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Bank Financial Business Risk Assistant Management System Based on Clustering Algorithm

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ABSTRACT
In recent years, compliance risk has gradually become an important risk faced by China's commercial banks in addition to credit risk, market risk and operational risk. The lifeline of commercial banks is risk management. In view of the harmfulness of the financial crisis, this paper tries to find out the relevant index parameters that have obvious impact on the financial risk. By building a prediction model, it can predict the risk that may have an impact on China, effectively find the potential financial risk, serve the operation of the macro financial market, and improve the accuracy of financial supervision. In this paper, the current web crawler technology and clustering data mining analysis technology are applied to build an efficient audit risk management system based on bank financial risk management. It takes a lot of time, manpower and energy to screen the original messy and high-risk huge basic data, which effectively improves the management and control efficiency of audit risk in the current social security field, it reduces the workload of audit risk identification and control in the audit process, and can be popularized in some areas. Based on the construction of chaotic neural network prediction model based on wavelet clustering algorithm and FCM clustering algorithm, this paper makes an empirical comparison of the early warning effect of the two models, and compares the advantages and disadvantages of adding different clustering algorithms and chaotic neural network prediction through empirical comparison. After model comparison and analysis, it is found that the risk prediction system of chaotic neural network prediction model based on wavelet clustering algorithm has high accuracy, and the maximum error is only 0.1173, which meets the needs of users.

Keywords: *Clustering Algorithm, Banking and Financial Business, Risk Assistance, Neural Network.*

1. INTRODUCTION

With the rapid development of the global economy, the logistics industry has also ushered in a period of rapid development. The volatility of the global economic development makes the role of logistics finance in the market economic environment and its important position in the market environment more and more obvious [1-2]. However, while the logistics financial business plays an important role in the operation of market economy, the emergence of various risks also plagues the smooth development of logistics financial business of logistics companies to a great extent [3-4]. Therefore, how to strengthen the risk management of logistics financial business has increasingly become an important direction of industry research [5-6].

There are a lot of research results about the financial business risk assistant management system. For example, some scholars take AD-company as the research object, starting from the actual situation of the company's logistics financial business, using the expert evaluation method combined with SPSS statistical software for reliability analysis, and established the logistics financial business risk management evaluation index system [7]. Some scholars have also designed and implemented auxiliary software for fund business management, which combines the basic management requirements and specifications of the fund industry with the special business management requirements of the company. On the basis of the existing general business platform, it focuses on providing practical and efficient auxiliary tools for business personnel in terms of the flexibility of transaction execution and the completeness of investment information analysis [8].

The main research work of this paper is to apply the current web crawler technology and clustering data mining analysis technology, take the bank financial risk management as an example, to build an efficient audit

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risk management system, so that the original need to spend a lot of time, manpower, energy to screen the original messy, contains high-risk huge basic data, it effectively improves the management and control efficiency of audit risk in the current social security field, reduces the workload of audit risk identification and control in the audit process, and can be popularized in some areas.

2. ANALYSIS OF FINANCIAL BUSINESS RISK ASSISTANT MANAGEMENT SYSTEM BASED ON CLUSTERING ALGORITHM

2.1. Data Mining Technology

In the process of building and designing the audit risk management system based on data mining, this paper will adopt the general data mining analysis model, and use the clustering analysis algorithm to complete the mining of the association between the data information in the system and the related security information, so as to solve the security risk problem in the data identification audit link [9-10].

2.1.1. Data Similarity

Correlation is the basis of clustering analysis algorithm. The theory assumes that the same target value is estimated based on multiple data information objects, so that X_i and X_j is the data result described by the i-th data information object and the j-th data information object respectively, where X_i and X_j all obey Gaussian distribution. Their PDF curves are used as the characteristic functions of data objects, denoted as $p_i(x)$, $p_j(x)$, so X_i and X_j is X_i, X_ A measurement of J in order to represent X_i and the degree of difference between X_j, the introduction of confidence d_{ij},the value of d_{ij} represents the confidence degree between the i-th data information object and the j-th data information object, σ_i is the mean square error.

$$d_{ij} = 2\int_{x_i}^{x_j} p_i(X|X_i)dx \quad (1)$$

$$d_{ji} = 2\int_{x_j}^{x_i} p_j(X|X_j)dx \quad (2)$$

$$p_i(X|X_i) = \frac{1}{\sqrt{2\pi}\sigma_1}\exp\left\{-\frac{1}{2}\left(\frac{X-X_i}{\sigma_i}\right)^2\right\} \quad (3)$$

$$p_i(X|X_j) = \frac{1}{\sqrt{2\pi}\sigma_j}\exp\left\{-\frac{1}{2}\left(\frac{X-X_j}{\sigma_j}\right)^2\right\} \quad (4)$$

$p_i(X|X_i)$, $p_i(X|X_i)$ is expressed as probability density, the smaller the value of d_{ij}, the closer the measurement results between I and J. On the contrary, the greater the difference.

2.1.2. Fitting Function RBF Neural Network

According to the phase space reconstruction prediction model, this paper uses RBF neural network as the fitting function. In order to determine the structure of RBF network, according to the analysis method of chaotic time series, the input dimension and training sample pair of RBF neural network model are determined by using the estimated embedding dimension and delay time of reconstructed phase space.

Suppose that the input layer of RBF neural network has m nodes, the hidden layer has h nodes and the output layer has 1 node. The most commonly used radial basis function is Gaussian kernel function.

$$\varphi(x, c_i) = e^{\left(\frac{-||x-c_i||^2}{\sigma_i{}^2}\right)}, i = 1,2,\dots,n \quad (5)$$

Where, σ_i is the width of the basis function of the hidden layer neuron.

2.2. Demand Analysis

2.2.1. Risk Assessment Management Function

1) Asset value risk assessment

The risk assessment function of asset value is essentially to solve the problem of how the bank's asset value will fluctuate under certain conditions, especially whether there is downward fluctuation of value in the relationship, which means the loss of asset value. Therefore, it is necessary to establish a scientific early warning mechanism, and risk measurement provides the basic basis for early warning. The function of asset value evaluation is divided into two types in this system according to the purpose of evaluation, namely, risk of credit value fluctuation type and liquidity risk assessment [11-12].

2) Credit risk assessment

Credit risk is aimed at two levels, which are the uncertainty of the repayment ability of specific customers and the uncertainty of the repayment ability of all customers of the bank at present. The latter analysis and evaluation is based on the former statistical analysis, so the former is the basis of the function.

Credit risk assessment function is not only for business managers but also for customer managers. From

the perspective of use, the user of the group functions for the customer manager must achieve the following ways of use. First, the navigator automatically opens the list of users managed by the customer manager according to the user identity, and the user selects the active customer object of the current business relationship. According to the selected objects, the system automatically retrieves all the financial management information generated after the loan investigation project and displays it according to the default risk associated indicators within the bank. The system also searches all the financial details of the historical period for users to refer to.

2.2.2. Risk Internal Control Management

1) Credit business process control

The risk internal control for credit business can be divided into two types, the first is the basic control function and the second is the internal control function of high-risk business. This classification is to consider that the credit business has different treatment methods according to the different loan types, and its typical business risk factors are different. If the unified implementation of the highest level of internal control treatment does not necessarily increase the complexity, it is not conducive to the business itself or the characteristics of risk management.

According to the above classification, the basic control function is effective for all credit business processes, while the business control of high risk type is only implemented automatically for the credit projects currently classified as high risk, which is regarded as the additional internal control processing requirements based on the basic internal control function.

2) Anti-fraud management

The monitoring rules against fraud can be divided into user access rules, credit rules, customer and guarantee customer credit fraud inspection rules and account transaction rules. Each kind of rules has specific monitoring attributes and benchmark values, such as account flow and the direction of capital flow. For the subject object of the confirmed fraud event, such as the account, the system will automatically close the transaction processing on the account, temporarily freeze the credit or guarantee transaction for the customer, temporarily revoke its access rights to the internal user and automatically join the blacklist.

3. SYSTEM DESIGN

3.1. Design of Transaction Execution Management Subsystem

The main task of transaction execution management subsystem is to execute instructions based on various fund transaction rules and parameters. The module adopts the object-based design pattern, with bistp as the object base class of various trading funds, psninfo as the object type of account information, and bisrules as the object type management unit of trading rules. The data structure of the bistp class object is described as follows. The bistp class object provides the base class for specific transaction. Its main attributes and member functions include: transaction number bisidx, current status code state, account object factx, transaction instruction information block bispminst, transaction rule condition verification function biscondvf, transaction effective execution function bisreff, and delegation revocation processing function int biscancel (...).

3.2. Design of Risk Control Management Subsystem

The transaction risk control subsystem encapsulates the risk control management function through the bisriskctp class object, and accesses the access function required by the transaction platform through the actxinfo class object.

3.3. Design of Business Integrated Information Management Subsystem

The fund business integrated information management subsystem manages cstmcapproc class objects, bisstvproc class objects, smtproc class objects and cmpfmproc internally, and performs transaction analysis for fund accounts, statistical analysis for transaction transactions, settlement reconciliation data analysis and fund management index analysis and evaluation respectively.

3.4. Basic Business Management Subsystem and Database Design

Database is the core component of basic business data management subsystem. Based on the traditional relational data model, the system expresses the static and dynamic information in the fund trading business. Each type of information entity is described based on specific attributes, and redundant attribute expression is eliminated through foreign key reference relationship. In the database design scheme, the important static information entities include fund account, account management rules, stock pool information, etc., while the typical dynamic entities include transaction entrustment records, instruction execution information, transaction instruction information, fund transfer records, etc.

In addition to the business data entities organized around the basic business, the data management subsystem generates business analysis view and fund distribution view and other derived information through statistics.

3.5. System Security Mechanism

In addition to the above core function module design, the system also needs to consider other auxiliary mechanisms, the important part of which is the security mechanism. In this system, the specific security mechanisms are account identity authentication, digital signature of transaction records and data secure communication mechanism for online transaction mode. The basic scheme is to use the security key generation mechanism and public key certificate mechanism implemented by our bank's unified security gateway, the security of business data is based on the built-in symmetric encryption mechanism of database platform.

4. EXPERIMENTAL ANALYSIS OF BANK FINANCIAL BUSINESS RISK ASSISTANT MANAGEMENT SYSTEM BASED ON CLUSTERING ALGORITHM

4.1. System Test

The running environment of the system test is Linux and DB2 database on the server side. QTP and LoadRunner are used to verify the function and program performance. This section summarizes the main test methods and specific examples as follows.

4.1.1. Unit Test

Firstly, the system takes the software object as the basic unit to complete the test

(1) The data type of program variable is reasonable.

(2) The type of object interface parameters is reasonable, and the verification of input parameters is realized correctly.

(3) The implementation of the algorithm is correct, the processing logic is complete and there is no redundancy.

(4) The program has the logic to deal with the abnormal state correctly.

(5) The configuration of source program file is reasonable.

(6) The program runs correctly, and the defects and faults of code level are completely eliminated after unit test.

4.1.2. Commissioning Test

On the basis of all the above unit level and module level function verification, and all the procedures and documents have been revised, the trial operation focuses on verifying the system deployment, optimizing the procedures and databases, verifying the correctness of the interoperability of Tongtong business system, and comprehensively evaluating the business anti risk support ability. Table 1 shows the contents of interoperability testing.

Table 1. Business platform interoperability test tasks

System module	Main test tasks
Integration test of Business Internal control module and fraud risk management module	Business record detection and compliance verification of different credit types
Integration test of Business Internal Control and asset value risk management module	Data access test, function access test
Integration test of the whole system with the bank's current core accounting and settlement platform	Access to transaction data of credit project, such as credit extension, interest settlement and credit out
Integration test of asset value risk management module and default risk management module	Customer index classification calculation
Integration test of fraud risk management module and business process control	Correctly identify business events that do not conform to business rules
Integration test of the whole system and the current audit business platform of the bank	Consistency of credit project data and business operational data

In the trial operation stage, the supporting effect of the anti-risk ability of the bank's current business is evaluated, such as the accuracy of value fluctuation early warning and the degree of avoiding loss in the aspect of asset value evaluation, and the accuracy of identifying abnormal variables such as abnormal account and business flow in the aspect of anti-fraud, through the evaluation of such indicators to determine the degree of effective prevention and control of the bank's current operational risk.

4.2. Empirical Analysis of Chaotic Local Prediction Model Based on Clustering Algorithm

4.2.1. Chaotic Neural Network Prediction Model Based on FCM Clustering Algorithm

The normalized data is input into the RBF neural network from 2008 to 2020. The data from 2008 to 2019 is used as the training data, and the data from 2020 is used

as the test set. The chaotic model prediction curve of FCM clustering algorithm is shown in Figure 1.

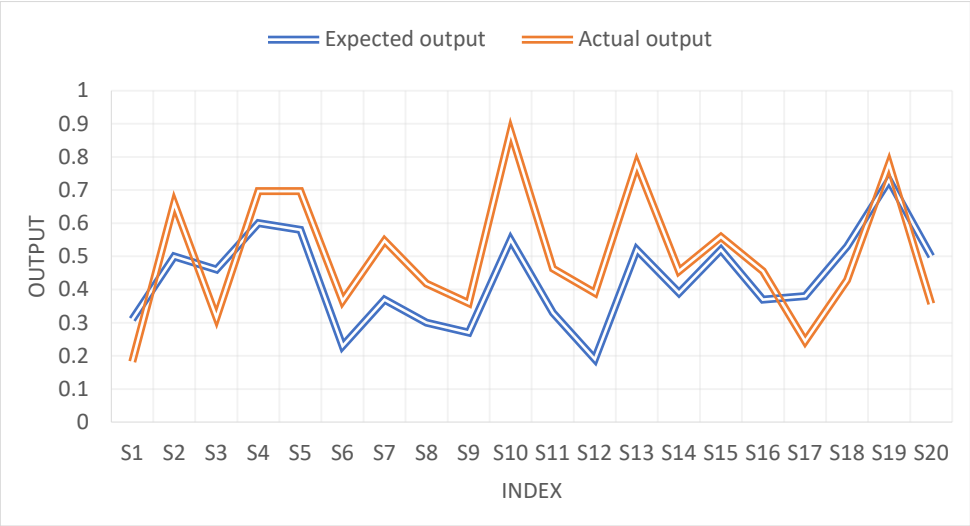

Figure 1. Chaotic model prediction curve of FCM clustering algorithm

It can be seen from the figure that the deviation between the actual output and the expected output is large, and the maximum error is 0.3265. Therefore, it can be concluded that the accuracy of the risk prediction system of the chaotic neural network prediction model based on FCM clustering algorithm is not high.

4.2.2. Chaotic Neural Network Prediction Model Based on Wavelet Clustering Algorithm

Based on the normalized data, the data from 2008 to 2020 are input into RBF neural network. The data from 2008 to 2020 are used as training data, and the data from 2021 are used as test set. Through the construction of wavelet mixed model for experiment, the prediction results are as shown in Figure2.

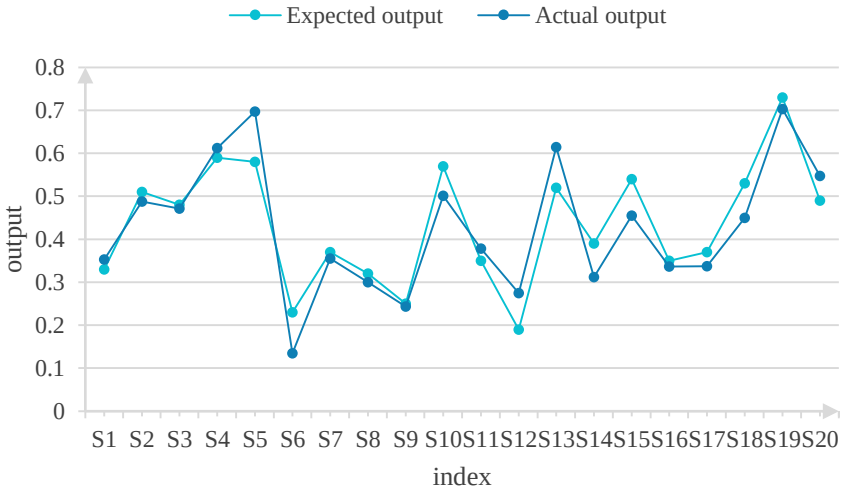

Figure 2. Prediction results of wavelet algorithm mixed model processing

As can be seen from Figure 2, the deviation between the actual output and the expected output is small, and the maximum error is only 0.1173. Therefore, it can be concluded that the risk prediction system of chaotic neural network prediction model based on wavelet clustering algorithm has high accuracy and meets the needs of users.

5. CONCLUSION

With the continuous improvement of China's social welfare, audit management in the field of social security has become more and more important. At the same time, its workload has become larger and larger. Many problems cannot be completely found by manual work. How to apply the current advanced network technology and data mining analysis technology to solve the efficiency problem of audit risk management, to realize the accurate identification of audit risk has become an urgent problem to be solved in the information construction of the current audit field. In view of this background, this paper proposes the application of Focused Web crawler technology and clustering self-learning algorithm to solve the problem of risk identification and management in the current audit field, and constructs an efficient and intelligent audit risk management system, it can effectively improve the efficiency of current audit risk identification and control, and reduce labor costs.

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