Construction of Enterprise Financing Risk Management System under Big Data Technology

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Abstract. With the wide application of big data technology, massive data information is transformed into the actual productivity of enterprises, which gives enterprises opportunities for development and brings new challenges to internal financial management. Facing the risk problems faced by enterprises in the process of financing, traditional risk management tools and technologies have obvious shortcomings in identification efficiency and control ability. In this regard, this paper puts forward a set of construction scheme of enterprise financing risk management system based on big data technology, and puts forward a new solution for enterprise financing risk management. The system takes Hadoop cluster as data management and processing server, and combines Javaweb technology to form a comprehensive application service platform integrating online application, data mining, visual analysis and other functions. Practice has proved that the system constructs the corresponding business risk and financial risk analysis model through principal component analysis and Logistic regression algorithm model, which meets the needs of enterprises for financing risk management and improves the ability of enterprises to resist financing risks.

Keywords: big data; enterprise financing risk; machine learning algorithm; Hadoop; computer software application.

1 Introduction

In the era of digital economy, a series of new digital technologies, such as Internet, big data, cloud computing and artificial intelligence, have reshaped the whole process of information collection, transmission, storage, analysis and application, and also transformed massive data information into important production factors to promote economic and social development, and promoted the transformation and upgrading of various industries and fields. [1] At the same time, enterprises need a lot of financial support in the process of transformation and upgrading, but due to the influence of factors such as credit qualification, scale and operating conditions, the financing risk of enterprises has expanded. Faced with this situation, enterprises usually adopt traditional financial risk management methods to realize financing risk identification, evaluation, control and supervision. However, under the traditional mode, there are obvious limitations in the data processing ability of enterprise financing risk management, and the

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work efficiency is far behind the actual application requirements. [2] In view of this, according to the current research results of enterprise financing risk management at home and abroad, combined with the analysis results of project financing risk management proposed by Ainu Nadina[3] and others, the application experience of big data analyzed by Matveevskii S[4] in reducing the financing credit risk of small and medium-sized enterprises, and the research on financial risk control strategy of small and medium-sized enterprises under the background of big data completed by Yang Chuanyu [5], This paper holds that enterprises should make a comprehensive analysis and evaluation of enterprise financing risks based on the perspective of big data analysis, predict the risks that enterprises may face in financing activities and their consequences, and then provide a basis for enterprise financing risk management. [6] The introduction of enterprise financing risk management system will give full play to the application advantages of big data technology, data mining technology and computer application technology, and put forward a set of practical and comprehensive solutions from the aspects of data and content sources, risk handling tools and technologies, and overall business process control. It enhances the ability of enterprises to control financial data processing and financing risks, and guarantees the rapid completion of digital transformation and upgrading of enterprises.

2 System construction

Enterprise financing risk management system is divided into four parts: presentation layer, business application layer, data processing layer and source data layer. Figure 1 shows the overall frame structure of the system. Among them, the data processing layer is under the responsibility of Hadoop framework and adopts cluster deployment mode. In terms of hardware devices, Hadoop cluster includes three nodes, which are named Master1, Slave1 and Slave2 respectively. Each node needs a 4-core hexadecimal CPU with 16G memory and 512G hard disk to meet the distributed storage requirements of various types of data. [7] In terms of software program, the bottom operating system of each node is Linux, with version of CentOS 6.8, jdk-1.8 and Hadoop framework version of 2.7.2. After the deployment of Hadoop cluster is completed, the big data management server will be built together with business database MongoDB, data caching tool Redis, Zookeeper cluster resource management framework, Flume-ng log capture tool and Kafka message sequence system. [8]

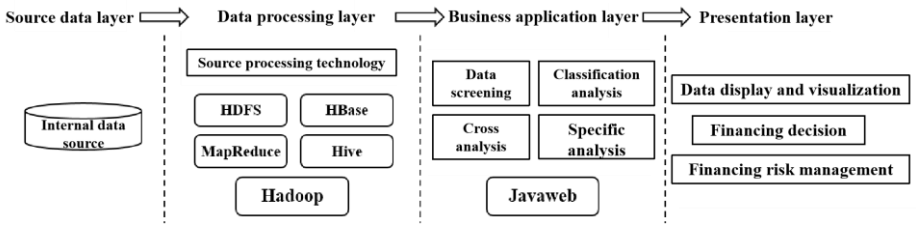

Fig. 1. Overall frame structure of the system

At the same time, in the data processing layer, the corresponding algorithm design and deployment will be carried out according to the application design of data mining function in the business application layer. The data mining algorithm models mainly used in this study include principal component analysis and Logistic regression algorithm, which are all deployed in MaprReduce distributed computing framework under Hadoop cluster to complete the call and control of algorithms. Figure 2 shows the process of implementing Logistic regression algorithm by MapReduce.

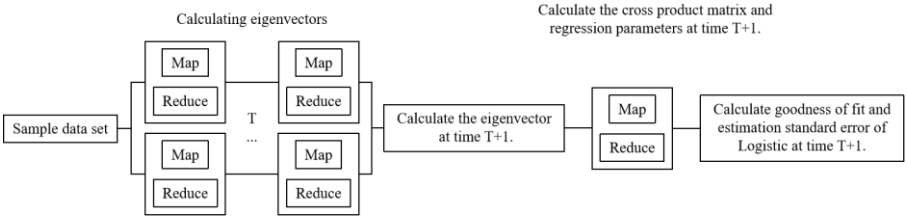

Fig. 2. The process of realizing Logistic regression algorithm by MapReduce

However, the construction of system business application layer and presentation layer mostly depends on Javaweb technology. Under the Javaweb technology system, the display layer is the user interactive interface, which is led by JSP technology and supplemented by HTML, CSS and JavaScript to complete the page development and deployment. The business logic layer can complete the definition and declaration of various functions of the system, encapsulate the algorithms and calculation processes of all functional applications needed by the system, and interact with the data access layer and the presentation layer. [9] The development environment that Javaweb technology relies on includes MyEclipse V 2022, Tomcat 8.0 server and MySQL 5.7 database server.

3 Functional implementation

3.1 Business risk assessment

Business risk is the inherent risk of enterprise's production and operation activities, which is directly manifested in the uncertainty of enterprise's profit before tax and interest, and can have a direct impact on enterprise's financing risk. [10] In this regard, the system will conduct business risk assessment based on the operating data of the enterprise, and provide help for the control and management of enterprise financing risk. In the system, the data management server under Hadoop framework can share and connect all types of data. When users initiate enterprise business risk assessment online, they can select data samples according to key fields such as year, month and category.

The system supports the construction of enterprise management risk assessment indicators by principal component analysis, that is, the data values of 10 basic indicators are standardized and reduced in dimension to form comprehensive indicators. Table 1

shows the basic index information table, and the eigenvalues λ and eigenvector B are obtained by calculating the correlation coefficient matrix of each index value, and the principal component Z and principal component contribution rate H are calculated by linear equation column, and the calculation formula is shown in Formula 1. [11] When the user inputs the selected sample data into the model, the system will automatically calculate the score coefficient of each factor, as shown in Table 2.

Table 1. Basic index information table

No.	Basic index	No.	Basic index
1	Net profit growth rate f_1	6	Operating cash flow f_6
2	Revenue growth rate f_2	7	Net asset f_7
3	Profit rate f_3	8	Asset-liability ratio f_8
4	Return on assets f_4	9	Liquidity ratio f_9
5	Asset income growth rate f_5	10	Quick ratio f_{10}

$$\begin{Bmatrix} Z_1 = XB_1 \\ Z_2 = XB_2 \\ \cdots \\ Z_n = XB_n \end{Bmatrix}, X = (f_1, f_2 \cdots f_n) \qquad H_i = \frac{\lambda_i}{\sum_{k=1}^{n} \lambda_k} \tag{1}$$

Table 2. Score matrix of each analysis index

	Index F_1	Index F_2	Index F_3	Index F_4
f_1	0.931	0.028	-0.025	0.196
f_2	0.617	-0.123	-0.441	0.194
f_3	0.633	-0.008	0.211	-0.312
f_4	0.815	0.078	0.158	0.347
f_5	0.833	0.055	0.149	0.135
f_6	0.141	-0.007	0.107	0.866
f_7	0.245	0.179	0.798	0.412
f_8	0.081	0.202	0.904	0.040
f_9	0.023	0.987	0.165	0.026
f_{10}	0.033	0.984	0.163	0.021

According to the analysis index score matrix, the principal component factors F_1, F_2, F_3 and F_4 are converted into variance contribution rate to get the corresponding weight values, and then the calculation formula of enterprise business risk assessment is obtained by weighted calculation. [12] As shown in Formula 2, where F represents the comprehensive score of business risk assessment. According to the critical value of F, three ranges will be set in the system, which correspond to the three business conditions respectively, and the corresponding financing risk judgment results will be given, as shown in Table 3.

$$F = 0.397F_1 + 0.223F_2 + 0.117F_3 + 0.085F_4 \tag{2}$$

Table 3. Comprehensive score of operational risk assessment and judgment result of financing risk

F value	Operating condition	Financing risk
F>0.7463	Good	Low
-1.35<F<0.7463	General	General
F<-1.35	Poor	High

3.2 Financial risk forecast

The financial risks of enterprises include financing risks, and the financial health of enterprises also determines the success or failure of enterprise financing. In this regard, the system will predict the financial risk of enterprises based on the operating data of enterprises, and further improve the management and control of financing risks of enterprises. Under this function module, after the user selects the data sample, the system selects three indicators with strong sensitivity and high correlation as independent variables based on the index system of enterprise financial data analysis, and uses t-test and nonparametric test, and inputs them into the Logistic regression analysis model to predict the economic benefits of enterprises. According to the maximum accuracy, the system selects the backward step-by-step method to fit the model, as shown in Formula 3, which is a Logistic regression model, e is the natural logarithm, and z is the parameter. [13] Table 4 shows the variable values of Logistic regression analysis model. Through the significant difference value, the difference of each index is clarified, which can provide positive feedback for the final identification result. The final prediction model is shown in Formula 4. For the output result of Logistic regression analysis model, 0.5 is taken as the benchmark value. When the output value is greater than 0.5, it can be determined that this index will face financial risks, otherwise it can be proved that this index is currently in a normal state.

$$P = \frac{e^Z}{1+e^Z} \tag{3}$$

Table 4. Variable values of Logistic regression analysis model

	Weight variable	Standard deviation	Wald value	Free degree	Significant difference
Return on assets m_1	-11.514	2.816	10.052	1	0.001
Net profit growth rate m_2	-4.705	1.319	8.083	1	0.002
Revenue growth rate m_3	-2.261	0.871	4.834	1	0.000
Constant	1.573	1.007	3.504	1	0.012

$$\log\left(\frac{P}{1-P}\right) = 1.573 - 11.514m_1 - 4.705m_2 - 2.261m_3 \tag{4}$$

4 Conclusions

In order to promote the reform of enterprise financing risk management mode, this paper constructs an enterprise financing risk management system based on big data technology. The system can complete data mining analysis from its own business risk and financial risk, realize the control and early warning of enterprise financing risk, and promote the value embodiment and reasonable application of internal data information. In the follow-up research, it will further enrich the system's support for other algorithm models and provide necessary technical support for enterprise financing risk management.

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