Business management data analysis method based on big data computing science

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Abstract

Under the development trend of economic globalization, big data computing and science have been widely used in the management and data analysis of industrial and commercial enterprises. Relevant technical theories can not only strengthen the comprehensive management level of enterprises, but also provide a new impetus for business management decision-making. Especially in the increasingly competitive market environment, if the traditional decision-making management model continues to be applied, it is difficult to meet the needs of the development of the new era, so it is necessary to scientifically conduct data analysis and management decisions based on big data computing. After understanding the operation mechanism of big data and its impact on the decision-making composition of business management enterprises, this paper defines the enterprise-level data warehouse architecture and performance optimization results according to the enterprise comprehensive data analysis platform with big data as the core, and finally defines the enterprise management countermeasures using big data computing science, so as to promote the better development of enterprises.

Keywords

big data, computational science, business administration, enterprise, data analysis

1. Introduction

Under the development trend of economic globalization, big data is the basic strategic resources for the construction of modern society development, in promoting business management enterprise management, big data technology science has unique application value, effective use can improve the industrial and commercial management system, deep mining more data information, give full play to its potential value. In essence, big data is a huge collection of data with various functions, which contains a very large amount of data information and scale, far beyond people's knowledge and understanding of information use [1]. In the process of big data collection, storage, management and analysis, the reasonable use of professional software and technical equipment can better meet the system application requirements. Nowadays, some scholars define big data as data

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information with large scale, fast transmission speed and relatively rich types, and big data technology can obtain and store various technologies used by big data in a short time. Once this concept was put forward, it has been highly valued by all sectors of society, and has been widely used in many fields in practice and exploration [2]. From the perspective of business administration enterprises, putting forward management decisions based on big data computing science can provide more technical support in enterprise construction and reform. Big data technology has the following advantages in business administration and enterprise management: First, the storage and use of data information continue to rise, which is more efficient than traditional data storage and analysis; Second, the application speed of data flow is getting faster and faster, and the requirements of information processing are getting higher and higher. Third, the overall data type is more abundant, including structured and unstructured forms, the former is the use of basic behavior of data information, in the process of processing in accordance with a specific mode of operation, while the latter has a diversified composition, whether it is click, or transmission can obtain a lot of information [3].

From the current perspective of enterprise business management decision-making, big data computing science has the following impacts: First, decision-making environment. With the continuous increase of data information, enterprises are gradually entering the development stage of big data. How to effectively use corresponding technologies to obtain economic laws and market characteristics, and ensure that management decisions are targeted and effective is the core topic for enterprises to discuss at present. According to the impact of big data environment on enterprise decision-making, information collection, data application, etc., the actual management decision-making environment has changed and has very significant data-driven characteristics, which lays a solid foundation for enterprise reform and exploration in the new era. Second, decision data. The core of big data is not data, but the potential value of data will have an impact on the development of enterprises [4.5]. Therefore, enterprises should not only have the ability of information collection, but also form the ability of data integration research in the practice and development. With the faster and faster production speed of network information and data, enterprise decision-making should put forward implementation requirements for processing information, analyze the relationship between various data according to the nature of big data, so as to grasp more valuable content and provide basis for business management decision-making. Third, decision technology. In order to effectively process more information and data, enterprises have developed and applied corresponding technology platforms in practice and exploration, among which cloud computing platform provides technical support for data management and facilitates the presentation of more content to enterprise managers. In this process, the rational use of knowledge mining technology to find data links can obtain more quality services in technological innovation. Especially after entering the new era, with the continuous improvement of economic and technological level, the market has a variety of information transmission channels, and enterprises use big data computing methods to obtain diversified information data, which can not only put forward perfect management methods, but also create high-quality conditions for catering to the market [6]. From the current situation of enterprise construction management, big data computing and science have not been rationally used,

the corresponding technical advantages have not been fully demonstrated, and there are still many problems during business management. Therefore, this paper starts from the perspective of the impact of big data computing science on business management enterprises, and after understanding the operation mechanism of big data and the architecture of enterprise data warehouse, defines the method of enterprise management data analysis based on big data computing science [7].

2. Method

2.1. Big data technology

Big data technology refers to the modern technology theory including language processing, computer technology, artificial intelligence, data analysis, statistical analysis and many other technologies. From the perspective of practical application, the types of technologies and application tools included are shown in Table 1 below. Using big data to create a comprehensive data analysis platform for enterprises can ensure the adaptability of various business and management work [8].

Table 1

Types of Big Data Technologies and Application Tools

Types of big data technologies	Big data technology and tools
Infrastructure	Cloud computing platform, network technology, cloud storage, virtualization technology, resource monitoring technology
Data acquisition and basic processing	ETL, tools, data intelligent perception technology, web crawler.
Data storage	The fusion of relational database and non-relational database, main memory database
Calculation and analysis of data	Data prediction and mining, data query and analysis, BI business intelligence, map processing.
Presentation of data	Visualization tools, graphs and reports, realistic technology

2.2. Process of data mining

The process of data mining is shown in the figure below, which mainly includes the following steps:

1. Determine the research problem domain: Clear mining needs and set goals are the first steps to carry out mining operations.

2. Select the target data set: select some data from the data source as the mining target according to the requirements.

3. Data preprocessing: targeted processing of the target data set, so that it can be directly carried out high-quality mining data [9].

4. Implementation of data mining: according to the mining requirements for the actual operation to generate patterns. In this stage, it is necessary to consider the algorithm matching problem, which usually takes into account two aspects: data characteristics and

the requirements of the operating system [10].

5. Interpretation and evaluation model: the work that needs to be done before the final result is presented to the user.

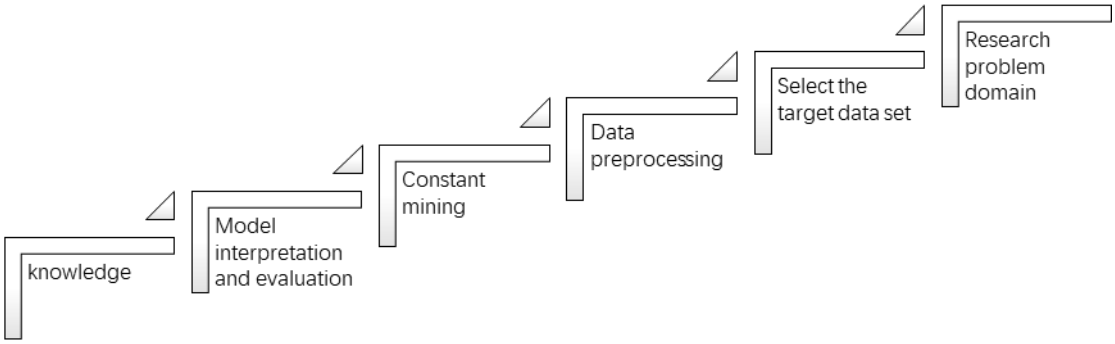

Figure 1： The general process of data mining

It is necessary to filter out a large number of patterns formed in the previous mining phase, eliminating some useless or uninteresting patterns. If no useful patterns are found among these patterns, it is necessary to return to the initial problem domain description phase and re-mining.

6. Knowledge: apply the final patterns obtained using the above steps to practical problems, guiding human behavior with useful knowledge [11].

2.3 Data Mining System

Figure 2 illustrates the mainstream architecture formed by the development of the system to today's fourth-generation mining platform. Several issues need to be considered when designing a data mining system: The solution to these issues forms the basis for the system's ability to conduct mining. Currently, the most common data source systems are databases and data warehouses. The integration of mining systems with data sources is mainly considered in four solutions: decoupling, loose coupling, semi-tight coupling, and tight coupling. Among these solutions, decoupling is the worst design while tight coupling is the most ideal design. Tight coupling can effectively achieve mining objectives, improve mining efficiency, and facilitate information exchange between different systems; however, its implementation is very difficult. A compromise solution is semi-tight coupling [12].

Figure 2: Data mining classic system diagram

2.4. Enterprise comprehensive data analysis platform

In the context of the application of big data computing science, the enterprise comprehensive data analysis platform architecture as shown in the following figure is constructed, which includes the following levels: [13]

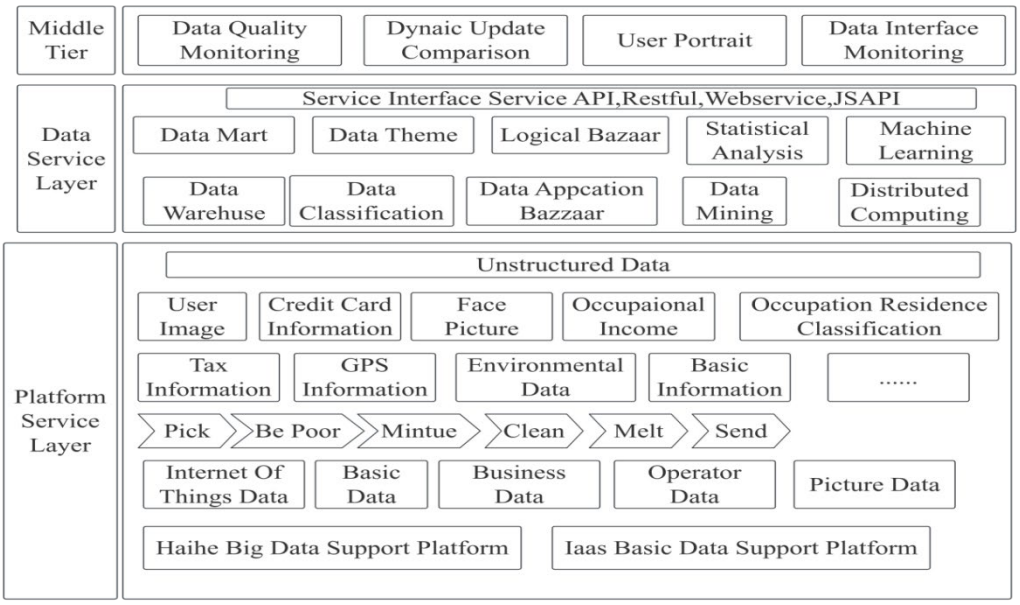

Figure 3: Platform architecture diagram

First, the platform service layer. This level design includes PaaS platform management and IaaS platform management. The former mainly provides users with two kinds of middleware services, mainly big data middleware and general middleware. The latter provides network services, storage services, cloud services, and computing services.

Second, the data service layer. This level of design includes multiple links, among which the integration and processing of professional data is to ensure the standardization and standardization of relevant data management, and it is necessary to process the relevant content in accordance with the business requirements of the enterprise while processing the conventional data, so as to provide a reference for the project implementation. Data exchange will use the database to complete data acquisition, batch collection and encryption processing operations; Computing analysis will provide users with crawler services, data mining, management services, etc., to improve the user's application experience; Data support can ensure the standardized control of relevant data, ensure the security and confidentiality of data information, and lay a solid foundation for the stable development of enterprises [14].

Third, the application service layer. In this level of design, according to the needs of the enterprise's comprehensive data analysis platform, it will deeply understand the operation of the enterprise, ensure that the follow-up work of the platform can be carried out normally and stably, and lay the foundation for the standardization and high efficiency of the platform.

2.5. Platform functions

In order to obtain a powerful and practical enterprise comprehensive data analysis platform, the platform functions can be designed according to the following figure:

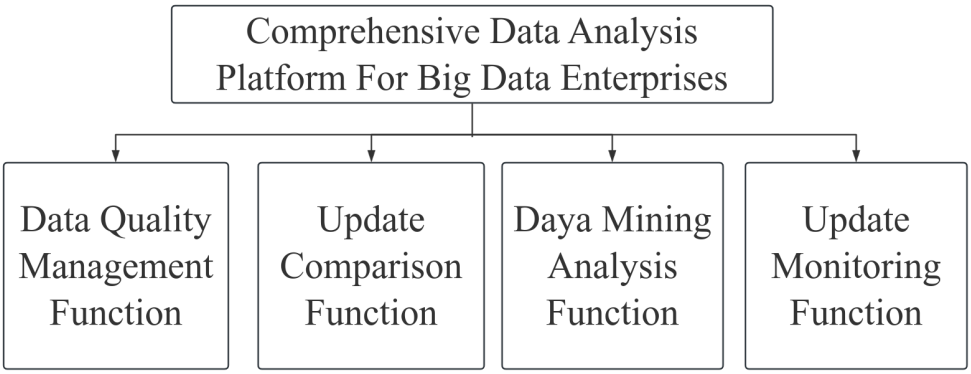

Figure 4: Structure diagram of platform functions

First, data quality management. This function mainly carries out the storage design and development of the platform, including data filtering, data exchange and data storage, etc., which can help managers find and solve various problems, improve the operating efficiency and supervision level of the platform; Second, update the comparison. This function can use the exchange platform to complete data summary and data exchange, comprehensive comparative analysis of the obtained data information, and ultimately ensure the authenticity and effectiveness of the results, and transfer it to the designated platform for storage; Third, data mining. This function will be organized according to the information catalog, the result will be multiple links as a unified whole, make full use of big data calculation, complete the design and implementation of information mining scientifically, and finally complete the construction and application of reasoning model with the help of computer technology in-depth analysis; Fourth, update monitoring. This function will use the platform to analyze and mine different types of information data, and on this basis, find the correlation between various data, find the problems existing in the platform according to the dynamic monitoring, and automatically send an early warning signal to notify the professional maintenance and treatment, so as to ensure the safety of the platform application operation [15].

2.6. Data warehouse architecture

Data warehouse mainly provides analysis and decision-making services for enterprises. The specific architecture is shown in Figure 5 below:

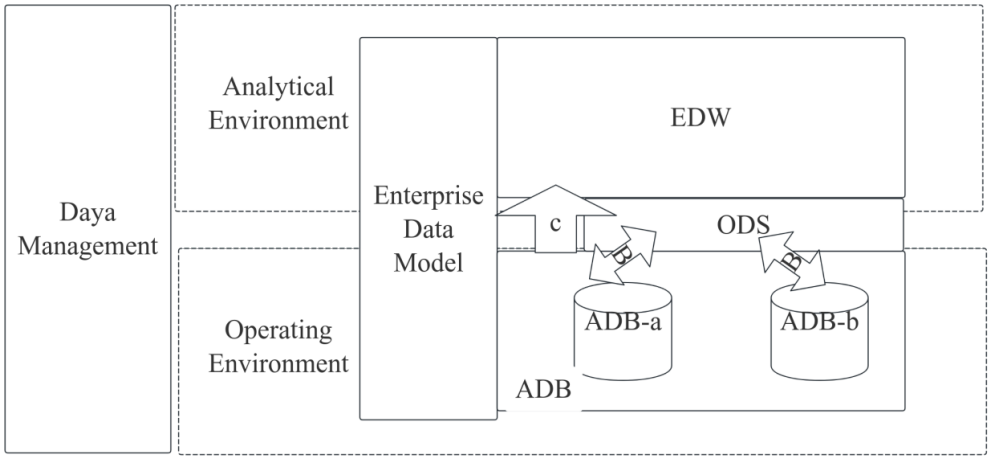

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Table 2

Database for three sets of simulation experiments

Initial Performance Index of Vertica Database	The First Round of Testing	Second Round Test	Third Round Test
Concurrency	20	40	80
Number of errors	876（1）	48	688（2）
Average time consumption	00：01：29	00：03：28	05：42
Minimum time consumption	00：00：01	0：00：01	00：00：02
Maximum time consumption	00：47：45	1：00：01	00：49：27
Total time spent executing query	138：57：40	325：31：18	535：24：00

Testing time-consuming	06：59：00	08：26：52	08：26：00
Number of successful queries per minute	13.45	11.12	11.12

Table 3

Performance Results

Concurrency	24
Number of errors	43（1）
Average time consumption	00：00：00：38
Minimum time consumption	00：00：00：00
Maximum time consumption	00：19：56
Total time spent executing query	06：05：37
Testing time-consuming	02：18：17
Number of successful queries per minute	40.75

Based on the comparative analysis of Table 2 and Table 3above, it is found that the database optimized by performance adjustment has been improved in terms of query, which is embodied in five aspects: average time consumed, maximum time consumed, total time consumed for executing queries, test time consumed, and the number of successful queries per minute. According to the result summary analysis, compared with SeaQuest database, the underlying database of EDW can execute most query requests faster; During the test period, the resource pool of the system had realistic constraints on the query requests to run. Without these constraints, some queries would consume more time. After adjustment and optimization, various indicators of the database have been greatly improved compared with the previous, such as the average time consumed per query has been increased by about 5.5 times, the time consumed by drunk queries has been increased by about 3 times, the number of successful queries per minute has been increased by about 3.6 times, and the application efficiency of system resources has been increased by about 2.8 times.

2.7. Application countermeasures

In view of the application and construction platform of big data computing, science in business administration, enterprise management and data analysis, in order to fully demonstrate the application value of big data, we should start from the following aspects: First, strengthen information construction. Enterprises should put forward strategic plans that are consistent with their own business nature, start from a macro perspective, deal with information construction at different levels, gradually improve the management countermeasures and configuration processes of the decision-making system, and strengthen the internal information management level of enterprises. Secondly, determine the value orientation. Whether it is internal business optimization or strategic plan determination, in-depth analysis should be made according to customer needs to ensure a good communication bridge between the enterprise and customers. Department employees can use data analysis to sort out customer information, so as to facilitate the adjustment of business direction, and determine infrastructure and management

mechanism. Finally, improve the decision-making mechanism. In order to demonstrate the application value of big data computing science during the decision-making of business administration enterprises, staff should propose a sound management mechanism based on enterprise decision-making, pay attention to refining data management, data analysis, performance appraisal and other related content, and ensure that data collection and application can be implemented in all aspects, so as to improve the effectiveness of business administration decision-making. At the same time, it is necessary to regularly organize employees to participate in training activities with big data as the theme, actively learn new computational science knowledge, rationally use basic means of big data to solve business problems, and propose visual means in line with business management decision-making in technological innovation, so that information analysis and information extraction become more simple and convenient, and ensure the scientific management decisions of enterprises.

3. Conclusion

To sum up, business administration enterprises use big data computing science to build a comprehensive data analysis platform, complete data analysis and data application in an orderly manner, which can facilitate managers to grasp the actual situation of enterprise operation faster, reasonably control enterprise cost expenditure, improve the economic and social benefits of enterprise operation, and provide technical support for enterprise development.

Reference

[1] L. Wang, A. Chen, H. Wu, “Analysis of enterprise management mode based on big data,” Chlor-alkali Industry, pp. 39-45, 2023.

[2] N. Tan, “Research on digital operation method of Big Data Platform,” Computer Knowledge and Technology: Academic Exchange, 2022.

[3] L. Zhong, Y. Chang, F. Wang, “Distributed dynamic industrial process based on analysis of characteristics of slow running state evaluation,” Journal of Automation, pp. 1-13, 2024, doi: 10.16383 / j.a as c230154.

[4] L. Liu, “Analysis and key points of big data on business management decision,” Modern Business, pp. 100-103, 2022.

[5] Z. Han, “Based on big data era under the background of the innovation of the enterprise management mode to explore,” Journal of Economics and Management Research, pp. 59-60, 2022, doi: 10.12346 / emr v4i1. 5296.

[6] F. Song, J. Li, Y. Wei, “Application research of intelligent electric drive bridge foresight Technology based on DMBOK,” Mechanical and Electrical Engineering Technology, pp. 159-162, 2023.

[7] M. Tang, “Exploration and Practice of Using data analysis to promote enterprise management Improvement,” Science and Information Technology, pp. 190-192, 2022.

[8] Q. Xing, “Analysis on the innovation path of enterprise business administration under the new normal of economy,” Chinese Science and Technology Journal Database

(full-text Edition) Economic Management, 2022.
[9] A. Zhang, A. Li, “Research on financing problems of Small and medium-sized enterprises,” Chinese Science and Technology Journal Database (full-text Edition) Economic Management, 2022.
[10] J. Gu, Q. Li, Y. Ban, “Whether digital transformation can promote import expansion of Chinese enterprises: Empirical analysis from listed companies,” The Southern Economy, pp. 123-141, 2023. doi: 10.19592 / j.carol carroll nki scje. 410643.
[11] K. Jia, “Economic structure transformation of enterprise business management analysis,” Journal of Economics and Management Research, pp. 7-9, 2023. doi: 10.12346 / emr v5i1. 8238.
[12] L. Luo, Q. Ye, S. Wang, “Study on the influence of party organization on enterprise management efficiency: an empirical analysis based on the survey data of enterprise-labor matching in China,” Photocopying Newspaper Materials: Labor Economy and Labor Relations, 2022.
[13] Z. LIU, B. Wang, F. Liu, “Application of data analysis in textile and garment enterprise management,” Woolen Textile Technology, 2022.
[14] J. Shi, “Analysis of enterprise business administration innovation path under the new normal of economy,” Chinese Science and Technology Journal Database (full-text Edition) Economic Management, 2023.
[15] D. Deng, “Analysis and key points of big data on enterprise business management decision,” Financial Management: Collection, 2023.