) * l(cdt, c_i) \tag{11}$$

The detailed process of feature selection algorithm based on LRT is given, which is used to select the feature words with the most classification ability. For each category., and the corresponding corpus each word appearing in it is regarded as C_i candidate feature word *cdt*, and its likelihood ratio $l(cdt, c_i)$ with category C and is calculated. One of the methods to calculate the final likelihood ratio score of *cdt* is to calculate the average value:

$$l_{\text{avg}}(cdt) = \sum_{i=1}^{m} \Pr(c_i) * l(cdt, c_i) \tag{12}$$

The corresponding feature selection method is referred to as LRTavg in this article. Another way is to find the maximum value.

$$l_{\max}(cdt) = \max_{i=1}^{m}\{l(cdt, c_i)\} \tag{13}$$

In many cases, users know what they want when looking for financial information, but sometimes they need to search or query the same kind of information or related information. At this time, the use of retrieval alone can not achieve the best results. In the process of financial information disclosure, it adopts the way of providing subject services according to the classification of service objects (audience), such as dividing the information service objects into citizens, enterprises and foreign citizens, providing specific relevant information for each object, and then clustering according to what they do. Its advantage is that even if the information is not clear, users can browse through the guidance provided by the classification results and quickly find the corresponding information.

2.3 Realization of Intelligent Classification of Financial Statistical Information

In order to ensure the effect of intelligent classification of financial statistical information, it is necessary to establish an information release system and a powerful information retrieval platform, which can ensure the needs of information release and information retrieval. Just like the current Internet, most problems can be solved with search engines. This method is technically easy to implement, consumes less time and energy, and has a lower cost, and the goal can be achieved quickly. Then, how to correctly handle the relationship between the two is not only related to the respective development of information classification and integrated retrieval, but also determines the future trend of my country's fiscal information disclosure work.

Financial project information coding is not only the embodiment of project information classification system, but also the basis of WBS for computer management and PMIS application. The information coding of the project needs to go through a certain process, as shown in Fig. 6.

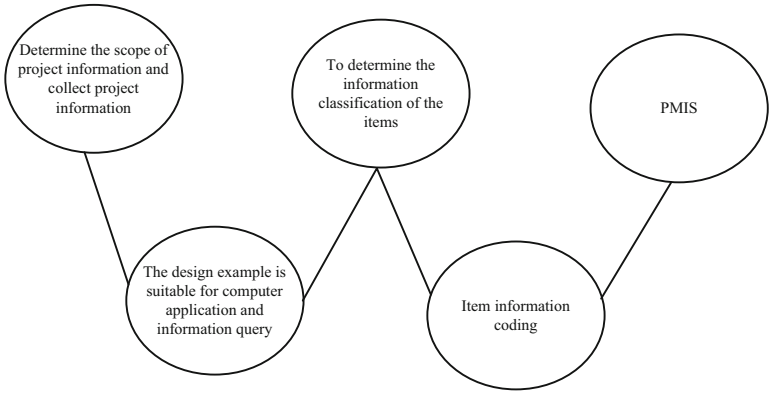

Fig. 6. Optimization of information classification coding process

Financial project information coding includes project structure decomposition and coding, work task decomposition and coding, unit code of project implementation parties, project contract code, design drawing catalogue and coding, design change classification and coding, financial information classification and coding, etc. project decomposition coding and work task coding are the basis of many coding. The description of financial disclosure information can be classified and described through multiple dimensions. Through the following four dimensions: subject classification, genre classification, organization classification and service object classification.

Among them, subject classification: the method of classifying information resources based on their content attributes—themes. Genre classification: that is, the method of classifying information resources based on their external attributes-genres. Institution (department) classification: the method of classifying information resources based on the responsible unit—department or institution. Service object classification: the method of classifying information resources based on the specific groups targeted by the audience.

Specifically applied to the PMIS system, the process and work content of the project coding system are shown in Fig. 7.

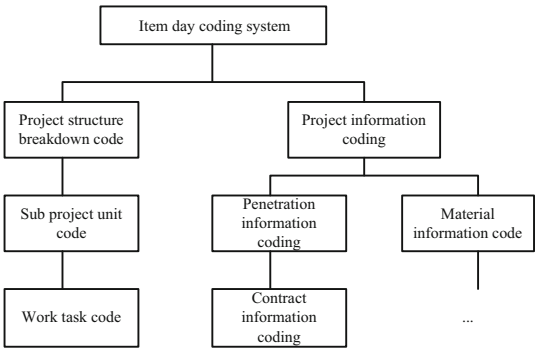

Fig. 7. Classification of abnormal financial information

Project structure coding is the core of the identification system, which enables the information generated in the whole process of project implementation to be linked and classified through the system. All kinds of different information, such as progress information, investment information, capital information, quality information and contract information, can be connected with each other on this basis.

Financial information intelligent classification is the exact opposite of traditional distributed and intrusive information intelligent classification. It has simple hardware configuration and complex analysis software. Analysis software can collect data for complex mathematical analysis and obtain useful information. The system recognizes or estimates the type, operating status and related parameters of each load based on this information. Through the analysis of these data, the system operation law of multi-label classification non-invasive load monitoring can be better studied, so as to realize more intelligent monitoring.

In the process of monitoring data transmission, when the data detected by the non-invasive intelligent classification of information fluctuates up and down within the normal range, the intelligent classification of information automatically defaults to the normal state of the monitored financial data, and no alarm is required. Once the collected characteristic data exceeds the normal range, the information intelligent classification will automatically check the fault area and send an alarm in time, so as to ensure the safety of the system operation. The specific operation flow of the non-invasive intelligent classification of load information is shown in Fig. 8.

When the attributes of a certain dimension of financial disclosure information change, it will not affect the attributes of other dimensions, thus ensuring the stability of the catalog system to the greatest extent. Each category should have at least one corresponding field in the metadata.

In the actual implementation process, the classification methods do not necessarily have to be adopted at the same time, but at least the subject classification must be adopted. After the conditions are mature, other classification methods will be gradually adopted

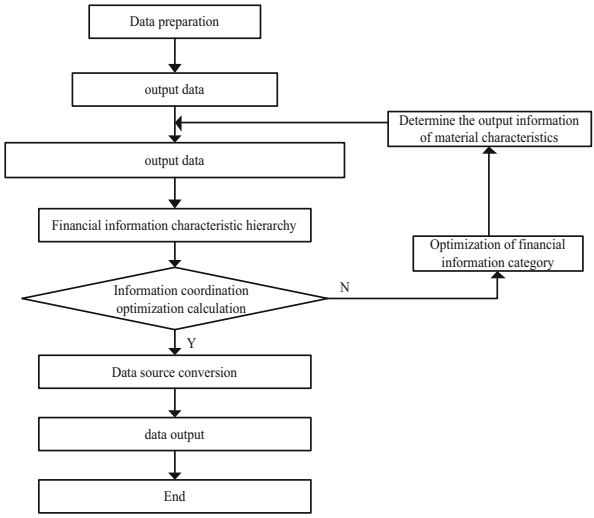

Fig. 8. Optimization of financial information classification process

in order to carry out a more comprehensive and systematic information classification of financial information.

3 Analysis of Results

In order to verify the rationality of the design of the financial statistics information intelligent classification system, this paper takes the data of a financial company as an example. Set the DAC resolution in the controller to 16 bits. Set the power resolution in the amplifier to 15 bits. The system is composed of three computers. The hardware configuration of the system is Intel dual - core 2.6 GHz processor and 16 GB memory size. The experimental parameter settings are shown in Table 2.

Table 2. Experimental parameters

Parameter	Numerical
Number of computers	3 sets
Processor	3.5 GHz
Memory	32 GB
Database	SQL server
Server	Single/double disk array

Based on the above experimental environment, the operation effect of this paper and the traditional system is compared, and the detection results are recorded, as shown in Fig. 9.

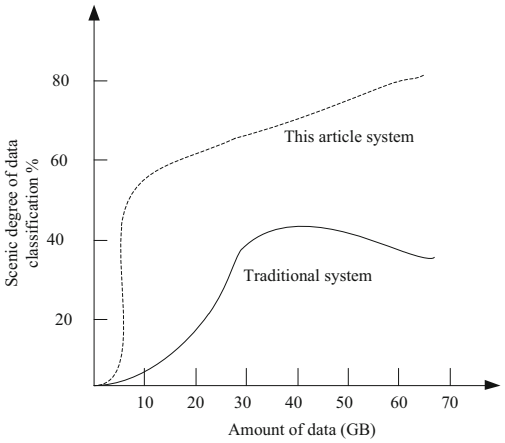

Fig. 9. Comparison test results

As can be seen from Fig. 9, in the actual application process, compared with the traditional system, the financial information classification system designed in this paper has higher accuracy, better processing effect on massive data, and better guarantee the security of financial information processing.

4 Conclusion

In this research, some analysis and discussion of the information classification system in the fiscal information disclosure catalog system are carried out, and an intelligent classification system of fiscal statistics information based on recurrent neural network is proposed. The experimental results prove the effectiveness of the system, which can better assist the implementation and development of the classification and processing of fiscal information in my country.

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