Design and Application of Sports Athlete Training Progress Management System based on Big Data Analysis

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Abstract: Sports athletes in order to achieve hard-won results, the daily training project content is numerous, the subject is multifarious. Among them, there are both basic physical training, project skills training, and special training in psychological quality. In the era of big data, big data analysis technology helps athletes to conduct training analysis, record training results in time and convey feedback to athletes and coaches, improving the management level of athletes' training progress, so as to realize the systematization, informatization, intelligence and high efficiency of sports athletes' training management. Through the integration of big data analysis technology and Internet technology, the construction of athletes' training progress management system can provide athletes with more scientific training management decisions, so as to help them achieve better training results.

1 INTRODUCTION

In the current era, big data has been widely used in various industries and fields of our daily work and life, and it has gradually become the backbone to promote the development of the whole society and economy. Big data analysis technology derived from big data has also become a powerful data support tool for people's fine management and decision making. In the practical application process, big data analysis technology, computer technology and Internet application platform technology are used as tools and means to process, store and transfer relevant information, so as to realize prediction, control, organization and decision making in this field (Sun 2019). In this process, the application scope of big data analysis technology is constantly expanded and developed, and the application mode of "Big data +" is gradually generated, thus setting off a new wave of development in various industries and fields in the whole society.

At present, the application of big data analysis technology is urgently needed to improve the training of sports athletes in sports management. Traditional sports athlete training management is mostly based on manual statistical analysis, and the tools used are only spreadsheets, with single data collection direction and linear data analysis method. Therefore, it directly affects the management of sports athlete training and

the evaluation of training effect. In this paper, the author believes that the training progress management system of sports athletes should be reasonably constructed, so that the innovative application of big data analysis technology can meet the complex training management needs of current sports athletes, and effectively improve the information integration and information timeliness of sports training management mode. Through the sports athletes training progress management system can help athletes and coaches both grasp the training information data, so as to formulate and modify the training plan of athletes on the basis of scientific data information, improve the training effect of athletes.

2 OVERVIEW OF SPORTS ATHLETE TRAINING SCHEDULE MANAGEMENT

2.1 Meaning of Sports Training

Sports training is a planned sports activity organized by sports athletes under the guidance of coaches in order to improve their sports competitive ability and sports achievements. It is the only way to improve the sports level of sports athletes, and also an important part of competitive sports. Sports training is mainly

applicable to professional sports athletes, whose purpose is to continuously explore and improve the sports ability of professional sports athletes. Therefore, in the course of sports training, there are many training contents and complex subjects, and sports training also has the characteristics of high intensity and long time. In order to constantly change the basic physiological state of sports athletes, promote their higher limit forward. In addition, the professional sports training of sports athletes also needs professional and scientific training methods as guidance, on the one hand, it can quickly improve the performance of sports athletes, on the other hand, it can fundamentally protect the health of sports athletes, prolong their career. The improvement of sports training effect cannot be separated from the cooperation of coaches and athletes, and strict progress management is also necessary to ensure the training effect of athletes.

2.2 Sports Training Schedule Management

The management of sports training schedule refers to a comprehensive process of scientific and reasonable use of various methods to improve training effectiveness (Wang 2020). Sports training with the athlete's career from childhood to youth to adult, every athlete's physical, emotional, psychological bearing capacity in different training level, therefore, in different stages of sports training plan formulation and implementation process must consider the comprehensive growth state of the athletes. In particular, the coach should be familiar with the progress of each athlete's sports training, timely adjust the training plan according to the emergence of uncertain factors such as athlete's emotions and injuries, and adopt appropriate management methods to improve the performance of athletes' sports training is an important subject of his research and the core content of coaching work.

2.3 Deficiencies of Traditional Sports Training Schedule Management

At present, in sports training management, coaches mostly adopt the traditional management method, that is, all athletes adopt the same "militarized" management, and it is impossible to develop individual training plans for each athlete in line with their physical quality, technical and tactical requirements and psychological development level. In the aspect of training data recording, there are some problems such as single data collection means,

few data information recording and mechanical data information recording. Therefore, in the management of sports training progress, more rely on the experience of coaches rather than scientific analysis of data results, which is easy to lead to deviations in the formulation of athletes' sports training plans, and even lead to serious consequences such as injuries of athletes due to the wrong decisions of coaches.

To sum up, based on analysis of large data sports athletes training schedule management system can according to the need of sports training, through the technology of data in the process of athletes training a variety of data collection, cleaning, storage, analysis and mining, the formation of intelligent sports training model, help coaches and athletes to deeper and more intuitive to see the effect of sports training, At the same time, it can also supervise athletes' physical functions accordingly, which is convenient for coaches to adjust training plans according to training effects in time, control training intensity, and realize professional and scientific management of sports training schedule.

3 BIG DATA ANALYSIS TECHNOLOGY AND TRAINING PROGRESS MANAGEMENT SYSTEM

3.1 Big Data Technology

In the current era of big data, data development promotes the progress of the society as a whole, and massive data information brings new opportunities and challenges to various industries and fields in the whole society. Big data technology is an emerging technology in data capture, data storage, data analysis, data application and other aspects far beyond the traditional data management tools and manual data analysis capabilities. Big data has the obvious characteristics of large data scale, fast flow speed, multiple data types and low value density. So we need new data processing models to realize the true value of big data. In the face of a large number of inaccurate, unstructured and incorrectly utilized data information, big data technology can obtain results through a series of analysis and processing, clarify the correlation between data, and be applied to practical work production and decision-making analysis and making, providing accurate and scientific data information support. And gradually realize the digital, information and intelligent development of the industry or field.

There are five steps in the whole life cycle of big data from generation to practical application, namely big data collection, big data pre-processing, big data storage and management, big data analysis and mining, big data presentation and application (Yang 2017). This process also corresponds to the five core technologies covered by big data technology. In addition, the application process of big data processing is also an important basis for the construction of big data technology system, as shown in Figure 1, which is the big data technology architecture diagram.
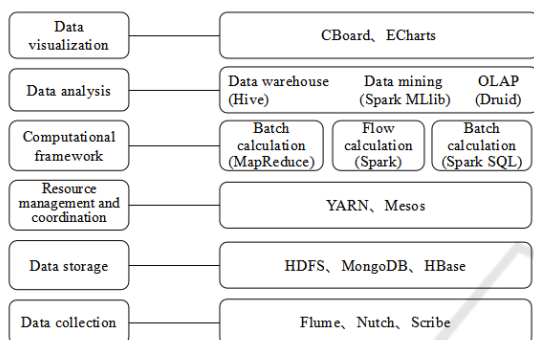

Figure 1: Big data technology architecture diagram.

3.2 Big Data Analysis Technology

Big data analysis technology is one of the cores of big data technology. It is the whole process of extracting, refining and analyzing massive low-value density data from the aspects of big data visualization analysis, data mining and predictive analysis. In short, big data analysis technology is data mining technology. The common technical methods involved in data mining include prediction model discovery, sequence model discovery, dependency model discovery and so on. The data object can also be divided into relational database, object-oriented database, text data source, multimedia database and so on. Big data analysis and data mining is the main process: set the goal of data analysis and mining, the corresponding data extracted from the target database objects, and then use data mining methods for data analysis, the final will be the result of the analysis of data mining in the form of visual intuitive display, also can support to make decisions on the predictive data results.

3.3 Sports Training Progress Management System

Sports training progress management system is an innovative practice of integrating big data technology and Internet application platform technology into sports training progress management. Firstly, all the data of athletes in the process of sports training are collected and classified and stored by wearable devices and high-speed cameras, such as heart rate, blood pressure, body temperature, energy consumption and other athletes' physical data. There are such as speed, strength, distance, habitual movements, jumping athlete technical data. In addition, the data of athletes' mental states such as tension, depression, excitement and so on will be classified and retained. Secondly, through the large data analysis technology will be more integrated processing data information, the data results build intelligent model for athletes personality and preferences, and make the athlete daily training plan and schedule according to the can depend on, to help athletes and coaches comprehensive, intuitive understanding of real effect of exercise training, improve the effect of exercise training. Thirdly, under the technology of Internet application platform, the sports training progress management system is built to facilitate athletes and coaches to implement the overall, scientific and intelligent management and monitoring of the sports training system engineering.

4 THE DESIGN AND IMPLEMENTATION OF SPORTS TRAINING PROGRESS MANAGEMENT SYSTEM

4.1 Overall Framework

The sports training progress management system adopts B/S architecture in the system hardware deployment, in which the system background server includes Web server, database service and business logic server. Under B/S structure, sports training schedule management system control can be divided into the front end the application layer, business layer and data access layer, business logic as the user to the server's instruction in between the user and the database server deployment and response, so as to realize the human-computer interaction between users and system, and user calls to the data. Figure 2 shows the architecture diagram of sports training progress management system.
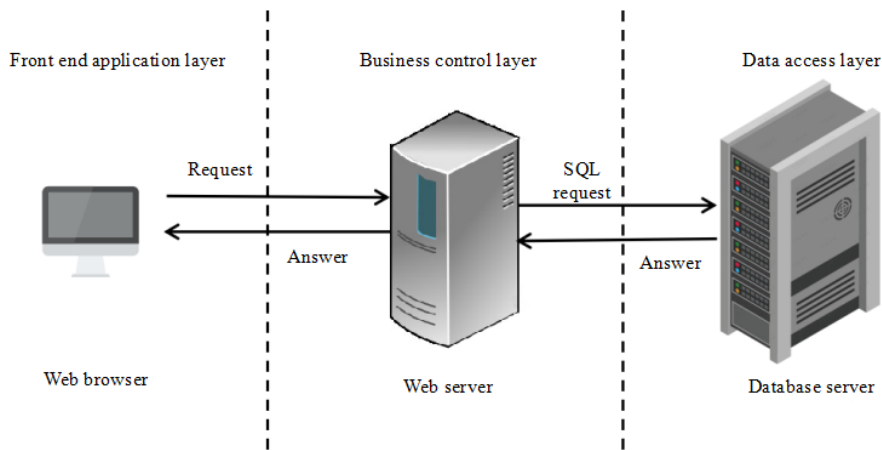
Figure 2: Architecture diagram of sports training progress management system.

In the B/S architecture, users can log in to the system through a browser that accesses the Internet on a desktop client and use various system functions. And the overall business expansion of the system is simple and convenient, only by adding the function page can be completed. In addition, it has the advantages of low development and maintenance cost and strong data sharing. The normal operation of sports training progress management system is inseparable from the support of software system and hardware equipment. Table 1 shows the specific system hardware and software configurations.

Table 1: Hardware and software environment configuration of sports training progress management system.

	The Web server	Apache
	Database server	Oracle database management software
Server Configuration	Hardware Server CPU	3.00GHz
	Hardware Server Memory	16GB
	Hardware Server Hard disk	2TB
	System development operating platform	Windows Sever 2019
Client Configuration	Software operating system	Windows 10.0
	Recommended Browser	IE/Chrome

In addition, the main application of big data technology in sports training progress management system is to collect, store, analyze and mine various data of athletes in the process of sports training as well as the application of data results. The big data analysis system adopts Hadoop distributed system architecture of cloud server to deal with the parallel operation and resource allocation of multiple data in the training process of athletes. Meanwhile, it provides outgoing API and Web interface to facilitate the collection of athletes' training data and the invocation of sports training progress management system. The collection of athletes' training data mainly relies on intelligent wearable devices and high-speed cameras. Intelligent wearable devices can directly obtain the physical function data of athletes, while high-speed cameras can extract and analyze the athletes' habitual movements, preferred routes, technical skills and other small data information that cannot be distinguished by naked eyes through the recording of athletes' training process frame by frame. The two kinds of data cooperate with each other to improve the data record of sports training, realize the comprehensive perception of athletes and training process, and provide necessary data support for the management of sports training progress.

4.2 Specific Functions

4.2.1 System Management

Sports training progress management system supports different users and different roles for login,

role is divided into athletes, coaches and administrators. Users can log in to the system to use system functions after registering the account and password with unique identification. Different roles have different functions displayed after login, and different roles have different permissions. The administrator can assign different roles and adjust permissions for different users.

4.2.2 Coach End

In the coach end of sports training progress management system, the functional modules supported by the system include training progress management and athlete management. Among them, the training progress management function module also includes basic training management, special training management, training objectives, training progress adjustment, training data recording, training results evaluation and other contents. In the athlete management module, the coach will check the specific training progress of different athletes and various analysis data in the training process, so as to adjust the training progress and change the training intensity, training subjects and training methods accordingly. To achieve personalized training program development, diagnosis, decision making and evaluation for each athlete.

4.2.3 Athlete End

At the athlete end of sports training progress management system, the functional modules supported by the system include training plan management, training progress management and personal information management. Among them, training plan management includes short-term plan, long-term plan, special training plan and training plan modification. In the training progress management, athletes can view the training arrangements, training plans and corresponding coach information of different training subjects, as well as see all the data visualization results and intelligent data model of personality and preference in their training process. It is convenient for athletes to find their own shortcomings and strengths in the training process, and also provides decision-making data support for timely adjustment of training schedule. In addition, under the functional module of training progress management, it also supports the evaluation feedback of coaches and the statistics of training items reaching the standard, so as to improve the refinement of the control of personalized training progress of different athletes and the effectiveness of training effects. In

personal information management, athletes can view and update their personal information at any time, see the change of their own body function data, but also can obtain the corresponding healthy diet information and life tips information, so as to form a systematic management of sports training, comprehensively improve the effect of athletes sports.

4.3 Technical Support

According to the design requirements and functional modules of the sports training progress management system, the system needs to take into account the function switch between different roles of athletes and coaches, as well as the transfer and call of Internet application technology platform and big data analysis and mining data information. Therefore, in the development platform and system function module selection, it is necessary to pay attention to the compatibility between each module and function practicality. Java language and MCV mode are used to build the application layer in the front part of the system, and Oracle 11.2 is used to select the database server. In the big data analysis technology infrastructure module, Java, Python, Shell three languages are selected to complete data analysis and mining function interpretation and script compilation. HDFS technology is used for task management of big data analysis and mining. Apache, Hadoop and YARN technology are used for parallel computing to coordinate external Web server and big data analysis module. Hbase distributed database and Hive data warehouse technology are used for data storage of cloud server for big data analysis.

In addition, data results generated by big data analysis and mining are realized by data visualization analysis, and displayed in the front-end application layer page with D3.js. D3.js can display data in HTML, SVG, and CSS. Like jQuery, D3 directly manipulates the DOM (Liu 2020).

5 CONCLUSIONS

The construction of sports athlete training progress management system based on big data analysis is a pioneering practice in the integration of big data analysis technology and Internet application platform technology innovation in athlete training management. Relying on big data analysis and mining technology, the data information of athletes' training progress will be fully perceived, which is convenient for coaches and athletes to find their strengths and weaknesses in the training process, and

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timely improve the training plan to achieve fine control and personalized needs of sports training progress. It improves the effectiveness of sports training and provides a new idea for the digitalization, information, intelligence and scientific development of sports training for athletes.

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