Research Article

Optimization of University Financial Services Using the Blockchain Technology

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At present, the financial work of most colleges and universities is facing the dilemma of low intelligence level. The financial sharing mode of colleges and universities using blockchain technology can effectively supervise their financial management while solving the problems of high costs related to financial sharing services, hidden dangers of data security, and low efficiency. Therefore, this paper makes an in-depth study on the application of blockchain technology and the financial sharing service mode of colleges and universities. Firstly, the University Financial Sharing Service Center platform based on blockchain technology is constructed. Furthermore, each module of the service center platform is described. Combined with the constructed platform, university finance is deeply mined by using the mining algorithm based on certain association rules, which is convenient for effective management. Finally, an artificial intelligence algorithm is used to adaptively optimize financial management. Similarly, the planning model and fitting algorithm of the least square method are used to control the risk of the financial management so as to realize the optimization of the financial sharing service mode. The experiment results demonstrate that the proposed method can effectively improve the efficiency of the financial sharing service and reduce the potential safety problems and costs of financial management.

1. Introduction

The level of financial management in colleges and universities will have a direct impact on the effectiveness of their strategy for decision-making across the institutes. With the gradual development of China’s higher education, the scale of university resources is also gradually expanding, and the requirements for the optimization of financial management systems have become even more. Some problems, such as difficult reimbursement, cumbersome process, low efficiency, too weak data analysis, and poor fund supervision, seriously perplex the relevant personnel of financial management in all colleges and universities. The traditional financial management system cannot meet the needs of gradually increasing business volume and the supply of financial information. Therefore, the optimization and upgrading of financial management systems are imminent and essential. In fact, the rapid development of blockchain technology brings new ideas and new directions to solve the current financial management problems of colleges and universities. The effective application of blockchain technology can provide an important guarantee for the information security and accuracy of financial data in colleges and universities. Furthermore, this will also improve the financial management system of colleges and universities so as to help improve the intelligent level of financial management, data, and information. Subsequently, this will strengthen the management of financial budget, optimize the efficiency of funds use, strengthen revenue and expenditure supervision, improve the transparency of financial budget and the efficiency of audit, and improve performance management. Therefore, using blockchain technology to optimize the financial management systems of colleges and universities is of great benefit to improve the efficiency of financial accounting, the fine management of finance, and the overall level of financial services. However, this should be taken into account in such a way so that the financial management systems of colleges and universities can meet
the needs of scientific research and better serve the strategic decision-making of colleges and universities.

In this paper, we use blockchain technology in order to build the central platform of the university financial sharing service mode and introduce the major modules in detail. Moreover, to manage the university finance based on association rules, a mining algorithm is suggested. Finally, we use an artificial intelligence algorithm to effectively control the risk of financial informatization so as to complete the optimization of the financial sharing service mode. The method proposed in this paper is compared with other state-of-the-art methods. Our empirical evaluation suggests that the proposed method is superior to other methods in terms of cost, data security risks, and financial management efficiency and has good application value. The major contributions of this research can be summarized as follows:

(i) An in-depth study is provided on the application of the blockchain technology to the financial sharing service mode of colleges and universities;
(ii) The university financial sharing service center platform based on the blockchain technology is constructed, and each module of the service center platform is described;
(iii) Combined with the constructed platform, the university finance is deeply mined by using the mining algorithm based on association rules;
(iv) An artificial intelligence algorithm is used to adaptively optimize the financial management;
(v) The planning model and fitting algorithm of the least square method are used to control the risk of the financial management of colleges and universities.

The rest of the manuscript is structured in the following manner. In Section 2, we provide a brief description of the related work and state-of-the-art methods. Construction of University Financial Sharing Service Center based on blockchain technology is illustrated in Section 3. In Section 4, the discussion over the optimization of the University Financial Sharing Service Mode based on blockchain technology is further elaborated. Analysis of experimental results and discussion are sketched in Section 5. Finally, the paper idea, along with obtained results, is summarized in Section 6. Several directions for further research are also presented in this section.

2. Related Work

At present, with the national support for higher education and with the rapid development of the social economy, the traditional financial management model cannot effectively meet the growing business management needs and has become the main factor restricting the development of education, teaching, and scientific research in colleges and universities. Gao et al. proposed an early warning method for university financial management based on the chaotic particle swarm optimization (PSO) technique. Firstly, this paper analyzes the early warning principle of financial management in detail and finds out the change in the law of financial management early warning in colleges and universities. Moreover, it establishes and describes the model, obtains the early warning classifier of financial management in colleges and universities, and introduces the chaotic particle swarm optimization (PSO) algorithm into it. The proposed algorithm optimizes the parameters of the early warning classifier of financial management in colleges and universities and finally carries out the simulation experiment of financial management early warning in colleges and universities. The experimental results show that for the traditional early warning methods of financial management in colleges and universities, the accuracy of financial management early warning in colleges and universities based on the chaotic particle swarm optimization has been significantly improved. Moreover, the proposed model can early warn the financial management of colleges and universities in an effective time so as to solve some problems existing in the early warning of financial management in colleges and universities. Although it has a high application value, it has the problem of high economic cost [1].

A new combination of support vector machine (SVM) and Zhus is proposed in [2]. Firstly, the authors preprocess the financial data of colleges and universities, extract the data, and then model the data set. Then, the gray wolf optimization algorithm is improved by using the algorithm of differential evolution so as to improve the global search ability of the financial management. In fact, the authors solve the problem with the same approach because they believe that the gray wolf algorithm is easy to fall into local optimization and then realize the optimization of SVM parameters. Finally, the AdaBoost algorithm is used to improve the ability of financial data information classification of degwo-svm model. The experimental results show that the financial management prediction model based on the AdaBoost and SVM combination has significant dilemma prediction advantages. Compared with other algorithms and methods, the accuracy of the financial management data classification is significantly improved, but there are hidden dangers of data security [2].

Aiming at the complex and nonlinear characteristics of university financial data, a university financial early warning model based on a chaotic long drosophila algorithm and optimized regression neural network is proposed by Zhao et al. [3]. Firstly, the Logistic chaotic map is introduced to modify the initial value of FOA, and then the FOA step size is modified to a dynamic step size based on the optimal initial value so as to find the optimal spread value. Finally, the data predicted by the financial management are comprehensively analyzed, and representative comprehensive indicators are selected. The improved drosophila algorithm has a better ability for global optimization and rapid convergence of financial information and improves the accuracy of GRNN’s financial management prediction. The simulation results show that, compared with other models, this model can effectively improve the accuracy of the financial management early warning in colleges and universities and has a high degree of fit with financial data. However, due to the complexity of the process, there are hidden dangers in financial data [3].
Guo et al. suggested a model aiming at constructing the evaluation model of scientific and financial risk in colleges and universities. The theory of support vector machine (SVM) is introduced into the evaluation process of financial data in colleges and universities. Using support vector machine to solve small sample data and nonlinear problems, it has strong generalization ability and constructs the evaluation algorithm model of a support vector machine. In order to effectively improve the performance of the support vector machine, the cuckoo search algorithm is used to optimize the support vector machine so as to improve the accuracy of vector machine detection. The feasibility of the model is verified by the financial data of a university. The verification results demonstrate that the financial data evaluation model based on the support vector machine has high accuracy and can effectively solve the nonlinear problem of financial data. Although it has good application value, there is still the problem of asymmetric data information [4].

3. Construction of University Financial Sharing Service Center Based on the Blockchain Technology

According to the analysis, a university financial sharing service mode platform based on blockchain technology and application has been established. A schematic diagram of the platform is shown in Figure 1. The platform consists of three layers: (i) service layer; (ii) application layer; (iii) base layer. These layers are responsible for providing different services that are described in the following sections.

3.1. Login of Terminal Equipment. Using the distributed system characteristics of the blockchain technology, students and teaching staff can log in by using a computer or mobile intelligent terminal with the help of their student card or staff ID card, respectively. Different accounts are described in detail. After logging in the role, apply for the business process according to the relevant options of the mobile client received by the front desk, and submit the transaction to the control module of the financial shared service platform to classify the financial data [5, 6].

3.2. Control Module of Financial Management Service Platform. The main control module of the service platform is composed of multiple modules, including the control module of personnel list, bachelor’s degree, project research, document image, and so on. The mobile client of the platform generates vouchers according to the scanner method and transmits the original accounting vouchers established in the business process to the service platform of the Financial Sharing Center. The module of interconnection control between banks and universities. After students make an online payment, financial institutions can automatically generate vouchers and submit them to the service platform of the Financial Sharing Center, which is mainly used for accounting processing. The module of cost budget is composed of three parts: (i) the cost budget of special funds, (ii) the comprehensive cost budget of campus, and (iii) scientific research expenses. It mainly includes budget management, the system of adjustment and internal control, and the control module of official card clearing. Among them, the official card is a new transaction mode, and the teaching staff can use the official card to settle the travel expenses, conference expenses, and purchase expenses. The control module of financial statements is combined with the tables in various teaching fields of colleges and universities to integrate the financial reports of colleges and universities [7, 8].

3.3. Interactive Service of Financial Capital and Data Information. The interactive service platform of data information content in colleges and universities has connection points, which are used to describe the management authority of character information content in detail. The university financial sharing service platform is connected with the university budget management platform to promote the scientific and reasonable management of university finance [9, 10]. Furthermore, it can help to integrate different management systems inside and outside the university into the university financial sharing service platform to complete the university resource sharing and prevent the problem of information asymmetry [11, 12].

3.4. Auxiliary Management and Decision Support. The application platform supporting management decision-making is the financial data analysis layer, which is composed of the overall data analysis system [13]. The analysis system of early warning information data and the intelligent management system of system software. According to the data analysis system, based on the financial statements of colleges and universities, this paper makes a detailed analysis of the investment adjustment and change of college resources and
the ownership structure so as to find out whether the asset investment of colleges and universities is effective [14]. The analysis system of early warning information data comprehensively analyzes the specific revenue and expenditure situation and cost budget of colleges and universities so as to ensure the scientization of financial expenditure of colleges and universities. The intelligent management system of the system software implements the management method for the Financial Shared Service Platform of colleges and universities so that the financial shared service resource information can be shared and the relevant contents of confidential information can be effectively maintained [15, 16]. Figure 2 shows the application framework of Financial Sharing in colleges and universities.

4. Optimization of University Financial Sharing Service Mode Based on the Blockchain Technology

4.1. Financial Information Management Based on Association Rule Mining Algorithm. The HG D mainly refers to the percentage of financial item information set in the overall database, which is recorded as h(i). The DK L refers to the union of item sets in the overall data. Suppose that in the financial information item set I(I = (i_1, i_2, ..., i_n)), any financial item i has a weight [17]. We can use this weight to measure the importance of the financial item in the overall set. The greater the weight, the more prominent the importance of the item and vice versa. On this premise, the financial items in the set are sorted according to the weight, and the information arrangement and combination from large to small are obtained, which finally forms a linear ordered set [18, 19]. The entire process of deep mining of university financial information based on association rule mining is shown in Figure 3.

Next, we use the above platform and represent the information elements in the financial item set I. If z≺x, it means that z is ahead of x. If the support of Z weighting is defined as M(z) × HG D(z), it means that the minimum weighted support of the project is as follows:

$$HGD(z) = \frac{f_z - f_a(z)}{D}.$$  \hspace{1cm} (1)

In formula (1), HG D(z) represents the number of times that element z is found in financial management data, D represents the number of financial data, f_z represents the weighted frequent item set, and f_a(z) represents the factor of weighted support calculation.

According to formula (1), the minimum weighted support of university finance is calculated. On this basis, the confidence of financial data is calculated according to the data mining algorithm of association rules. If z ≺ x ∈ I，则 z ∩ x = ∅，the confidence of z ⇒ x can be defined as follows:

$$D(z ⇒ x) = \frac{k(z \cup x)}{n(x)},$$  \hspace{1cm} (2)

In formula (2), k(z ∪ x) represents the number of times two financial items appear together in the data, and n(x) represents the correlation degree of the data; and D(z ⇒ x) represents the confidence of z ⇒ x.

According to the above formula calculation, we find out the problems of frequent item sets in university financial information and clarify the principle of reliable relationship in university financial information so as to complete the in-depth mining of financial information and provide an effective basis for university financial information management [20, 21].

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**Figure 2:** Application framework of financial sharing in colleges and universities.

**Figure 3:** Financial information in-depth mining process.
On the basis of mining the financial information of colleges and universities, through the mining algorithm of association rules, a database of financial information management is constructed to manage the financial information of colleges and universities. The business logic, along with several operations of the database, is shown in Figure 4. The specific information contained in the database is represented as given by Table 1.

In order to realize the information and data sharing of financial management in colleges and universities, we should formulate a unified interface management engine and carry out unified allocation.

The interface of the system is defined to provide the function of data exchange for the financial system because the financial information of colleges and universities is easily affected by noise in the process of exchange. Therefore, the data mining algorithm of association rules is used to standardize the format of financial data exchange, which can be expressed as follows:

\[
G = K[\varphi] \cdot \frac{m}{b_i}
\]  

(3)

In formula (3), \(G\) represents the information of financial data exchange, \(K[\varphi]\) represents the center of financial data, \(b_i\) represents the conversion factor of data, and \(m\) represents the parameters of data storage.

On the premise of completing the construction of the above financial database, according to the database definition of financial information management in colleges and universities, the field names, types, and widths involved in all financial databases are defined, which are expressed as given below:

\[
j = \sum_{i=1}^{d''} c \rightarrow b
\]  

(4)

In formula (4), \(j\) represents the integration parameters in the financial data set, \(\sum_{i=1}^{c} c\) represents the parameters defined in the data, \(b\) represents the set factor of the financial data set, and \(d''\) represents the information of the database.

The main purpose of defining the field name, type, and width involved in the university financial database is to maintain the database so as to complete the construction of the university financial database [22, 23]. Using the above process to complete the financial management of colleges and universities based on the data mining algorithm of association rules.

4.2. Risk Factor Control Algorithm of Financial Informatization Based on Artificial Intelligence. Combined with the above financial information management of colleges and universities, a limited set of horizontal evaluations of risk factor control of financial informatization in colleges and universities are constructed, which is expressed as follows:

\[
f_{1g-M}(z) = \left( f_{1g}(z) h_x \ast f_{1g}(z) h_y \ast f_{1g}(z) \right).
\]  

(5)

In formula (5), \(f_{1g}(z)\) represents the analysis value of the risk factor control of financial informatization in colleges and universities. Under the constraints and conditions of financial cash flow and financial redundancy, combined with financial policy and financial correlation factors, this paper analyzes the control model of financial informatization risk factors of financial informatization management and obtains the statistics as illustrated by the following formula:

\[
C_{xx}(jr) = \sum_{r=1}^{l} \left\| W_r^T x_{ir} - W_r^T x_{r0} \right\|^2 B_{irr}.
\]  

(6)

In formula (6), \(x_{ir}\) represents the characteristic component of risk factor control of university financial informatization, \(x_{irp}\) represents the characteristic quantity of fuzzy state of university financial informatization risk factor control, and \(W_r\) represents the coefficient of sample regression [13].

Using artificial intelligence control method to control the risk factors of the financial informatization in colleges and universities, it is concluded that the main process of the risk factor control artificial intelligence learning is stated as follows:

\[
X_i = (a_{c}^{[1]}, a_{c}^{[2]}, a_{c}^{[3]}).
\]  

(7)

The artificial intelligence learning algorithm is used to adaptively optimize the risk factor control of financial informatization in colleges and universities [12]. Combined with the least square programming model, the risk factor control constraint rules of financial informatization in colleges and universities are expressed as follows:

\[
\begin{align*}
\min (f) = \sum_{i=1}^{m} \sum_{j=1}^{n} C_{ij} X_{ij}, \quad & \sum_{j=1}^{m} X_{ij} = a_i, i = 1, 2, \ldots m, \\
\sum_{i=1}^{m} X_{ij} = b_j, j = 1, 2, \ldots m, \quad & X_{ij} \geq 0, i = 1, 2, \ldots m, j = 1, 2, \ldots m.
\end{align*}
\]

(8)

In fact, we adopt the extreme learning method to train the adaptive control level of the risk factors of financial informatization in colleges and universities [11]. Under the learning condition of artificial intelligence, the adaptive learning model of risk factors control of financial informatization in colleges and universities is expressed as follows:
\[ \sum_{j} \alpha_j y_j K(x_j, x_j) + y_j b - 1. \quad (9) \]

Through the above steps, the adaptive control of risk factors of financial informatization in colleges and universities is realized. The formula of optimal control output is expressed as follows:

\[ Q' = k \frac{G_i X_i}{M_{Du} p}. \quad (10) \]

Combined with the above analysis, the least square programming model and fitting algorithm are used to control the risk factors of university financial informatization so as to complete the optimization of the University Financial Sharing Service mode based on the blockchain technology [24, 25].

5. Analysis of Experimental Results

In order to test the optimization effect of University Financial Sharing mode based on the blockchain technology, empirical analysis is carried out. Table 2 shows the experimental environment data along with parameters. We select some historical data from the financial management system of a university as the data related to the research object. In order to make the results more convincing, we carry out five experiments. The sample distribution of the data is shown in Table 3.

Figure 5 shows the efficiency comparison between the financial information management based on the association rule mining algorithm proposed in this paper and the traditional financial information management.

Through the analysis of Figure 5, it can be seen that the efficiency of financial information management of the mining algorithm based on the association rules proposed in this paper is higher than that of the traditional financial management information methods. A series of five experiments have been carried out, which shows that using the method proposed in this paper can effectively improve the efficiency of the Financial Shared Service Mode in colleges and universities. Figure 6 shows the risk comparison of college financial data between the college financial risk factor control method based on artificial intelligence proposed in this paper and the methods proposed in [1, 2].

From the data analysis, as shown in Figure 6, it can be seen that the data risk of the method proposed in [1] has been very high with the increase in financial data information. Although the method proposed in [2] is not particularly high initially, the risk curve fluctuates greatly with the increase of financial data information. This indicates that there is a certain risk in financial data information. The risk of the college financial risk factor control method based on artificial intelligence is lower than the other two methods at the beginning. Although the risk curve of financial data information fluctuates to a certain extent, it is still lower than the other two methods. This shows that the data security risk
of the University Financial Sharing Service Center proposed in this paper is significantly low.

Figure 7 shows the cost comparison between the university financial sharing service method based on the blockchain technology proposed in this paper and the two methods proposed in [1, 2].

As can be seen from the experimental data in Figure 7, the cost of university financial management of the methods proposed in [1, 2] is significantly higher than that of the methods proposed in this paper. Through five experiments, the cost of university financial management in each experiment is higher than that of the methods proposed in this paper, which shows that the methods proposed in this paper can effectively reduce the cost of university financial shared services.

6. Conclusions and Future Work

In the era of intelligence, information technology and computer network technology show a trend of rapid development. There is an urgent need to improve the financial management ability and service level of colleges and universities. In this paper, combined with the constructed platform, university finance is deeply mined by using the mining algorithm based on certain association rules, which is convenient for effective management. Finally, an artificial intelligence algorithm is used to adaptively optimize financial management. Similarly, the planning model and fitting algorithm of the least square method are used to control the risk of the financial management so as to realize the optimization of the financial sharing service mode. The application of the blockchain technology in the financial sharing service mode of colleges and universities can effectively promote the transformation of financial functions of colleges and universities from accounting to financial management decision-making so as to effectively improve the efficiency of the Financial Sharing Service mode of colleges and universities and reduce the cost of financial management. In the future, we will integrate machine learning methods such as SVM and CNN within the proposed blockchain model. In terms of SVM, a cuckoo search algorithm could be integrated to obtain higher effectiveness.

Data Availability

The data can be made available upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest to publish this work.

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