Journal of Information Technology Review

DLINE JOURNALS

Print ISSN: 0976-3511
Online ISSN: 0976-2922
JITR 2025: 16 (2)
https://doi.org/10.6025/jitr/2025/16/2/47-54

Intelligent Algorithms for Athlete Training in Higher Education Using Big Data Technology

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ABSTRACT

In the computer age, data is the most valuable resource. Based on big data analysis technology, we have developed an intelligent physical training model for college students to control their training pace better. Simulation technology was also utilized to study and evaluate the operability of this technology, with the goal of developing more effective training programs for college students. The research found that in the field of big data analysis, it is essential to utilize intelligent training methods to manage and adjust the competition time and intensity among college students. This method not only helps us to formulate and implement competition plans more swiftly but also aids in better understanding and handling a large amount of information, thereby improving the efficiency and quality of competitions. Hence, this method is worth our effort and promotion.

Keywords: Big Data Technology, Athlete Physical Education, Intelligent Training Algorithm, University Sports

Received: 18 September 2024, Revised 4 January 2025, Accepted 12 January 2025

1. Introduction

With big data technology, athletes can better understand their conditions, allowing them to adjust their training methods more precisely and perform better in competitions. For instance, sprinters can utilize big data analysis to better refine their technical level, while long-distance runners can more quickly identify their shortcomings and promptly take improvement measures. Soccer players possess a profound understanding of their technical level and can accurately predict their opponent's offensive strategy, promptly adjusting their tactics to achieve the best possible record. However, the application of big data also brings some potential risks [1]. Athletes may overly rely on the results of big data analysis, which could lead to a decline in interest in the competition and even a loss of competitive enthusiasm. The excessive pursuit of perfection has drained the fun of the game, causing it to lose its original entertainment value. With the rapid development of science and technology, the emergence of big data has brought about tremendous improvements to society,

significantly enhancing functions such as collection, dissemination, storage, and processing, and promoting information innovation [2]. Today, we have sufficient resources to explore various complex issues, enabling us to categorize a wide range of things quickly and accurately. With an increasing amount of research data available, we are paying closer attention to its reliability and usability. This enables us to focus more on exploring and analyzing the connections between things, thereby improving the perspectives of sports audiences and experts. In this dynamic era of big data, sports experts and scholars must stay current with the trend, refine their scientific research concepts, and adapt to this shift. A more comprehensive approach should be adopted to examine the respondents, rather than relying solely on traditional random sampling methods [3]. At the same time, data should be viewed more tolerantly rather than merely relying on structured data, as the latter may cause many unnecessary troubles. The traditional athlete training progress planning system still has many shortcomings, especially since the system's terminal is difficult to process and analyze big data in a timely and accurate manner, resulting in slow execution and thus hindering the progress of training planning. With the advent of the big data era, big data analysis technology has demonstrated unique advantages in intelligent training progress planning, utilizing advanced software systems for data collection and processing. These systems offer extensive data coverage, high timeliness and practical value, precise and timely results, and diverse output options. Therefore, this paper designs an intelligent model for athlete training progress based on big data analysis, which not only can realise the real-time transformation of data analysis from manual to computer and from experience to calculation but can also significantly improve the timeliness and reliability of data information processing, thus providing practical guidance for athlete training planning.

2. Related Work

With the advancement of technology, more industries are leveraging big data to promote their development, thereby driving the growth of sports in China, including sports promotion, competitions, education, public services, and the sports industry. As technology evolves, the application of big data analysis in sports communication has become increasingly extensive. It not only promotes precision marketing and the development of new wireless value-added services but also helps drive the integration of multimedia, providing a new direction for the future of sports network communication [4]. In addition, it offers a new approach to sports communication by analyzing and sorting data to enhance the effectiveness and accuracy of information, providing users with a better reading experience [5].

With the advancement of technology, big data technology has been successfully applied to the dissemination of sports events, making this field more complex [6]. With the continuous increase in data volume, the sources and types have become more diverse, and processing and mining this information have become increasingly difficult [7]. Ren D and others pointed out that we should use the strong support of cloud computing to establish a complete big data mining system from the bottom to the top, including the support platform, function layer, service layer, to meet different types of application scenarios, such as infrastructure, platform, software, etc.; in addition, a model combining qualitative and non-qualitative should be established to reveal the complex relationships between big data, thus better understanding their causal relationships [8].

With the advancement of technology, big data has emerged as a new driving force. It has not only changed the traditional method of formulating school sports policies but also made the actual impact of sports courses more apparent, providing more comprehensive monitoring and management for the physical and mental

health of students [9]. In addition, big data gives significant support to the development of the sports industry, offering companies more information and resources, thereby promoting industry growth. According to the latest research results, utilizing big data can enable more comprehensive marketing, thereby better meeting customer needs, and can more effectively concentrate resources, thereby achieving a more effective aggregation of sports brands. Additionally, it can focus on experiential marketing to deepen the connection between users and brands. Research shows [10] that the application of big data can significantly promote the vigorous development of China's sports industry, not only can it help us obtain higher economic benefits, but it can also motivate us to carry out cross-border integration, promote cooperation, and promote the sustainable development of small and medium-sized enterprises.

Regarding the technical support of big data, Narayanan U and others believe that the big data mining system architecture needs to fully utilize the support functions of cloud computing [11]. This architecture is divided from the inside out into a support platform layer, function layer, and service layer. Relying on this architecture, a variety of service forms, such as infrastructure as a service, platform as a service, and software as a service, can be provided to users. In terms of the logical relationship of big data, the causal basis of its analysis is the causal derivation basis of related quantitative analysis, as the relationship described by correlation is a causal derivative relationship [12]. In the field of college sports, the use of big data technology can transform the traditional school sports policy formulation model into data-driven, return the essential functions of school physical education, reconstruct the physical education teaching evaluation, and improve the student physical fitness test, but also face challenges such as privacy protection, lack of technical talents, and concept solidification; In the sports industry, big data plays a vital role in the dissemination of sports brands. Some research indicates that big data is conducive to focusing on precise marketing strategies and strengthening consumers' daily standardization. It facilitates the efficient integration of communication channels, enhances the aggregation of sports brands, and promotes the concentration on experiential marketing, thereby strengthening the stickiness between users and brands [13]. Other research shows that the opportunities brought by the big data era to China's sports industry include: big data mining and analysis create more value for the sports industry; promote the collaborative innovative development of sports industry clusters; accelerate the technological process of the sports industry, etc.; in the field of sports scientific research, big data provides a new field for sports scientific research, the research object is from random samples to total samples, the research data type is from precise structured data to chaotic, inclusive unstructured data, the research paradigm is to find new topics from a large number of correlations.

3. Construction of Athlete Training in Physical Education based on Intelligent Algorithm

3.1 Intelligent Model Design

The overall architecture of the mesh program/server, in combination with the MAHSUH server, can effectively enhance the collaborative effect between each module. Additionally, the program can respond to user needs promptly, collect athlete training requirements through data feedback, and compile statistics quickly to make corresponding responses. Ultimately, the collected data is stored in an extensive database on the server side, thereby achieving intelligent training progress monitoring. Figure 1 illustrates a model framework for intelligent training designed to enhance athletes' efficiency.

3.2 Okumura-Hata Intelligent Model

In the field of big data analysis, the Okumura-Hata intelligent mode is widely used. It has strong anti-interfer-

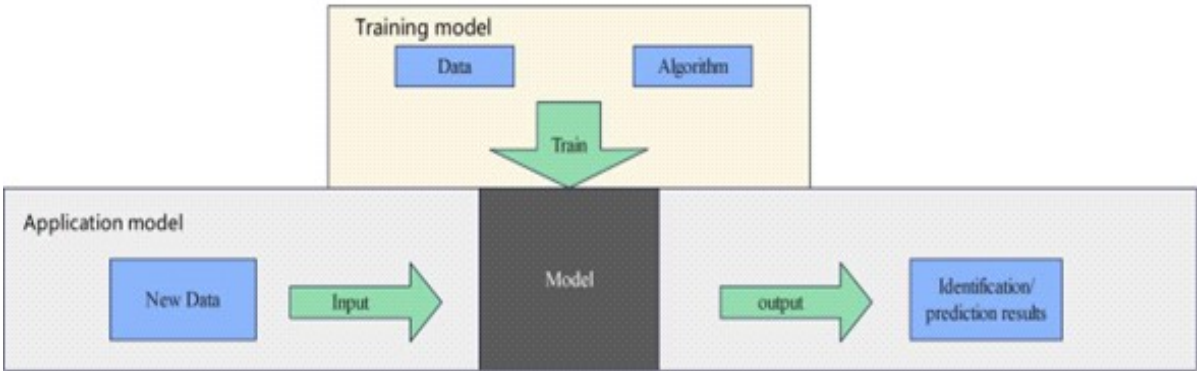

Figure 1. Intelligent Model of Athlete Training Progress

ence ability, which can effectively improve the accuracy and stability of the model. In addition, it can also build a comprehensive pattern based on the collected information, thereby better interpreting and exploring the essence of data analysis. Based on the Okumura coordinate graph and normal distribution of curve functions, the Okumura-Hata intelligent mode can effectively categorize data and infer its characteristics based on the normal distribution of statistics. Moreover, this model can also help us better understand the statistical trend of the motion by analyzing the extreme values of the data, thereby enhancing the accuracy and credibility of the data more effectively.

$$\frac{Q(k)}{N(k)M(k)} = s_c\left[\frac{Q(k)}{N(k)M(k)}\right]^a \tag{1}$$

$Q(k)$ represents the maximum error of the data, $N(k)$ represents the reference elevation, $M(k)$ represents the working frequency band, $K(k)$ represents the change in the mathematical model after loss index calibration, δ represents the propagation distance, and v represents the quantitative constant. The specific feedback data ($H[a]$) of the Okumura-Hata intelligent simulation is as follows:

$$H[a] = \frac{\partial^2 \Omega}{\partial v^2} \tag{2}$$

The feedback data from the Okumura-Hata intelligent model can help us better plan the training progress of athletes. The time-lag parameters vz and the annotation operators ec of these feedback data can help us utilize these data more effectively, thus achieving a preliminary construction of the model.

3.3 Optimization of 3 Training Progress Algorithms

By utilizing the Okumura-Hata intelligent model, we can more effectively collect and process athletes' training data from a big data analysis perspective, thereby better preventing the issue of data transition. To better solve this problem, we need to correct the training progress algorithm process.

$$\frac{\partial^2 N_2}{\partial i^2} = \frac{\left(k - k_m - N_2\right) W_0(i)}{w_0(i)} > 0 \tag{3}$$

By changing *a'N*, we can improve the balance of the model and improve computational efficiency. Additionally, we can utilize AI to enhance computational efficiency and better manage computational complexity. However, when we improve the computation method, we find that the robustness of the module is weakened by the improvement, which leads to computational delay. Therefore, we suggest utilizing intelligent control to enhance the computational method and improve computational efficiency by optimizing the computational process. In this sentence, Ep is a pre-set highest critical value, [*h1, h, hp*] are converging data sets from the highest point to the lowest point, all of which have good optimization effects, [*Xi, X, X,*] are a set of disappearing data. We utilize formulas (2) and (3) to refine and optimize our intelligent model, thereby enhancing the accuracy and efficiency of our training plan. In the early stages of the system, content-based recommendations are particularly suitable. This algorithm is based entirely on the user's past behavior and initial choices, and the content provided is highly similar to the user's past behavior, resulting in high interpretability. Additionally, this algorithm is independent of the behavior of other users. The collaborative filtering algorithm does not rely on historical data, instead constructing a user behavior matrix to facilitate dynamic analysis processing. Knowledge-based recommendation algorithms primarily rely on knowledge graph technology, where the core idea is to build an ontology and associated rules in a specific field to create a corresponding knowledge base and make recommendations based on the weight ratio of the data within the knowledge base. The knowledge base integrates rich semantic information from various data sources and provides recommendation services based on the information inferred to meet the user's needs. Using algorithms such as TF-IDF and Word2Vec, we can conduct a detailed analysis of keywords and build a series of models based on their characteristics. We can also use Top-N tags to calculate the weight of each piece of information and make a series of models. Additionally, we can utilize cosine similarity to evaluate different models and obtain more accurate recommendation results.

4. Experimental Design and Analysis

4.1 Experimental Design

A key aspect of the auxiliary training system for college sports education athletes in this experiment is to identify the movement postures of key points on the human body. Based on the experimental foundation, we use big data to integrate and capture the movement data of the athlete's skeletal key points after processing. According to this key point data, we can define the posture of college sports athletes. By extracting features of keypoint angles and speeds, we compare standardized data and training data, finding that both types of data have errors in terms of angles, coordinate points, and postures. Timely adjustment and correction for motion rectification are employed to achieve efficient training goals. By using two Kinects, we can collect data on key points of the human body. Each key point has unique coordinate values in different frames, allowing us to recognize athletes' limb movements and postures by comparing the differences in these coordinate values. By adjusting the three-dimensional coordinates of the human body, various training action postures can be achieved, resulting in changes in the three-dimensional coordinates of joints such as the shoulders, elbows, wrists, hands, knees, and others, thereby gaining more effective interactive effects.

4.2 Analysis of Experimental Results

By using basketball athletes as research subjects and mimicking their training conditions to basketball game scenarios, we can achieve better results. We will use the SO test software to verify the reliability and manipulability of this model, measuring its accuracy and reliability through the YUH and pol parameters. This will help us better understand the development trend of this sport and better control its direction of development.

According to Figure 2, the detailed results of the experiment are presented.

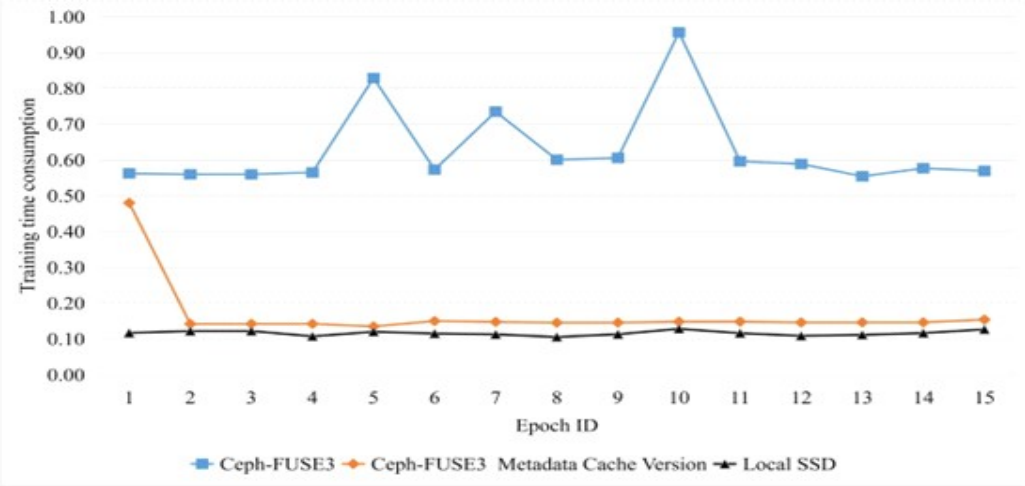

Figure 2. SO detection experimental results

As shown in Figure 2, a comparison is made between the key position inspection results of intelligent training actions for left and right higher education sports coaches. Professional and trainer automatic movement data for 8 corresponding key positions, from start to end, are collected. The average value of joint point coordinates for several consecutive frames is recorded as one frame when the standard personnel and trainer complete this action. From start to end, 60 corresponding frames are selected as the judgment data for the joint point motion trajectory. By comparing the time limit and coordinate point differences, the difference in motion trajectory changes at the corresponding coordinate points can be obtained. Based on the data, it can be seen that the POL parameters of the intelligent development model for sports talent cultivation progress are relatively stable, always above 1.0. This level of intelligence can reach a high level of consistency, and the YUH index shows a smooth growth trend, indicating that the model has high feedback. When developing the model intelligently, the data strength characteristics are shown in Figure 3.

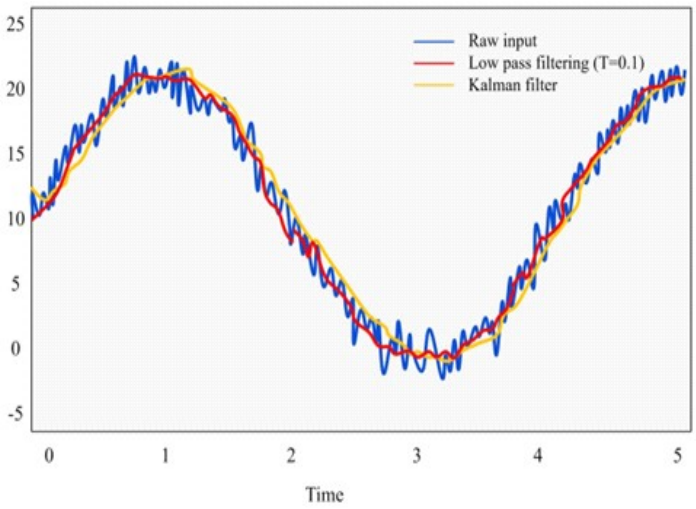

Figure 3. Data Intensity

As can be seen from Figure 3, the data intensity in the intelligent formulation mode of basketball player development, as analyzed through big data, is high, which accurately reflects the basic level of the data. If there is more data, it suggests that the accuracy of the development results for this mode is improved. In Figure 3, it can be seen that the athlete's skeletal point data after filter estimation is closer to the real value, and the corresponding error after filter estimation is less than the observed error. The filtering effect obtained is noticeable, so the use of Kalman filter estimation in filter fusion under computer big data technology is feasible.

5. Conclusions

After in-depth research, we have found that in today's competitive arenas, the training needs of many athletes have shifted from traditional manual methods to more efficient self-service methods. Not only does this method save labor production costs, but it also simplifies the process. To better respond to these changes, we propose a new method that utilizes big data to optimize training progress, thereby enhancing efficiency and quality. Our research also demonstrates that this method is highly suitable for addressing increasingly complex competitive scenarios. By adopting advanced technologies, we can enhance the system's intelligence, resulting in improved smoothness and accuracy. Therefore, we strongly recommend its popularization.

Acknowledgements

The study was supported by 2023 Guangzhou Xinhua University Teaching Research, College Sports (No. 2023KCSZ013).

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