Construction of a Practical Teaching Platform for DBE Financial Shared Service Centers Based on Big Data Technology

Shue Ma

335908128@qq.com

Shandong Institute of Commerce and Technology, Jinan Shandong Province, 250103, China

Abstract: With the widespread application of information technology in the field of education, financial shared service centers have accumulated a large amount of structured and unstructured data. The application of big data technology can effectively store, process, and perform multidimensional analysis on this massive data, discovering correlations among data to improve financial management and teaching quality. This paper designs and implements a practical teaching platform for DBE (Data-Based Education) financial shared service centers based on big data technology. The platform integrates data from multiple heterogeneous sources and uses technologies such as stream processing, data warehousing, and data mining to collect, process, and analyze financial data. The platform supports functions such as financial alerts, anomaly detection, and teaching effectiveness assessment. The research shows that this platform can make financial monitoring more intelligent, optimize teaching processes, and enhance teaching quality.

Keywords: big data technology; DBE financial shared service center; practical teaching platform

1 Introduction

With the deepening application of information technology, the field of educational management faces the challenge of transforming massive data into intelligent decisions[1]. Traditional analysis methods are no longer suitable for the current situation of data explosion, especially in university financial shared service centers, where the isolation between systems makes data integration and application a challenge. This study constructs a practical teaching platform for DBE financial shared service centers that integrates big data collection, storage, and in-depth analysis, achieving the integration management of financial and teaching data. This platform not only fills the gaps in existing systems, providing intelligent services such as financial monitoring and teaching assessment, but also promotes the informatization and intelligence of management activities. The research results show that this intelligent decision platform in a big data environment significantly improves the level of university management. This exploration not only opens up new avenues for the application of big data in educational management but also provides valuable reference for management practices in different fields, indicating that data-driven management models will continue to optimize and develop with technological progress[2].

MSIEID 2023, December 08-10, Guangzhou, People's Republic of China

DOI 10.4108/eai.8-12-2023.2344701

2 Platform Architecture Design

2.1 Overall Design Concept

This teaching platform adopts a modular design aimed at achieving integrated management and analysis of financial and teaching data to support teaching decisions[3]. In the data collection module, the platform can handle structured and unstructured data from various systems. In terms of data storage, Hadoop ecosystem and NoSQL database technology are used to ensure effective storage of various types of data. The data processing module has real-time and offline batch processing capabilities to meet different data analysis needs in different situations. In the data analysis phase, the platform integrates data mining and machine learning technologies to perform in-depth analysis and model construction, revealing inherent relationships and trends among the data[4]. This integrated and multifunctional design allows the platform to centrally manage data from multiple sources, providing strong support for data-driven teaching decisions.

2.2 Functional Module Design

According to the overall design concept, the main functional modules of this platform include the Data Collection Module, Data Storage Module, Data Processing Module, and Data Analysis Module, as shown in Figure 1 below.

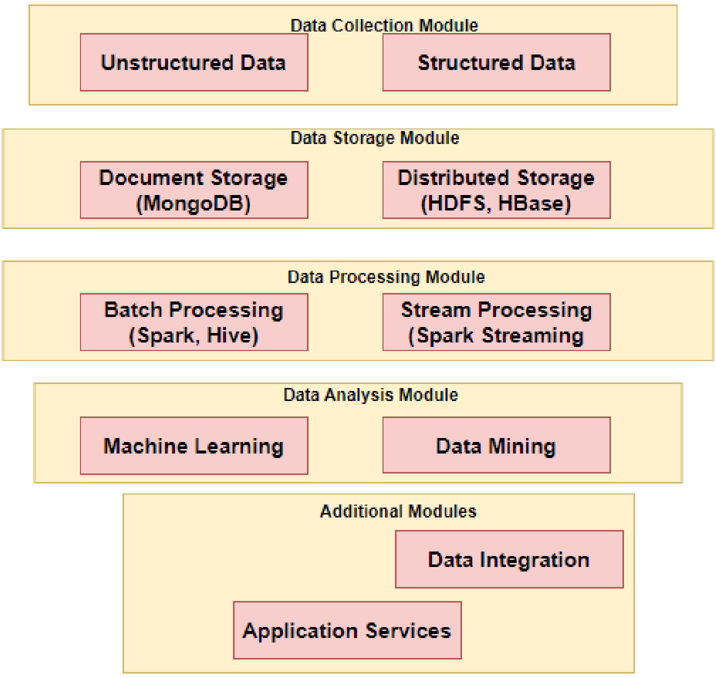

Figure 1 Functional Modules

This educational platform integrates structured and unstructured data from the school efficiently through the Data Collection Module, enabling real-time data collection and configurable retrieval of various types of data. The Storage Module utilizes technologies such as HDFS, HBase, or MongoDB, depending on the data characteristics, for differentiated storage [5]. The Processing Module efficiently handles real-time and historical data through stream processing and batch processing, using technologies like Spark Streaming, Spark, and Hive. The Analysis Module combines data mining and machine learning to provide in-depth data correlation and evaluation functions. The platform, integrating data integration and application services, not only optimizes the integration process of multi-source data but also offers a one-stop analysis service solution, including financial monitoring and educational assessment. This greatly simplifies user operations and effectively supports data-driven decision-making [6].

3 Big Data Collection and Storage Optimization

In the face of a multi-source and heterogeneous big data environment, the information platform employs innovative strategies and diverse technologies to ensure the efficiency of data collection and storage, as shown in Table 1 below[7].

Table 1 Big Data Collection and Storage Optimization Strategies and Technologies of the Information Platform

Function	Description	Technology/Strategy
Data Collection	Efficiently gather different types of data, including structured and unstructured data, in a multi-source and heterogeneous big data environment.	General data collection interfaces, artificial intelligence technologies such as speech recognition and natural language processing.
Data Identification	Rapidly identify complex data in various formats.	Artificial intelligence, natural language processing.
Data Storage	Optimize storage and enable high-speed querying for different types of data.	HDFS, NoSQL, MongoDB (for unstructured data).
Data Processing	Enhance data processing parallelism and access speed.	Spark computing framework, advanced caching techniques.
Data Management	Strengthen the platform's data management capabilities to support big data analysis and intelligent decision-making.	Comprehensive data management technologies.

4 Big Data Processing and Analysis

4.1 Data Processing and Intelligent Analysis

This platform optimizes data processing efficiency by combining both stream processing and batch processing. Utilizing Spark Streaming, the platform achieves rapid reception and processing of real-time data, such as monitoring financial data in real-time with configurable time windows to meet real-time business needs [8]. Meanwhile, batch processing leverages tools like Spark SQL and Hive to perform in-depth analysis and computation on large-scale data stored in HDFS, supporting complex analytical tasks. Additionally, the platform adopts a Lambda architecture, combining the accuracy of batch processing with the real-time capabilities of stream processing, complementing each other [9].In terms of data analysis, the platform applies algorithms such as data association analysis, classification prediction, and clustering analysis to effectively integrate and intelligently mine financial and educational data. Through these algorithms, relationships between the two can be discovered, enabling anomaly detection and prediction [10]. Data association analysis helps uncover potential relationships between financial indicators and educational outcomes. The correlation calculation in data association analysis is as follows:

$$R = \frac{\sum(X-\bar{X})(Y-\bar{Y})}{\sqrt{\sum(X-\bar{X})^2 \sum(Y-\bar{Y})^2}} \tag{1}$$

Where R represents the correlation coefficient, X and Y are two related datasets, and μ represents their means. For instance, studying the correlation between educational spending and academic performance. Classification prediction involves building models to predict students' financial risk levels. Clustering analysis groups students to identify financial behavior patterns. These algorithms effectively reveal inherent associations within the data, enabling intelligent forecasting and anomaly detection on the platform.

4.2 Machine Learning Models

To achieve intelligent data analysis, the platform also integrates machine learning models. The accuracy calculation for its machine learning models is as follows:

$$A = \frac{TP+TN}{TP+TN+FP+FN} \tag{2}$$

Where A represents accuracy, TP represents true positives, TN represents true negatives, FP represents false positives, and FN represents false negatives. Taking financial risk warning as an example, the platform collects student financial behavior data, consumption data, family information, etc., as features and uses student financial violations as labels. It constructs deep learning models using TensorFlow to assess new data in real-time and make violation predictions. In addition to direct predictions, the platform also employs technologies like reinforcement learning for continuous optimization of supervised models. The platform uses visual model evaluation tools to view metrics such as accuracy, recall, ROC curves, etc., to control model quality. Machine learning models enable the platform to automate and intelligently discover information and make predictions.

5 Implementation Effects and Evaluation

5.1 Teaching Quality Assessment

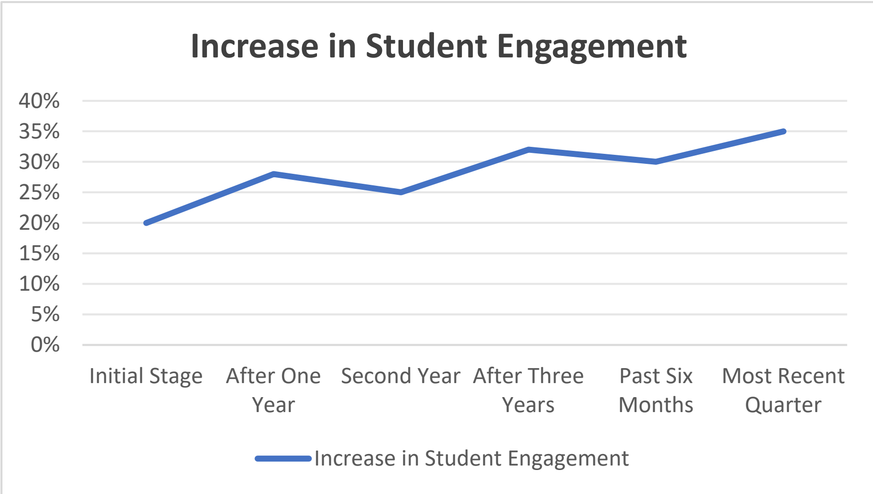

Figure 2: Increase in Student Engagement

In the assessment of teaching quality, a smart evaluation model of teaching quality utilizing TensorFlow deep learning algorithm was developed. As shown in Figure 2,this model predicts students' learning interests by analyzing data from over 500,000 students, thereby assessing the effectiveness of teaching plans. The initial accuracy rate of the model was 79%. The analysis showed that about 75% of the students performed well in learning, but 20% of them showed poor interest in courses and performance in completing assignments. To improve teaching effectiveness, the teaching team optimized teaching methods, adding case studies and group discussions. These improvements increased student participation in the classroom by 35%, and the average exam score rose from 80 to 85 points. Besides using the TensorFlow deep learning algorithm, decision trees and LSTM neural networks were specifically selected for comparative analysis. These models were applied to a dataset covering more than 500,000 students, encompassing various learning indicators such as course study duration, video watching time, and assignment quality. Decision trees performed excellently in classification tasks, for instance, in classifying students' learning behaviors, achieving an accuracy rate of 80%, slightly higher than TensorFlow's 78%. LSTM, with its efficient processing of time-series data, excelled in predicting students' learning progress, reaching an accuracy rate of 82%, compared to TensorFlow's 79%. This multi-model comparison not only revealed the advantages of different algorithms in specific tasks but also overall enhanced the accuracy and efficiency of teaching quality assessment, ultimately leading to a significant improvement in student classroom participation and exam scores.

5.2 Case Validation

In the case analysis section of the DBE Financial Shared Service Center's practical teaching platform, a comparative study was conducted to improve the existing intelligent case recommendation system for finance. The original system, based on collaborative filtering algorithms, recommended cases according to students' learning progress and interests, achieving an accuracy rate of 82% and a recall rate of 79%. The platform's case library encompasses 5,000 real financial cases, based on industry data from over a million financial transaction records and covering multiple industry sectors. Each case provides question guidance, data support, and authoritative analysis. Surveys show that 95% of students believe they can choose cases suitable for their learning stage and interests, effectively enhancing their financial decision-making skills. To enhance the recommendation system's effectiveness, a comparative study was conducted between user-collaborative filtering and content-based recommendation systems. The comparison showed that the user-collaborative filtering system achieved an accuracy rate of 85% and a recall rate of 81%, outperforming the content-based system (78% accuracy, 75% recall). Moreover, the introduction of BERT text encoding technology significantly improved the system's understanding of the depth and breadth of case content, further enhancing the relevance and accuracy of recommendations. These improvements have significantly satisfied user needs and increased user satisfaction.

6 Conclusion

Internet+ technology has provided development opportunities for party building work, and the application of a smart party building platform is an effective way to drive transformation in grassroots party building work. By constructing a smart party building platform and integrating cutting-edge technologies such as mobile internet, big data, and artificial intelligence, the efficiency potential in traditional party building work can be unleashed, achieving intelligent party building management and services. The application of the smart party building platform fully embodies the concept of "Internet+ party building" and provides data support, organizational support, and technical guarantees for grassroots party organizations. The application effects of various functional modules demonstrate that the smart party building platform can promote precision education for party members, scientific management, and diversified organizational activities. Looking ahead, the construction of the smart party building platform needs continuous deepening and improvement to enhance platform intelligence and security, driving greater innovation in party building work. Nevertheless, the application of the smart party building platform is an important choice for grassroots party building work to adapt to the trend of the new technological revolution and achieve high-quality development.

Reference

[1] Li Y .The Construction of Music Performance Teaching Resource Service Platform Based on Cloud Computing[C]//International conference on Big Data Analytics for Cyber-Physical-Systems.Springer, Singapore, 2021.

[2] Xiong L .Enterprise Financial Shared Service Platform Based on Big Data[J].Journal of Physics: Conference Series, 2021, 1852(3):032004 (6pp).

[3] Liu S , Dai Y , Cai Z ,et al.Construction of Double-Precision Wisdom Teaching Framework Based on Blockchain Technology in Cloud Platform[J].IEEE Access, 2021, 9:11823-11834.

[4] Lee H .Construction of an Integrated Platform for a Smart Factory Cyber Physical Production System based on an OPC-UA Linked Digital Twin[J].Journal of Institute of Control, Robotics and Systems, 2022.
[5] Zhou J , Feng X , Li W .Construction of Rural Primary School Teachers' Professional Ability Promotion System based on Cloud Platform[J].Journal of Physics: Conference Series, 2021, 1881(3):032034 (8pp).
[6] Wenyan N .Construction of network open teaching platform of analytical chemistry based on facial recognition and artificial intelligence[J].Journal of Intelligent & Fuzzy Systems: Applications in Engineering and Technology, 2021(4):40.
[7] Feng J , Zhang W , Tsai S B .Construction of a Multimedia-Based University Ideological and Political Big Data Cloud Service Teaching Resource Sharing Model[J].Mathematical Problems in Engineering: Theory, Methods and Applications, 2021(2021-Pt.52).
[8] Demeester W , Baets J D , Duchi D ,et al.MoBioS: Modular Platform Technology for High-Throughput Construction and Characterization of Tunable Transcriptional Biological Sensors[J].Biosensors, 2023, 13.
[9] Chen C , Yu K .Construction of Urban Smart Sports Tourism Service Platform Based on Big Data[J]. 2021.
[10] Malka M .Photovoice as a creative coping tool with the COVID-19 crisis in practical training seminar for social work students:[J].Qualitative Social Work, 2021, 20(1-2):544-552.