A STRATEGY FOR BUILDING A SMART SPORTS PLATFORM BASED ON MACHINE LEARNING MODELS

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Reception: 13/11/2022 **Acceptance**: 08/01/2023 **Publication**: 23/03/2023

Suggested citation:

G., Mingchan. (2023). **A strategy for building a smart sports platform based on machine learning models**. *3C TIC. Cuadernos de desarrollo aplicados a las TIC, 12(1)*, Page-Page. https://doi.org/10.17993/3ctic.2023.121.248-265

ABSTRACT

With the rapid development of big data technology, it has greatly changed the way people get information, and also improved the speed and quality of information. In this context, smart sports has become a new trend in sports development. This paper creates an intelligent learning environment and builds a smart sports platform through advanced concepts and technical means, which can effectively optimize the integration and sharing of sports resources. Starting from the overall architecture design of smart sports, the key technologies of machine learning model to realize smart sports are sorted out. Through the five basic linking stages with machine learning model as the core, the value innovation path of platform construction structure is analyzed. The current status of sports resources application is studied, and the data mining algorithm is used to calculate the user usage data of the smart sports platform and improve the construction of the smart platform. Through the construction of the smart sports platform, people shift from traditional reading books and watching TV programs to getting information through intelligent mobile terminals, and the proportion of attention to sports information is as high as 58.6%. This shows that by building a smart sports platform, it can provide support and guarantee for the sustainable development of sports.

KEYWORDS

Smart sports; machine learning modeling technology; resource sharing; platform construction; sports information

https://doi.org/10.17993/3ctic.2023.121.248-265

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1. INTRODUCTION

Machine learning model analysis has increasingly become an important reference for people's judgment and decision making, and is increasingly known and used. Various analytical tools and analytical methods based on machine learning models have emerged [1-4]. The idea of big data, which itself has undergone the process from experiment to practice and from niche to mass, is also increasingly known [5-8]. The smart sports platform is based on information technology, including machine learning model analysis, Internet of Things, and cloud computing technology, which together build a public basic service platform integrating social, cultural, sports, and environmental factors [9-12]. Its main functions include query service function, data collection function, and data management function. The rapid development of communication technologies such as machine learning models has made the integration and application of resource information the key to the construction of sports informatization [13-15]. The rapid development of science and technology development under machine learning models will promote the application of mobile terminals such as smartphones and tablets in the sports industry [16-18]. Machine learning models are a collection of massive data, the volume of which is particularly huge and cannot be processed by conventional software within a certain period of time. Machine learning models are characterized by massive scale, high-speed flow, and rich form [19-20]. The construction platform on the basis of machine learning models should be unified to manage the collected data, and the multi-channel, multi-level and multi-angle feedback query service window after data analysis. The platform can achieve the sharing of sports information in the province and even in the country or even globally, and build a service network covering the whole province, with the characteristics of intelligence, innovation and extensiveness [21].

The literature [22] mentions that smart cities are the direction and advanced form of future urban development, integrating the functions of digital, knowledge, ecological, and creative cities. Big data is changing people's life, work and thinking, bringing major changes in cities. Huge amount of data exists in all aspects and fields of the city. The establishment of a technical system framework for smart cities based on big data technology is discussed, and the feasibility of this technical system framework is explored. The literature [23] outlines the significance of machine learning modeling techniques in the construction of smart cities. Its important role in further promoting the development of the Zhengzhou Airliner Economic Zone in China and the whole process is analyzed. As well as how it can promote economic transformation and upgrading, it is expected to provide ideas and support for the Zhengzhou Airliner Economic Zone, China, to lead and promote the regional economy of Henan, China, in the future and achieve continuous improvement in sustainable development. Literature [24] et al. Also, a more reliable trust protocol can be established, which is conducive to the implementation of machine learning model applications. The literature [25] and others mention that with the advancement of urbanization and the coordination of urban transportation, municipalities, economic industries.

This paper analyzes the application of machine learning models in the design of smart sports and evaluates the impact of the planning and construction of smart

https://doi.org/10.17993/3ctic.2023.121.248-265

sports based on machine learning models on economic and social benefits. Through the wide application of machine learning models in building smart sports platforms, the government is able to run more smoothly, conveniently and efficiently in planning, construction, industry, people's livelihood, society and cities. The current situation of sports informatization construction, as well as the advantages and related strategies of the construction plan of the smart sports platform based on big data, are mainly analyzed and discussed.

2. SMART SPORTS PLATFORM CONSTRUCTION

The construction target of the smart sports platform is to gather various types of venues and fitness groups of people's resources, and realize the digital fitness consultation and guidance, sports and fitness activity resources, venue booking, equipment purchase, personalized sports services and sports culture exchange for all people and high social participation through the platform [26-27].

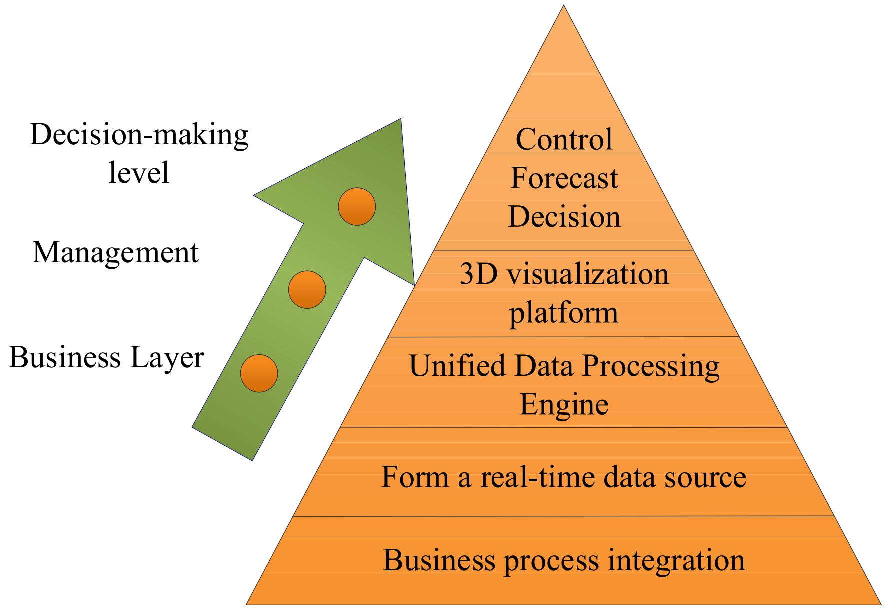

Figure 1. Smart Sports Platform Framework and Structure

The essential difference between smart sports services is the empowerment of "wisdom". It refers to the use of advanced concepts, technology and other means to create an intelligent learning environment, forming a precise, individual and flexible education service system as shown in Figure 1. As can be seen, although "wisdom" has different facets, "wisdom" represents, first of all, positive, innovative and comprehensive capabilities on the outside, and on the inside, value understanding and moral identity for good and common good. In order to better clarify the seven modules of the application service layer, to open up and integrate the storage and computing centered on big data, and to realize the effective operation of the modules and the process of value output.

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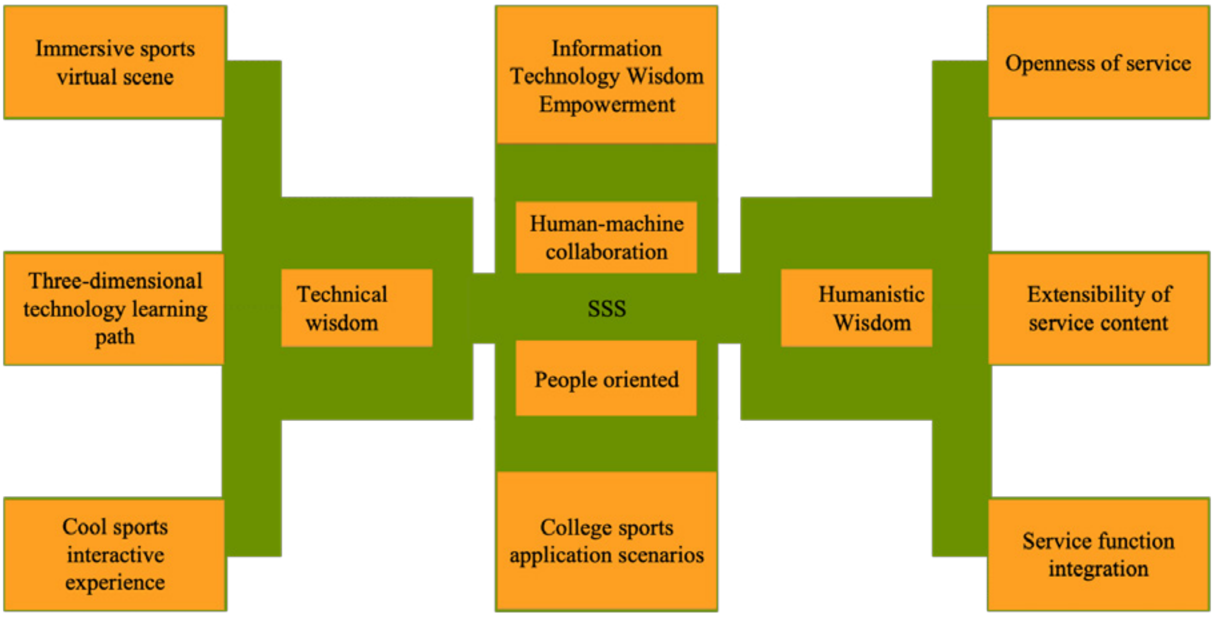

Figure 2. Creating a value innovation path for smart sports with machine learning models at its core

As shown in Figure 2, the module value innovation is analyzed through five basic linking stages with machine learning model as the core.

Demand identification: Based on the collection of basic data such as users' physical health level, sports cognition and technical ability, sports learning demands and sports preferences, the demand instruction for sports course learning is intelligently generated.

Precise Matching: By analyzing and mining the system data, we provide precise matching course learning solutions.

Intelligent push: When personalized learning solutions are intelligently pushed to the platform's user interface, users can operate tasks and learn skills according to the sports process and specific requirements of different scenarios in the module architecture even in fragmented time periods with the help of ubiquitous networks and mobile terminals.

Decision-making and implementation: Once a user enters a certain task point, the coach will synchronously track and instantly share the learning process data through intelligent perception, supervise and control the efficiency of sports implementation, make timely professional assessment in three dimensions of "sports spirit, sports practice and health promotion", and provide personalized counseling and suggestions for non-standard problems, as well as instant evaluation and feedback.

The evaluation of sports completed by users in the client is instantly fed back to the intelligent learning system to promote the quality of subsequent sports activities. In the five basic linking stages, the sports courses through the platform fundamentally stimulate the initiative and motivation of "value co-creation" between the platform and users, and realize the "sports meaningful growth" with technical support in the new era. Through the instant dialogue, two-way communication and joint exploration

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between coaches and users, the skills learning willingness of users is fully achieved in the new scenario, and targeted sports activities are effectively promoted.

3. SMART SPORTS SERVICES

From the perspective of service essence, the "wisdom core" of smart sports service is a "people-oriented wisdom". It takes the sports needs of service recipients as the core, and provides the most necessary, suitable, accurate and convenient personalized sports platform services and health management services through the systematic changes of service forms, service contents and service functions, thus manifesting the human-centered service thrust.

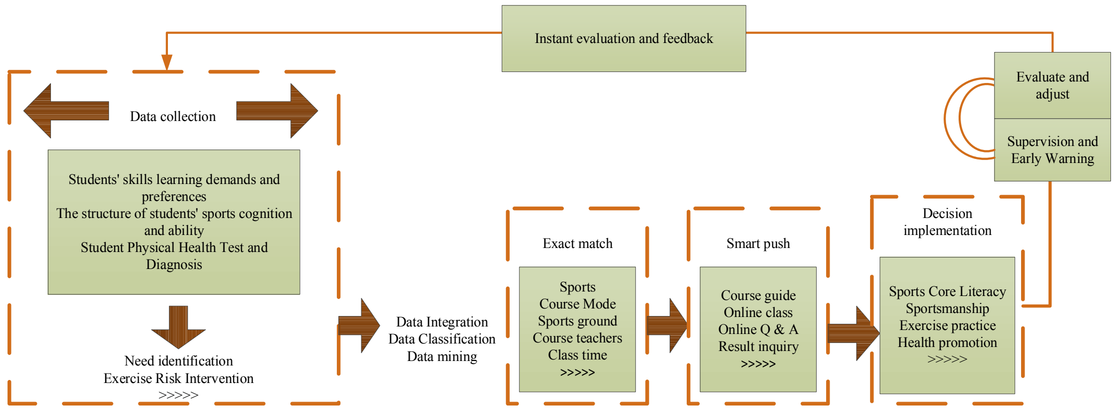

Figure 3. Smart Sports Service Structure

As shown in Figure 3 its performance is specified in：

1. Openness of service form. With the support of modern information technology, users only need to hold smart terminals to seamlessly connect and interoperate to the open, collaborative and shared central system of smart sports service platform, they can get "menu" sports resources and services anytime, anywhere, freely and efficiently, so that sports are everywhere.
2. Wide extension of service content. In terms of content scope, the content of intelligent sports services covers online and offline integrated sports model, sports community interaction, intelligent venue management and other multi-dimensional needs. In terms of content depth, sports skills output is more full and vivid under the conditions of language, image, emotional awareness three-dimensional multi-sensory technology, which can make the sports experience under the resonance of sports thinking and sports psychological immersion more profound.
3. Integration of service functions. It is through the application of intelligent technology and information technology, fully mining and analyzing the full record of data information and automatically generate adapted personalized services to meet the differentiated sports needs of the user body; through portable devices associated with the user's heart rate, blood pressure, pulse oxygen saturation and other physiological indicators, expression behavior recognition technology analysis of sports emotions, perception and other psychological indicators of the dual

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assessment feedback, to achieve the scientific norm of the user's sports risk Prevention and control, etc.

4. SMART SPORTS PLATFORM DESIGN

While leading sports reform and innovation, smart sports services are bound to bring great impact and challenges to the traditional sports learning mindset, sports management model and sports cultural environment.

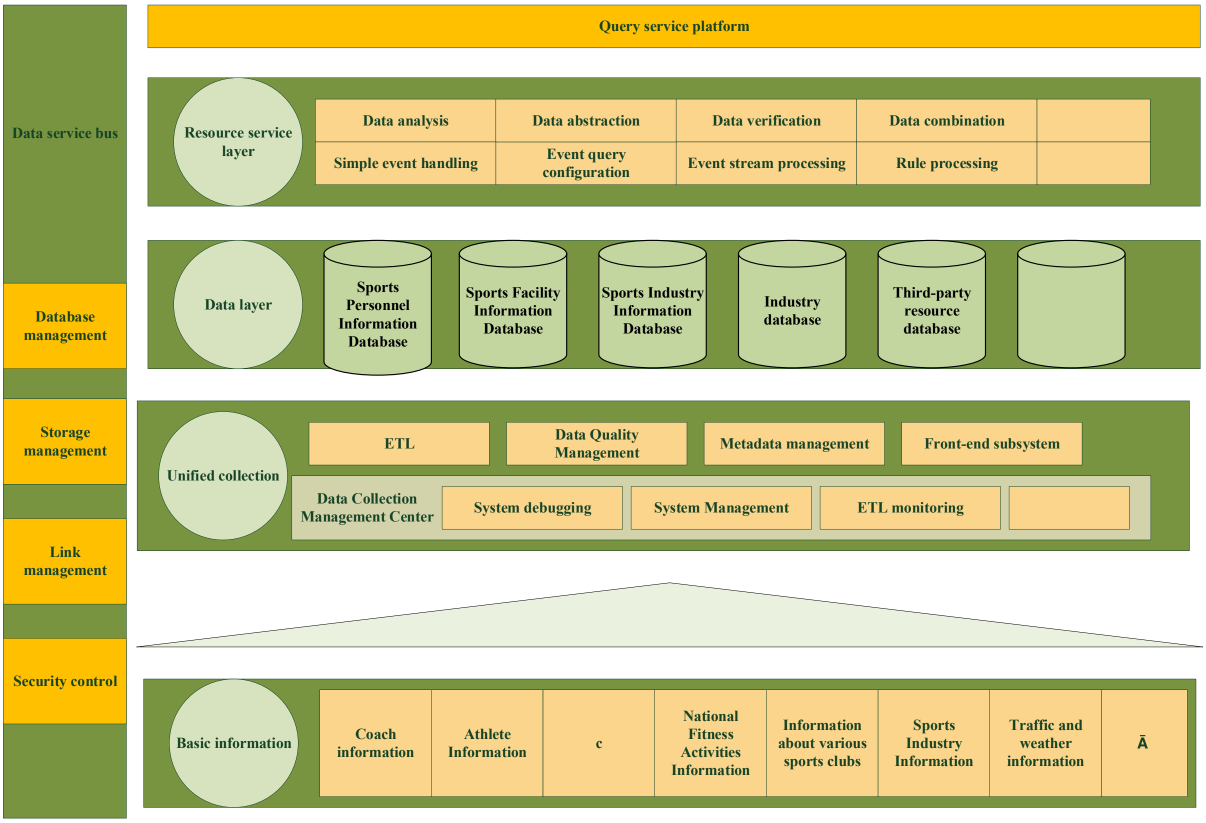

Figure 4. Logical framework design for smart sports platform

As shown in Figure 4, the resource service layer refers to the application functions based on the realization of data processing, mainly through modeling, to realize the analysis, abstraction, verification, combination and other processing of data extracted from the database, and the functions for event processing include brief event processing, event query configuration, event flow processing, rule processing, etc.

The data layer, i.e. database, is a warehouse for organizing, storing and managing data according to the data structure, and as the basic data storage area of the whole platform, and guarantee the integrity and convenience of data extraction by users.

As the convergence layer of the platform data, the unified collection realizes the convergence, filtering and data conversion of sports-related information such as sports activities personnel, and then submits them to the front subsystem for temporary storage, and submits them to the storage.

Users complete the selection of self-chosen content for sports courses within a specified period of time through the Smart Sports Platform. The platform sets the

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course content name for users to choose, and users choose the course with their own situation and interest points. Users can also give feedback on courses that are not set up through the platform's comment section and text the reasons for applying for the course. The platform will give feedback to the sports coach, and the sports coach will try his best to provide appropriate advice to support his own situation. This way not only realizes the interaction between coaches and students, but also improves the efficiency of communication.

5. MCHINE LEARNING MODEL ALGORITHMS

The data mining algorithm utilized in this paper contains a clustering analysis algorithm and a BP neural network model algorithm, and the two are organically combined to achieve data analysis of the construction of a smart platform. Thus, the user usage data of the smart sports platform is calculated, which can better improve the platform information and grasp the psychological needs of users.

Firstly, the data is classified and calculated using the K-means algorithm for the measurement technique step. Its main steps for analyzing big data are：

1. K centroids are randomly extracted from different sample data to select the initial cluster centroids.
2. Divide the sample cluster points by allocating each different data point to the center nearest to that data point. In this step, the distance formula is introduced to obtain:

$$d(x,y)^2 = \sum_{i=1}^{n} (x_i - y_i)^2 = \| x - y \|_2^2 \tag{1}$$

Based on the selected centroids of the clustered samples of each data, the distance between each database sample data and these central sample parameters is calculated using Equation (1), and the corresponding large data are re-classified according to the minimum distance.

(3) Based on the mean value of each clustered sample data object, the distance between each object and these central objects is calculated, and the corresponding objects are re-divided according to the minimum distance recalculating the mean value of the distance from the point in each class to the centroid of that class, assigning each data to its nearest centroid. Forming the matrix D with the minimum data calculated each time, thenl:

$$D = \begin{pmatrix} x_{11}, x_{12}, \cdots, x_{1n} \\ x_{21}, x_{22}, \cdots, x_{2n} \\ \cdots \\ x_{k1}, x_{k2}, \cdots, x_{kn} \end{pmatrix} \tag{2}$$

where x_{ij} is the set of the found minimum values.

(4) In big data processing, by using K-means algorithm can obtain the clusters with the smallest error criterion function of big data. By centering K sample data points in

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the space and clustering them, the information big data closest to the different samples is finally categorized.

After using the K-means algorithm output results, then use the BP network algorithm model algorithm to continue mechanical learning, training. It is able to map and handle the more complex nonlinear relationships in the data samples in a timely manner. In adjusting the BP neural network model, the following formula is followed: where the adjustment formula for the output layer power system is:

$$\Delta\omega_{ij} = \eta O_k^p(1 - O_k^p)(t_k^p - O_k^p)O_i^p \tag{3}$$

The adjustment formula for the implied layer weight factor is:

$$\Delta\omega_{ij} = \eta O_i^p(1 - O_i^p)\sum_{i=1}^{L}\Delta\omega_{ki}O_j^p \tag{4}$$

The quadratic exact function model for pairs of input patterns in different large data samples is:

$$J_p = \frac{1}{2}\sum_{k=1}^{L}(t_k^p - O_k^p)^2 \tag{5}$$

Expression for the total accurate function for N different large data samples:

$$J = \sum_{p=1}^{N}J_p = \frac{1}{2}\sum_{p=1}^{N}\sum_{k=1}^{L}(t_k^p - O_k^p)^2 \tag{6}$$

Big data samples are standardized as follows: assuming that the type of input big data information is m and the sample is N, for the input data X_{ij} is standardized according to the steps of the following equation.

$$Z_{ij} = \frac{(x_{ij} - \hat{x}_j)}{\delta_j} \tag{7}$$

$$\hat{x}_j = \frac{1}{N}\sum_{i=1}^{N}x_{ij} \tag{8}$$

$$\delta_j^2 = \frac{1}{N-1}\sum_{i=1}^{N}(x_{ij} - \hat{x}_j)^2 \tag{9}$$

In the above equation, $i = 1,2,\cdots,N; j = 1,2,\cdots,m$, and Z_{ij} in the above equation are the data after the normalization process. The standardization formula is shown in Equation (10).

$$y'_= = \frac{q(y_i - y_{min} + b)}{(y_{max} - ymin + b)} \tag{10}$$

Where: y_i is the output database sample data information; y'_i is the normalized database sample big data; y_{max} and y_{min} is the extreme and extreme small values of the output database sample big data; where $0 < q < 3; 0 < b < 2$.

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In the validation of clustering analysis algorithms, F-measure can be chosen as the evaluation criterion for determination, and here, two parameters, accuracy and recall, are cited. Accuracy and recall are able to evaluate the accuracy rate of clustering classification algorithms and are calculated as follows:

The accuracy rate is calculated as follows:

$$precision(i,j) = \frac{n_{ij}}{n_j} \tag{11}$$

Recall rate calculation formula.:

$$recall(i,j) = \frac{n_{ij}}{n_i} \tag{12}$$

Solve to obtain the value of F:

$$FI = \sum_i \frac{n_i}{n} max\{F(i,j)\} \tag{13}$$

Through the above-mentioned calculation process, the data mining algorithm can make the weights and thresholds in the neural network gradually adjusted to gradually approximate the results precisely needed for the test system, and timely discover all kinds of data information in the use of the intelligent sports platform. The data mining computing service is a platform service that strips the business logic from the computing application and provides the platform support service required by the business logic to the developer. Corresponding to the node part of the application, it provides data input adaptation and data pre-processing services, the processing node part provides streaming data analysis, complex event processing and business rule processing services, and the output node part provides data output adaptation services. Combining the above algorithms, the SCS model is proposed. Developers can define a streaming computing application that can run on the streaming computing service system based on the elements of the SCS model.

6. PLATFORM CONSTRUCTION ANALYSIS

6.1. TEST ENVIRONMENT AND METHODOLOGY

The construction of smart sports platform meets the practical needs and greatly improves the level of informationization of sports. In particular, universities should reasonably build a platform under the framework of smart sports based on machine learning model technology. In order to better build this platform, we should effectively share the standardized data, create a "one-stop" service platform, do a good job of data statistics and analysis, and provide a solid and reliable basis for decision-making.

After the above machine learning model algorithm, this part uses the Storm application execution entity to test the dynamic adjustment of parallelism, and then verifies the feasibility and effectiveness of the streaming SCS definition tool and SCS execution engine by application examples.

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In the test of Storm application execution entity parallelism dynamic adjustment algorithm, there are four virtual machines in the test cluster. One of them is used as a Nimbus node and Zookeeper is installed on the Nimbus node, while the other three are used as Supervisor nodes. All four virtual machines are installed with Ubuntu 12.04 OS, Open JDK 64-bit1.8.0_45, Storm version 0.94, and Zookeeper version 3.4.7.

The test environment for the dynamic tuning of the Storm application execution entity parallelism is shown in Table 1:

Table 1. Application execution entity parallelism dynamic test environment table

Name/IP	CPU/Memory/Disk	Use
Dclab-1/192.168. 1.252	Intel(R) Xeon(R) CPU E5-2660 0 @ 2.20GHz / 3.6GB/42G	Storm clouds zookeeper
Dclab-2/192. 168. 1.254	Intel(R) Xeon(R) CPU E5-2660 0 @ 220GHz/ 3.6GB/42G	Tutor
Dclab-3/192.168.1.2 38	Intel(R) Xeon(R) CPU E5-2660 0 @ 220GHz/ 3.6GB/42G	Tutor
Dclab-4/192.168.1.2 42	Intel(R) Xeon(R) CPU E5-2660 0 : @ 220GHz/ 3.65GB/42.2G	Tutor

The first step is to verify that the Parallelism Dynamic Adjustment module can dynamically adjust the parallelism ratio between components with sequential order according to the component execution events, and the second step is to verify that the Parallelism Dynamic Adjustment module can optimize resource utilization by dynamically adjusting the parallelism of each component. In our experiments, we set the statistical interval of Storm to 5 seconds, set the topology builtin. metrics.bucket size secs item in the configuration file of Storm.yaml as follows, set the high threshold to 92%, the low threshold to 32%, and the count period to 10. For the test of dynamic adjustment of entity parallelism of the Storm application execution, we validate it by three different applications Generall, General2 and General3, which all correspond to a Topology containing three nodes, i.e., one Spout and two Bolt nodes. The structure diagram is shown in Fig.

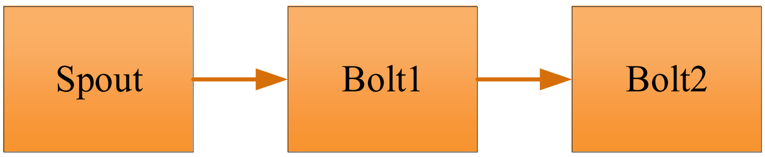

Figure 5. Test application architecture diagram

The code logic for each of the three test applications is as follows:

In General:Hibernate for 1 second in the execute method of Boltl, hibernate for 1 second in the execute method of Bolt2, and set the initial parallelism of Spout, Boltl, and Bolt2 to l; In General2:Hibernate 1 second in the execute method of Bolt1, hibernate 3 seconds in the execute method of Bolt2, and set the initial parallelism of

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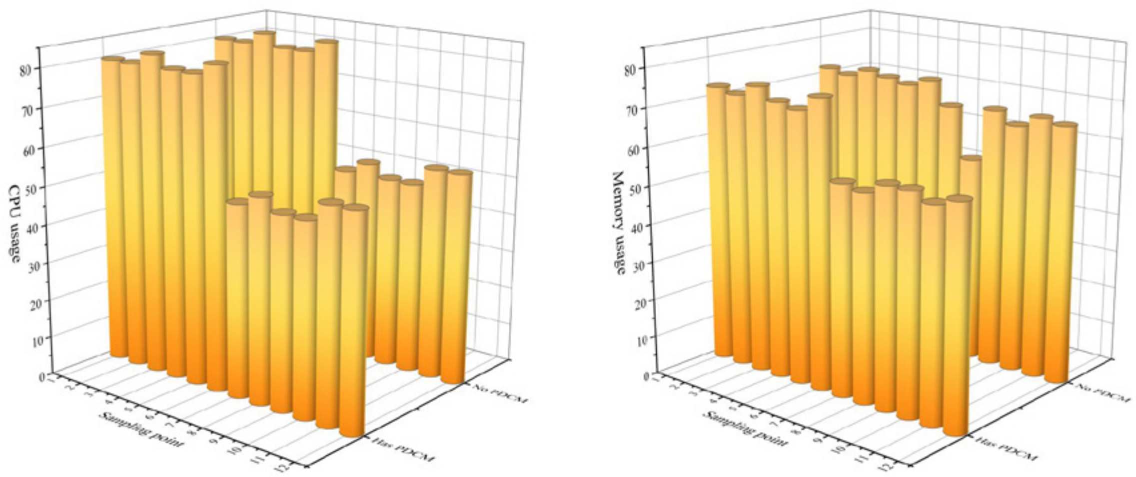
Spout, Bolt1, and Bolt2 to 1; General3:Hibernate for 3 seconds in the execute method of Bolt1, hibernate for 1 second in the execute method of Bolt2, set the initial parallelism of Spout to 1, and set the initial parallelism of Bolt1 and Bolt2 to 3. Submit each of the above three Topologies to Storm for execution.

6.2. SYSTEM PERFORMANCE

In order to test the optimization of the parallelism dynamic adjustment module on the use of system resources, we changed the Storm cluster to a single machine for testing, and then we sampled the system information in 12 time periods. The first 6 sampling points Jmeter opened 2000 threads, and the last 6 sampling points Jmeter opened 500 threads to send data. Then we record the CPU usage and memory usage of the system at each of these 12 sampling points. First, we run Storm on the machine without the parallelism dynamic adjustment module to sample the machine usage, and then replace Storm with Storm with the parallelism dynamic adjustment module and run it under the same conditions as before.



(a) CPU usage comparison (b) Memory Usage Comparison

Figure 6. Usage Comparison Chart

As shown in Figure 6, in Generall, the processing time of two Bolts is the same, so the parallelism ratio should be the same; in General2, the processing time of Bolt1 is one-third of the processing time of Bolt2, and the parallelism ratio should be roughly 1:3; in General3, the processing time of Bolt1 is three times of the processing time of Bolt2, and the parallelism ratio should be roughly 3:1. According to the change of the number of Executors in the three applications in the figure: Generall remains the same, and the ratio is still I:I: General2 increases by two, presumably because the parallelism of Bolt2 increases from 1 to 3, and the ratio is 1:3; General3 decreases by two, presumably because the parallelism of Bolt2 decreases from 3 to 1, and the ratio is 3:1. That is, the parallelism between execution entities with sequential relationship is dynamically adjusted according to the processing time proportionality. The parallelism of execution entities is dynamically adjusted in the actual execution process. By introducing the parallelism dynamic adjustment module (PDCM), the CPU

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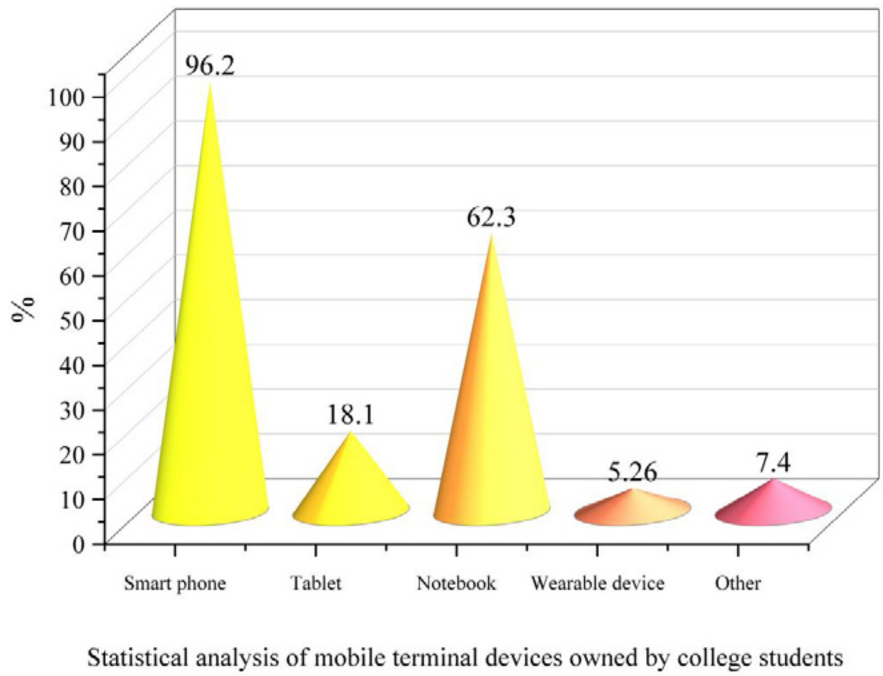
usage and memory usage of the system increase (<2%) but not very significantly, but when the real-time data volume is small, the parallelism dynamic adjustment module can release the free memory resources (8%-11%) by stopping the idle Executor. Through the smart sports platform route, on the one hand, users can independently choose their favorite sports for physical exercise, which improves their motivation to exercise independently; on the other hand, it facilitates the update of the sports platform content.

6.3. SURVEY RESULTS

Through the construction of a smart sports platform, students are used as experimental subjects in order to fully test the performance of the built platform. The issue of individualization and differences of students is emphasized by giving students the right to choose their own courses. At the same time, through the university's smart sports platform, teachers can make timely adjustments to their teaching programs and teaching plans to facilitate the completion of teaching tasks and teaching objectives.



(a) Statistical analysis of college students' ownership of mobile mobile terminal devices

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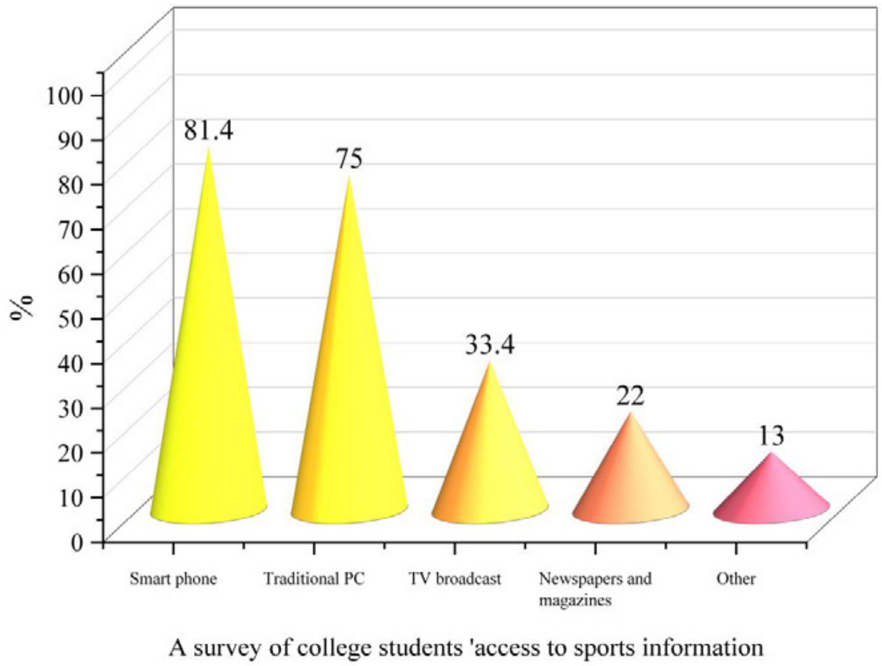
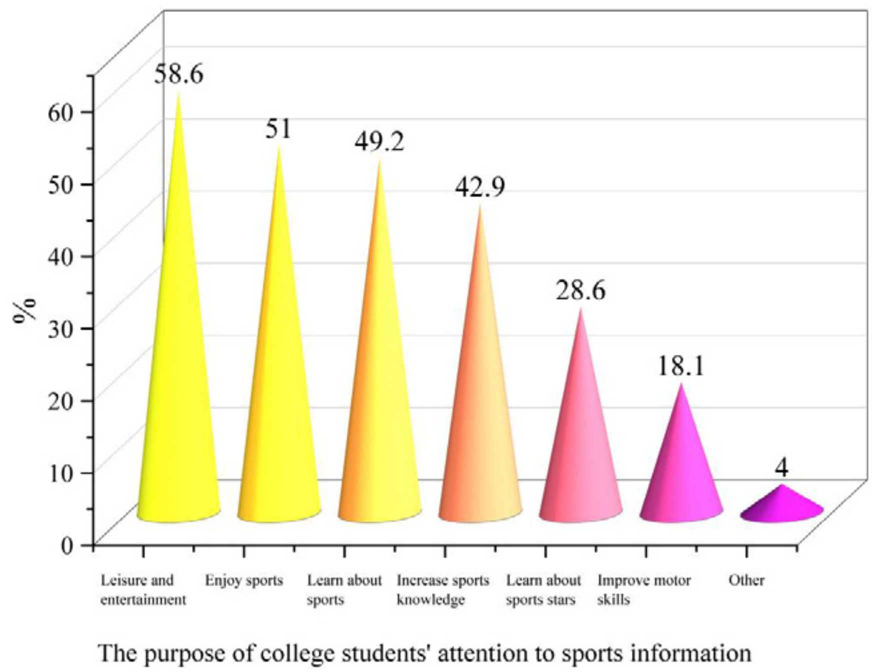


(b) Survey on college students' access to sports information



(c) Survey on the purpose of college students' attention to sports information

Figure 7. College students' access to and purpose of sports information survey analysis chart

From Figure 7(a), it can be seen that among the mobile terminal devices owned by college students, smart phones rank first, with almost one smart phone per person, while the proportion of students who own laptops also reaches 62.30%. It can be seen that the Internet access by smart mobile terminals has become one of the main

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lifestyles of college students at present. From Fig. 7(b), it can be seen that through building the intelligent sports platform in colleges and universities, the way of college students getting information has changed dramatically, from traditional reading books and watching TV programs to getting information through intelligent mobile terminals. From Fig. 7(c), it can be seen that leisure and entertainment is the main purpose for college students to pay attention to sports information, accounting for 58.6%, and enjoying sports competition is another main purpose for college students to pay attention to sports information, accounting for 51.00%; another more important reason is to understand sports news, accounting for 49.2%. Thus, it can be seen that through building a smart sports platform, college students start to become concerned about sports information.

7. CONCLUSION

The emergence of smart sports to better provide convenient services for participants. With a mobile client such as a smartphone or sports watch, people can get reasonable sports advice anytime and anywhere. The smart sports platform changes the way users exercise, and through interaction users can get more reasonable and standardized exercise intensity and exercise combinations by inputting their physical conditions and exercise patterns. In this paper, students are taken as the experimental subjects, and according to the platform statistics it is known that sports competition is the focus of college students' attention to sports information, with a percentage of 51.00%. The percentage of understanding sports dynamics is 49.2%. Let more students understand the fun of physical education and physical exercise through the smart sports platform under the machine learning model, and also let teachers inspire more teaching inspiration through the platform and generate good teaching interaction with students. Therefore, carrying out research on the overall architecture and key technologies of smart sports, and seeking to translate and apply its results in the fields of competitive sports and national fitness will certainly play an important and positive role in the development of sports.

DATA AVAILABILITY

The data used to support the findings of this study are available from the corresponding author upon request.

CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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