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Big Data Mining Algorithm for Optimal Generation of Intelligent Financial Business Portfolio Investment Decision

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Abstract: *In the current research process of artificial intelligence, cloud computing and other technologies, many useful derivative technologies have emerged, which have promoted the rapid development of the world economy and finance. Among them, intelligent services analyze and judge the surface and hidden needs of users, and actively use a safe and efficient technology to meet various needs of users. If people want to get the surface and hidden needs of users, they need to use data mining algorithms. Then the big data analysis algorithm was used to analyze and picture the user data searched by data mining. Big data is a new technology that can analyze massive data. At the same time, intelligent finance is also making rapid progress. Intelligent finance is an intelligent financial work mode formed by combining the traditional financial mode with Internet of Things, intelligent services and other technologies. The intelligence in this mode not only represents the individual optimization of a certain financial link or process, but also is a revolutionary new financial model. This paper is just to explore the application of big data mining analysis algorithm in intelligent financial business portfolio investment decision optimization, and propose to combine some algorithms of big data analysis and data mining with intelligent financial model, and carry out experimental analysis to determine that the integration of big data has improved the working efficiency of the original intelligent financial business portfolio investment decision model by about 35.3%. Although the current security and intelligent service theory in intelligent finance is still not perfect, the integration of big data can effectively make up for some of the shortcomings.*

Keywords: *Smart Finance; Big Data; Security Intelligence Service; Data Mining*

1. Introduction

The progress of society prompts enterprises to carry out the reform of financial work mode and enterprise management mode. In the traditional financial system, problems such as the long time for capital approval, the closed sharing of financial data by relevant departments, and the slow processing of financial data have had a serious impact on the development of enterprises. This is also the fundamental reason for developing intelligent financial systems.

At present, more and more experts in finance and financial management related industries begin to attach importance to emerging technologies such as security and intelligent services, and invest a lot of energy and capital in research and development and improvement of intelligent financial systems. Lehmann Erik E explored the role of intelligent finance in the enterprise's financial system, and determined that the intelligent financial system can play a positive role in financial decision-making and intelligent business processing based on data [1]. Donald David C has explored and analyzed some application parameters in the financial system of SMEs, and determined that the intelligent financial system can help SMEs maintain the vitality of competition and reduce the risk factors in enterprise decision-making [2]. Westerman Wim studied the transformation process of enterprises from traditional financial system to intelligent financial system, and determined the positive role of intelligent financial system in the operation efficiency of enterprises by analyzing the transformation process in all aspects [3]. Tarhini Mahmoud explored the application of decentralized financial system in reality, and

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analyzed the function and role of each system module, and determined that intelligent financial system can play an important role in more fields [4]. de Nichilo Stefano investigated the role and impact of the intelligent financial system in the tourism industry, and analyzed the tourism industry in a region from the perspectives of sustainability, management and interests, and determined that the intelligent financial system plays a positive role in the tourism industry [5]. Junita Afrah studied the management system of a region, and compared and analyzed it with the intelligent financial system in all aspects, and explored the role of the intelligent financial system in rural economic development [6]. Medvedovskyi Denys discussed the combination of intelligent technology and financial system, proposed a new intelligent financial content management model, paid attention to the focus of current social development, and proved the effectiveness of the intelligent financial content management system [7]. However, as the relevant research is just starting, the research on the theory of a universal intelligent financial system recognized by most people still needs a long time.

In addition, some researchers have turned their attention to big data, believing that big data can improve some deficiencies in the existing financial system, and combined with intelligent services to optimize the financial system. Cockcroft Sophie has identified the advantages of big data and some shortcomings in the current financial field through the application of big data in the financial and financial industry. Research on data indicated that big data plays a good role in data visualization and financial data analysis [8]. Goldstein Itay studied the impact of big data on the current and future financial industry, and analyzed some applications of big data in enterprise finance, market competition and enterprise asset pricing [9]. Subrahmanyam Avanidhar analyzed some cases of using big data in the financial field and provided some practical suggestions for people in the financial industry [10]. Sun Yun explored the application of big data in the financial field. The data showed that the financial business model combined with big data can propose effective risk control schemes, providing a visual perspective for financial market analysis [11]. Ferrati Francesco conducted research on how to use big data to predict the return on investment of enterprises. The data showed that big data can effectively control the investment risk of start-ups [12]. Tang Yong explored the interaction between the global financial industry and used big data and financial-related analysis methods to determine that the topological structure in the financial market has a certain impact on its development [13]. Wang Fatao explored credit risk assessment schemes for various e-commerce platforms based on big data. Combining big data with financial credit risk assessment, it was determined that this model can more comprehensively analyze the credit risk of SMEs [14]. At present, the basic computing cost of big data is still high, so some practical application schemes developed by relevant theories are only used in a small range.

Intelligent financial system has now become a technology that most enterprises are studying. If people want to establish a perfect intelligent financial system, people not only need more and better research and development personnel, but also require the financial personnel of enterprises to transform to a new era of compound financial management personnel.

2. Evaluation of Big Data Mining Algorithm

Driven by the current development of global financial digitalization, the integration and application of big data and real finance are deepening. Some enterprises upgrading their financial systems are feeling some advantages brought by the integration of big data and real finance. Big data can not only conduct large-scale analysis of consumer demand in the real financial market, but also optimize the enterprise's production processes and standards, supply chain management and intelligent consumer services.

(1) Security intelligence service

At present, technologies such as the Internet of Things, big data and cloud computing are in the ascendant, and various intelligent facilities for enterprises have been upgraded one after another, which also means that intelligent services in all walks of life have begun to enter the fast lane of development. What intelligent services want to achieve is a technology that actively serves consumers according to their needs. It collects and analyzes users' needs and combines them with the demand analysis data accumulated in the background to customize the overall demand analysis model for consumers. At present, intelligent services can not only analyze consumers' needs, but also collect and analyze consumers' hobbies and living habits, thus making consumers' personal modeling more perfect. In addition, the combination of intelligent services and data mining and other technologies can further explore some hidden needs related to the identity and working status of consumers, which are often

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imperceptible to some consumers themselves. Some applications of intelligent services are shown in Figure 1.

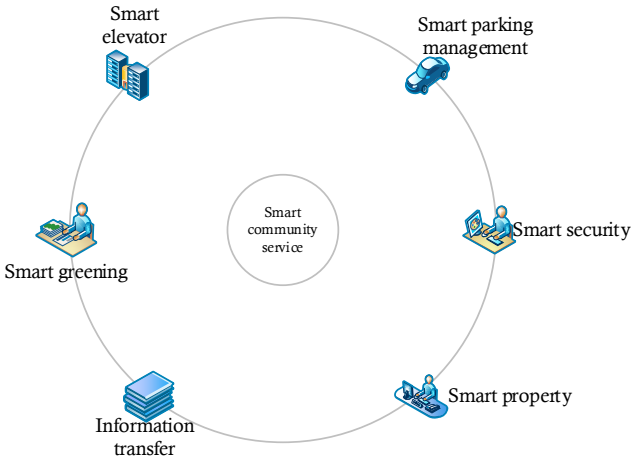

Figure 1 Schematic diagram of the primary application scenario of intelligent services

In addition, because the data involved in intelligent services are all private information of consumers, security has become the basis for the development of intelligent services. High standard security intelligent services are a convenient technology that consumers can really accept and need. In order to ensure the privacy of data in the process of data collection and processing, intelligent services usually use end-to-end security data processing technology. At the same time, they impose laws and regulations on relevant practitioners to further ensure the privacy of data.

(2) Data mining

The progress of database and Internet has made the database technology enter a new stage of development. From the past simple data storage to the ability to store, retrieve and manage data, the number of data in the current database has become increasingly large, and its retrieval ability has become increasingly unable to meet the current market demand. Therefore, the concept of data mining has been put forward. In general, data mining is to analyze the huge data sets collected by the system in order to discover the unknown associations among these data sets, and can help managers summarize the value of data sets. The application and operation of data mining are shown in Figure 2.

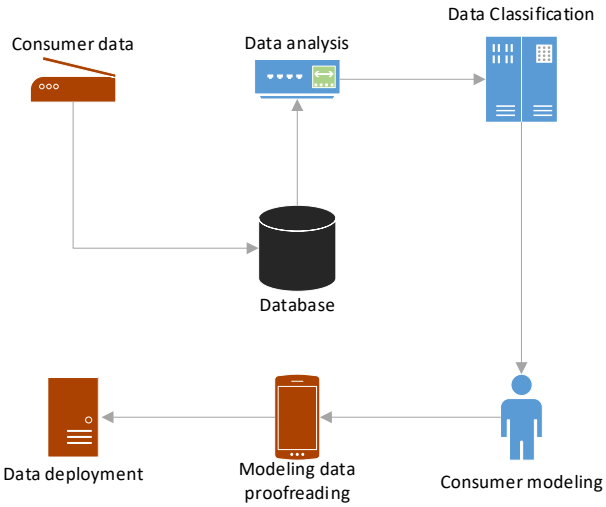

Figure 2 Schematic diagram of the application and detailed workflow of data mining in the financial field

Data mining usually includes six types of work, including data anomaly detection, data association rule learning, data structure analysis, data classification, optimization modeling error range and data summary. Usually, data mining would first detect the data exceptions in the database, and identify the wrong or changed data and identify it for further processing. Then, association rules are used to analyze the association between data to determine the characteristics of consumer portraits.

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(3) Big data analysis

The first is to make statistics on the data. Generally, big data analysis uses distributed databases or distributed computer clusters to make statistics and summary analysis on the data to meet the data analysis requirements of common scenarios. At the same time, the sample data collected by the front-end framework and simply filtered would be injected into a larger distributed database, and then use the streaming computing model to calculate the data to meet the computing needs. Then the data in the large distributed database is analyzed. The analyst would make preliminary prediction and judgment on the data based on some previous analysis results. In addition, visual analysis is also a technical means in big data analysis and a basic requirement for data analysis tools. Visualization can intuitively display the analysis results of data to customers.

The enterprise's big data analysis of consumer data can not only help the enterprise obtain a more comprehensive visual display of market business needs, but also enable the enterprise management to obtain more timely and accurate data to make decisions on some business of the enterprise.

3. Evaluation of Intelligent Financial Business Portfolio Investment Decision Optimization

The arrival of the era of intelligence has brought convenience to people and has also prompted intelligent transformation of all walks of life. The intelligent service system carries out a series of intelligent services by mining text information [15]. It is a clear development trend for enterprises to use digital technology to optimize the working mode and improve their operational competitiveness. For the financial system in enterprises, the intelligent era also puts forward more requirements. The first thing to bear the brunt is that the traditional bookkeeping mode of enterprises should be changed from manual bookkeeping to big data or cloud computing bookkeeping mode, and then for practitioners in financial management related fields, it is required to transform to composite talents, so that they can more skillfully carry out intelligent reform of the enterprise's financial system.

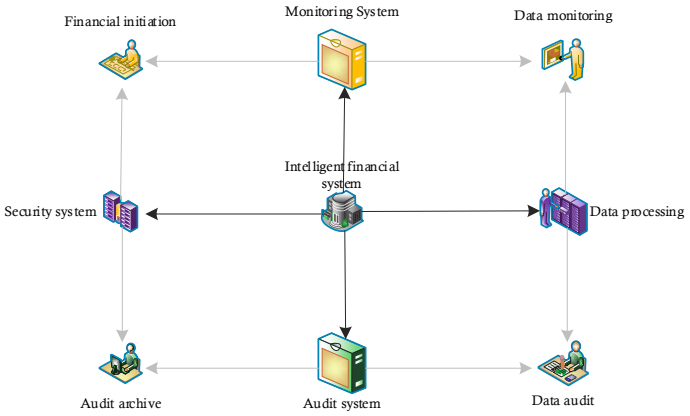

Figure 3 Schematic diagram of the workflow of the intelligent financial system

At present, if enterprises want to gain stronger competitiveness and development potential, the establishment of intelligent financial system is the top priority. Intelligent finance can improve and upgrade the original financial system of an enterprise to analyze its financial situation, monitor and control its financial risk factors, and make business decisions. On the other hand, big data analysis solves a series of problems such as the complexity of financial data analysis model in the original financial system, the huge energy and time consumption of financial data management and retrieval, and the low quality of financial analysis report. The financial intelligent machine is used to proofread the enterprise tax and inventory data, and collect and analyze the financial data, and the financial staff is only responsible for checking the analysis results of financial data and handling the abnormal sample data. This means that the manual part of the intelligent financial system is only the proofreading and audit archiving of the financial audit and accounting part. The first thing that needs to be considered in an intelligent financial system is the security of financial data. First, a system to ensure data security needs to be rebuilt to ensure the security and integrity of data transmission. Then, the encryption algorithm is used to encrypt key financial data, and different security protection levels are set according to their importance. At the same time, the security of the enterprise intranet needs to be strengthened and offline backup is often performed. The long-term development of enterprises cannot be separated from the support of intelligent financial systems, while the stable development of enterprises requires

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the support of security systems. The workflow of the enterprise's intelligent financial system is shown in Figure 3.

In essence, investment is a risky business behavior, and portfolio investment needs to analyze the current situation and potential of each asset, so as to develop a reasonable capital distribution model to maximize the collection of investment. The consideration of assets usually consists of three parts. The first is to assess the risk of assets. Big data analysis can perfectly collect and analyze the operation related data of the target assets, and timely and accurately display the various risk factors of the target assets in the form of data visualization charts. Then it analyzes the cash liquidity of the target assets. This module is mainly used to assess some special assets in the fields involved in the target assets. Usually, the liquidity of the target assets is measured by comparing the liquidity and current liabilities of the target assets. Finally, the profitability of target capital is analyzed. This module analyzes the development potential of the industry involved in the target asset and its competitiveness in the industry,so the intelligent financial system combined with big data analysis can also be better qualified for this job.

4. Evaluation on Big Data Mining and Analysis Algorithm

This paper mainly used some algorithms in data mining to calculate the financial revenue and expenditure planning, accounting and assessment. At the same time, C4.5 algorithm, maximum expectation and support vector machine were used to classify and process financial data. After that, the formulas of some algorithms used in this paper were introduced, and their functions in the intelligent financial system were described.

First, C4.5 algorithm is used to classify financial data. Generally, C4.5 algorithm would classify data by selecting one feature each time. It is necessary to introduce the calculation of entropy to provide classification features for C4.5 algorithm. The calculation formula is shown in Formula (1).

$$f(D) = -\sum_{i=1}^{k} \rho_i \log_2(\rho_i) \tag{1}$$

Among them, D represents data, and i represents the serial number of data; K represents the category of data, and ρ_i represents the amount of the i-th data in the overall data. Next, feature a is calculated as shown in Formula (2).

$$f_a(D) = -\sum_{i=1}^{m} \frac{D_i}{D} * f(D_i) \tag{2}$$

The next step is to calculate the difference between the entropy before and after classification. The expression is shown in Formula (3).

$$f(a) = f(D) - f_A(D) \tag{3}$$

The maximum expectation algorithm can find and analyze the hidden data in the database of the intelligent financial system. The modeling of consumers can be improved by searching for relevant data. First, it is supposed there is sample data of x_n consumers, and each consumer has a hidden data z_i, which is associated with the hidden data of other similar consumers. If there are other similar consumers, the maximum expectation is to find the correlation, and the calculation formula is as shown in Formula (4).

$$L(\theta) = \sum_{i=1}^{n} ln \sum_{j=1}^{m} p(x_i, z^{(j)}, \theta) \tag{4}$$

The correlation among hidden variables is calculated as shown in Formula (5).

$$c = \frac{p(x_i, z^{(j)}, \theta)}{Q_i(z^{(j)})} \tag{5}$$

The lower limit of this similarity is calculated as shown in Formula (6).

$$min = \sum_{i=1}^{n} \sum_{j=1}^{m} Q_i(z^{(j)}) ln \frac{p(x_i, z^{(j)}, \theta)}{Q_i(z^{(j)})} \tag{6}$$

Among them, Q_i represents the distribution function of hidden variables in the total data. Finally, the comprehensive calculation of the maximum expectation is shown in Formula (7).

$$L(\theta) = \sum_{i,j=1}^{m} ln \frac{p(x_i, z^{(j)}, \theta)}{Q_i(z^{(j)})} \tag{7}$$

The above are some of the main formulas used in this paper when optimizing the intelligent

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financial system of enterprises. They replace some modules in the original financial model that require manual calculation. This not only saves a lot of time for financial staff, but also further improves the efficiency of financial data processing of enterprises.

5. Experimental Evaluation of Big Data Mining Evaluation Algorithm in Intelligent Financial Business Portfolio Investment Decision Optimization

This paper first proposed a transformation route of the enterprise financial system that uses big data and security intelligence services to update and optimize the traditional financial system of the enterprise, and introduced the technologies used and some algorithms, thus determining the feasibility of the transformation route. The next step is to calculate the development prospect and improvement degree of the intelligent financial system, which is divided into three parts. The first two parts analyze and predict the development prospect of the intelligent financial system, and the last part determines the overall efficiency improvement degree of the intelligent financial system compared with the traditional financial system.

First of all, an investigation was conducted on an enterprise, and the judgment of each financial department on the intelligent financial system was collected and divided into three levels. The first is to accept comprehensive intelligent office, and the second is to accept semi intelligent office. The last is to accept only a small part of office process intellectualization. The results are shown in Figure 4.

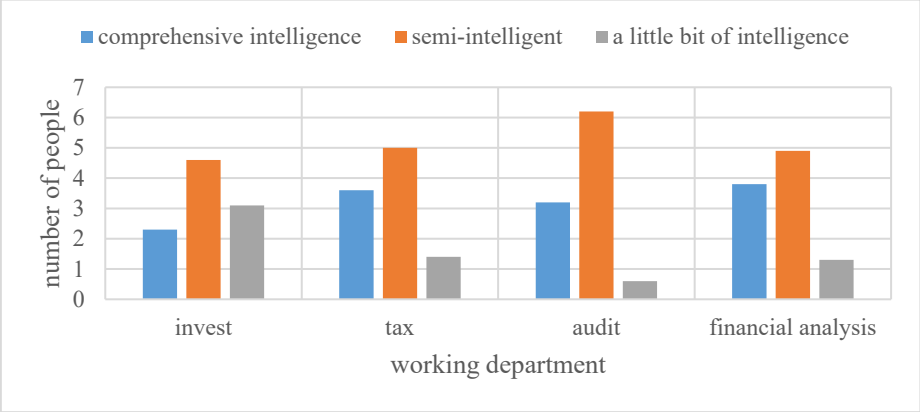

Figure 4 Schematic diagram of the data on the acceptance level of personnel in various positions in the financial department for intelligent office

By analyzing the data in Figure 4, it was clear that the staff of the financial analysis department had the highest acceptance of full intelligent financial office. This was mainly because the financial work was faced with a large number of complex computing tasks, and the burden on staff was also heavy. The highest department that accepted semi intelligent financial office was the audit department. On the one hand, there were some tasks that computers cannot currently handle in the audit. On the other hand, the audit department had less computing tasks than the tax department, so the demand for an intelligent financial system was not high. Most of the staff in the investment department could only accept semi intelligent office work, that is, use the intelligent financial system to do some simple data processing work. This was mainly because many risk factors in the investment department were still unpredictable by current technologies.

The survey was conducted for enterprises of different sizes, and the relevant data on the acceptance of enterprises to the intelligent financial system were displayed. The results are shown in Figure 5.

It can be seen from the acceptance of intelligent financial system by enterprises that the acceptance of intelligent financial system was gradually increasing with the size of enterprises. With the increase of market scale, enterprises need to process more and more financial data every day. At this time, more financial staff are required to calculate the financial data, which is also a big burden for enterprises. However, on the other hand, some infrastructures in the current intelligent financial system are still not perfect and have not experienced the test of the market, so some enterprises still have doubts about the intelligent financial system. This is why most enterprises are only willing to accept the semi intelligent financial system.

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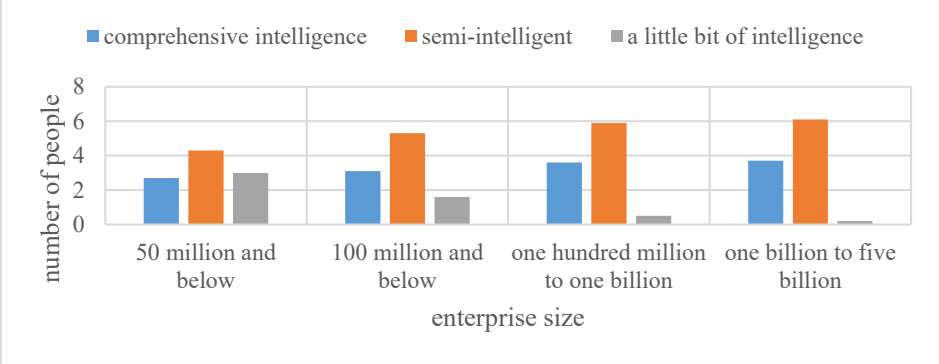

Figure 5 Schematic diagram of data on the acceptance of intelligent financial systems by enterprises of different scales

Finally, the calculation and processing efficiency of the intelligent financial system and the traditional financial system in each workflow were compared. The results are shown in Figure 6.

Finally, by comparing the calculation efficiency of the intelligent financial system with that of the traditional financial system in the four aspects of investment, tax, financial analysis and enterprise development prediction, it can be concluded that the working efficiency of the intelligent financial system had increased by about 35.3% compared with the traditional financial system. First, in terms of investment analysis, the intelligent financial system has stronger data collection and data computing capabilities. Second, in terms of the tax calculation, since most of the work of tax cannot be separated from the calculation ability, the improvement of tax was the highest. The general work content of financial data analysis and development trend prediction was similar to that of investment posts, so the degree of improvement was also relatively consistent.

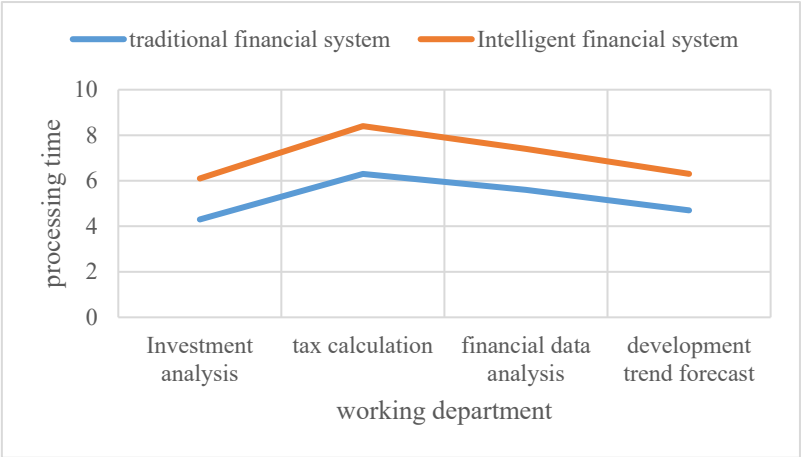

Figure 6 Schematic diagram of the comparison of the efficiency of each workflow between the intelligent financial system and the traditional financial system

6. Conclusions

The continuous progress of modern science and technology, such as big data and intelligent services, has brought new development ideas to all walks of life, and has also promoted the transformation and upgrading of business models in all fields. By establishing a perfect intelligent financial system, enterprises can not only improve the efficiency of solving current financial problems, but also optimize the efficiency of financial management and enhance their ability to deal with risks. On the other hand, financial practitioners should also adapt to the development of the times. They are no longer limited to the traditional financial accounting work, but learn new knowledge in time and carry out some necessary skills training, so as to cultivate a sense of overall situation in daily financial work. This paper analyzed and optimized the enterprise intelligent financial system using security intelligent services and big data related technologies, and proposes to encrypt the enterprise financial data using encryption algorithms in the intelligent financial system. The data processing and monitoring platform was introduced to complete the automatic analysis, classification and simple prediction of financial

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data. This can help enterprises to implement various work contents in the process of transformation and upgrading of traditional financial system, so as to enhance the business ability and competitive vitality of enterprises.

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