Research on Educational Information Management System Based on Computer Big Data

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Abstract. Aiming at the problem of computer network courses with more teaching content and rapid knowledge update, the paper builds a computer network adaptive learning system by collecting learning behaviour data in the education process and using the learning analysis technology of big data. The six modules of prediction and intervention can push learning content in a targeted manner, give feedback on learners' learning effects in time, and recommend next learning strategies, so as to achieve the effect of teaching students in accordance with their aptitude and cultivating students' independent learning ability.

Keywords: Computer, big data, education information management, teaching training.

1. Introduction
The effective analysis and application of educational big data in colleges and universities can play an important role in improving the quality of education, realizing personalized learning, optimizing the allocation of educational resources, and assisting in scientific decision-making in education. In 2015, the State Council issued the Action Plan for Promoting the Development of Big Data. The document pointed out that “data has become a national basic strategic resource”, and it clearly stated in the “Public Service Big Data Project” one of the ten major projects launched that education and culture should be built Big Data. In 2018, the “Educational Informationization 2.0 Action Plan” issued by the Ministry of Education proposed to use big data technology to provide learners with massive and appropriate learning resource services, deepen the application of big data in education, and promote the reform and development of education, teaching, management and services. The university education big data platform is the basis for data collection, correlation fusion, in-depth analysis, discriminant prediction, and scenario application [1]. Research on the architecture design of the education big data platform can contribute to the ease of use, scalability, stability, and security of the platform. Provide underlying protection. The data information of many colleges and universities is still in the collection and accumulation stage. Although the continuous development of mobile terminal systems has brought great convenience to information collection, the collected data only stays in the query stage, and the data is not integrated, Analyse and sort out the information so that there is no use value. How to use big data technology to let teachers understand the behaviour trends of students from these massive data, and take appropriate interventions to guide them to improve learning effects is one of the important research directions in the field of smart teaching.
2. Demand analysis

As of the end of 2016, the number of Chinese Internet users had reached 731 million, of which 695 million were mobile Internet users, and more than 90% were smartphone users. The screen size and resolution were gradually improved, and the intelligence of programs and experience continued to rise. The trend of using mobile search resources for learning is further obvious that not only students, but also teachers and administrators, as well as social people related to the education field, are the service targets of smart education, and their focus is different. The design of smart education system must take full account of different users' demand.

The focus of students is to master the learning content in an intuitive and vivid way in a relaxed and lively environment. The knowledge they need is readily available. Like-minded people discuss issues of interest together, have opportunities for self-expression, and master useful, interesting and challenging knowledge. Skills can gain a sense of accomplishment. Teachers pay more attention to how to stimulate students’ interest, whether the content of the courses taught can be mastered by the students, whether they have previewed, reviewed and completed the homework according to their own arrangements, whether the expected goals can be achieved, and whether the teacher’s efforts are recognized and good Teaching environment, real-time understanding of student dynamics, promotion of academic qualifications and professional titles, and convenient scientific research services are all problems they expect to solve. The focus of functional department managers is whether the business under their jurisdiction can be executed in sequence and the progress of the project. School-level leaders hope to grasp the overall situation of the school, and grasp the macro data and future trends such as enrolment, employment situation, construction process of major projects, fund use, etc., as a basis for decision-making [2]. There are many social users, and their focus is also different. For example, the superior authority cares about the implementation of policies and the realization of school goals, parents care about their children's achievements and performance, and companies care about whether they can recruit the talents needed by the company. Can there be more opportunities for cooperation.

It is not difficult to see that in the smart education system, building a data collection platform is the foundation. Teachers and students are the most important user group, and other users have different needs. Talking with data is the key, and targeted output customized push is the core application, which can be stored quickly. The security of access and data is a guarantee. Creating a student-centered learning environment and a teacher-led education environment, using big data technology to supervise school operations, and improving the level of comprehensive governance are advanced applications of smart education.

3. Design of adaptive computer education management system

3.1. Architecture design

Smart education requires the support of the hardware environment. The ideal carrier is a smart campus or big data centre that relies on the campus network. Physical classes are taught in smart classrooms based on cloud desktops, while virtual classes or learning communities composed of students with the same hobbies the form of the project team does not require a fixed location and uses fragmented time to learn in cyberspace and WeChat groups [3]. Online tutoring and offline teaching cooperate with each other to improve teaching quality. The university education big data basic platform is divided into four levels from bottom to top, namely: basic hardware layer, data resource layer, education big data collection and storage, education big data analysis and display. As shown in Figure 1.
3.1.1 Basic hardware layer. A cluster is constructed by a group of PCs or servers, which mainly carries tasks such as data storage, calculation, fault tolerance, scheduling, and communication, and executes and feedbacks instructions issued by other layers. The cluster can reduce the number of single points of failure, obtain higher computing speed, and can also be used as a backup. The basic hardware layer is the cornerstone of the entire big data ecosystem, ensuring that users can store data efficiently and quickly, and then perform efficient data analysis and mining, thereby helping users solve enterprise informatization problems. Hadoop includes two core components, the HDFS distributed file system and the MapReduce parallel processing framework. It allows users to easily construct and use a distributed computing platform and become the first choice of underlying technology.

3.1.2 Data resource layer. Analyse different systems, formulate the scope and goals of system data collection, collect all kinds of data (teaching, management, scientific research, services) generated in the daily management and teaching of the school, and information system data outside the school (government, universities, enterprises) to integrate various structured and unstructured data to provide support for big data analysis [4].

3.1.3 The collection and storage of big data of college education. It aims to develop adaptable interfaces for all kinds of heterogeneous data, connect with other systems inside and outside the school, and provide basic management functions such as association, conversion, and storage for data.

3.1.4 Analysis and display of university education big data. Use various big data the analysis methods, combined with Spark, MPP, HBase and other technical methods to conduct in-depth data analysis.
according to requirements, including clustering, classification, frequent item mining, sequence mining, prediction, recommendation, etc. Through the data report tool, various data reports are generated according to specific needs, the results are saved as report files, and finally displayed in a visual manner.

3.2. Adaptive learning technology
The first is the reprocessing of data. The requirements for learning and analysing data include structured data, unstructured data and even multimedia data. Structured data often refers to quantitative data, including homework and test scores, standardized test scores, and data that occur naturally in the learning process such as time and frequency. Unstructured data generally refers to quantitative qualitative data, including posts in discussion forums, content of assignments, and the writing process and content of group reports [5]. These data constitute new directions for educational measurement, such as text mining. In the past, educational measurement was mainly a measurement of educational output, that is, test scores. Even though the existing procedural measurement is a rough description of learning behaviour that students can recall through questionnaires, educational measurement can accurately track and record the real-time behaviour of learners in online platform learning. This leap in the quality of education measurement will inevitably lead to the improvement of the quality of education research, the expansion of the research scope and the exploration of research depth. According to the analysis and prediction of teaching data, change the teaching mode, realize personalized education, adjust teaching plan, optimize teaching method, and improve teaching quality. Guide the scientific and healthy development of student training models and educational quality management methods. Figure 2 shows the adaptive teaching model diagram.

![Smart education adaptive teaching model](image)

**Figure 2.** Smart education adaptive teaching model

A typical adaptive selection algorithm usually consists of an input layer, a hidden layer and an output layer. The neurons between different network layers are fully connected. For a given N sample
data \((X_i, t_i)\), where \(X_i = [x_{i1}, x_{i2}, \cdots, x_{im}]^T \in \mathbb{R}^m\), \(t_i = [t_{i1}, t_{i2}, \cdots, t_{im}]^T \in \mathbb{R}^m\) Suppose a single hidden layer neural network with \(L\) hidden nodes can be expressed as:

\[
\sum_{i=1}^{L} \beta_i g(W_i \cdot X_j + b_i) = o_j, \quad j = 1, 2, \cdots, N
\]

(1)

In the formula, \(g(x)\) is the activation function, \(W_i = [w_{i1}, w_{i2}, \cdots, w_{im}]^T\) is the input weight, \(\beta_i\) and \(b_i\) are the output weight and bias value of the \(i\) neuron in the hidden layer, and \(W_i \cdot X_j\) is the inner product of the two. Therefore, the hidden layer output can be expressed as \(T = H\beta\), \(H\) is the hidden layer node output, \(\beta\) is the output weight matrix, and \(T\) is the target matrix.

\[
H(W_1, W_2, \cdots, W_L; b_1, b_2, \cdots, b_L; X_1, X_2, \cdots, X_N) =
\begin{bmatrix}
g(W_1 \cdot X_1 + b_1) & \cdots & g(W_1 \cdot X_N + b_1) \\
\vdots & \ddots & \vdots \\
g(W_L \cdot X_1 + b_L) & \cdots & g(W_L \cdot X_N + b_L)
\end{bmatrix}_{N \times L}
\]

(2)

The training goal of a single hidden layer neural network is to minimize the output error \(\sum_{j=1}^{N} \|o_j - t_j\|\). From the above, the optimization objective function after adaptively introducing the L2 regularization term can be expressed as:

\[
\min_{\beta \in \mathbb{R}^L} \frac{1}{2} \|\beta\|^2 + \frac{C}{2} \|H\beta - T\|^2
\]

(3)

In the formula, \(C\) is the regularization coefficient. The output weight value can be solved by some optimization algorithms based on gradient descent, so the core of the adaptive algorithm is to minimize the error function by solving the output weight value [6].

### 3.3. Big Data Smart Push Application Design

Push is to send the organized information resources to the user terminal in the form of files or links, so that they can be opened directly without searching, which meets the personalized needs of users, is accurate and fast. The content of the push service can be customized by the user, or it can be determined by the intelligent analysis of the software in the big data environment, based on the activity track and behaviour record [7]. Making full use of the push service of the smart education platform can not only save students time for searching and organizing resources, but more importantly, they can receive the latest information regularly, and guide their interests and expertise continuously and in-depth, which is essential for improving work skills. Competitiveness is very beneficial. Once students log on to the Internet, their online behaviour, learning progress, and consumption will be automatically recorded by the system, gradually forming an activity track. Through big data mining and processing, teachers, administrators and developers can grasp the dynamics in time and use the push system to give they guide and help, as shown in Figure 3.
In the information push system, different information will be pushed to students, teachers, and managers at the same time as needed to help different users improve teaching and learning effects from different perspectives, thereby improving the quality of education. In the application of smart education, the workload of teachers will be greater than before. They must not only prepare less and prepare teaching resources, but also pay attention to the dynamics in the field, and constantly learn new technologies and ideas. Otherwise, they may not be able to control the classroom and need to master them. Guide program design, mobile courseware production, unstructured data capture, big data extraction and analysis, clustering and classification and other related technologies, portable cloud disk, anytime storage, and hand-recording have become indispensable habits for smart teachers.

4. Conclusion
This article constructs a smart teaching model based on a big data platform and implements it in non-computer major database application courses. The data results show that students’ interest in learning and their performance in peacetime have been significantly improved, their experimental hands-on skills have been enhanced, and their classroom activity has increased significantly. With the construction of wireless campus networks, more real-time learning data can be used to improve teaching effects. At the same time, higher technical requirements are put forward for the big data platform.

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