Zhang M. (2025) ENHANCING DESIGN OF SPORTS EVENT MANAGEMENT SYSTEM FRAMEWORK BASED ON BIG DATA TECHNOLOGY. Revista Internacional de Medicina y Ciencias de la Actividad Física y el Deporte vol. 25 (99) pp. 370-386.
DOI: https://doi.org/10.15366/rimcafd2025.99.024

ORIGINAL

ENHANCING DESIGN OF SPORTS EVENT MANAGEMENT SYSTEM FRAMEWORK BASED ON BIG DATA TECHNOLOGY

Min Zhang

[1] School of sports economics and management, Xi'an Physical Education University, Xi'an, Shaanxi, 710068, China.
E-mail: dsaaffwer111@163.com

Recibido 12 de Marzo de 2024 **Received** March 12, 2024
Aceptado 14 de Octubre de 2024 **Accepted** October 14, 2024

ABSTRACT

The objective of this paper is to enhance the operational efficiency and stability of sports event management through the refinement of a data mining algorithm, specifically an adaptation of the fuzzy C-means clustering method. This study addresses the practical challenges of sports event management by developing a system architecture that aligns with the specific functional requirements of such events. The system employs a point-to-multipoint bridge model, leveraging the campus network infrastructure to deploy server-side applications, thereby enabling access to the information management system via any browser-equipped device on both the campus and external networks. Furthermore, this research introduces a sports event management system that harnesses the capabilities of big data technology. The performance of this system has been rigorously evaluated, and the experimental results indicate its efficacy. Consequently, the system presents a viable solution for management in forthcoming sports competitions.

KEYWORDS: Big Data; Sports Event; Event Management; System Framework; Fuzzy C-Means Clustering

1. INTRODUCTION

With the rapid development of contemporary information technology, human society has also entered the era of computer-centric digital information management. Digitization, informatization and other system management modes continue to change the face of the world at a rocket-like speed, promote the continuous development and progress of society, and lay the foundation for technological innovation (Li et al., 2019). At present, people's living standards have improved significantly, ideology has also changed, and work pressure has increased. Due to the accelerated pace of life and more demand, only development and technological innovation can truly be invincible. This in-depth reform of the social environment has made it impossible for people to adapt quickly, causing the pace of work to fail to keep up. As a result, a large number of mobile personnel have appeared, causing many new problems that cannot be solved in time for production management. This has caused the traditional manual operation management model to face a very severe test. Therefore, research and development of an application-oriented, innovative, and intelligent management system is the only way to modernize the management model, and to achieve high-quality and efficient scientific and technological innovation. The management system refers to a "human-computer interaction system" that manages the university track and field games. It can realize the transformation from traditional manual management to modern practical technology by providing high-quality and effective management methods (Xu et al., 2021). In the actual system management program, cumbersome work can be arranged by completing records and simple operations by clicking the mouse and keyboard input to ensure the smooth and orderly progress of the sports meeting management. The database application system is mainly used in the setting of game rules, the collection of game player information, the arrangement of groups and lanes, the statistics and announcement of game results, and data query and other data processing functions. With reference to the system management process and the situation of the sports meeting system, the system is mainly composed of modules such as pre-match scheduling, in-match management, post-match processing, post-match query and system maintenance (Szűcs & Tamás, 2018). With the continuous development of computer technology, network communication technology, and database technology application, it is imperative to use computers to manage sports meeting information. Information management is an indispensable part of the management of modern games, and it is a necessary condition for adapting to the requirements of the management standards of the modern games and promoting the management of the games to be scientific and standardized. Only when information management is standardized, can we develop better in other areas. At present, many s and universities still adopt traditional manual operation methods in the management of school sports games. The organization of sports games is a very tedious task. The traditional manual organization has low efficiency and low accuracy. In order to meet the needs of the development of modern sports games, information management It must be replaced by a standardized management information system from the previous manual management. The organization of sports games in my unit has always used the modes of manual registration, grouping, ranking and scoring. Because this model has a large workload and is prone to errors. In response to this situation, I now develop the " Games Comprehensive Information Management System", using computers to manage the registration, grouping, semi-finals, finals and statistics of the games. This can reduce manpower, improve work efficiency and accuracy. Now major s and universities have popularized gigabit campus networks, and it has become possible to develop a "integrated information management system for sports games" based on campus networks. At the same time, we should also see that many sports games, such as the international Olympics, and domestic National Games and Urban Games, have also adopted computer networks to improve their management processes. For example, in the recent Olympic Games, thousands of microcomputers have been used to network for event management, which basically meets the management needs in terms of functions, but its development and operating costs are huge, and it is difficult to popularize. The scale of the games is not very large. More importantly, due to limited funds, it is impossible for all stadiums to be equipped with computer networks. If it is only configured in some stadiums, it will be inefficient due to changes in the competition venues. Disadvantages, to break the past, you must register at the designated place, spend manpower and material resources, personally go to the pointing place to fill in the registration information. Therefore, it is necessary to build a system based on the existing campus network, truly open to event participants and event spectators inside and outside the campus network, with strong information processing functions, and suitable for a large number of s' actual networks and At the same time, it truly realizes the "Sports Games Comprehensive Information Management System" that relies on the computer itself, has strong information processing capabilities and can meet athletes' online registration.

2. Related Work

The literature (Gu et al., 2019) defines school competitive sports as organized, planned and targeted competitive sports training and competition activities in the school education system that follow the laws of education and competitive sports with sports talents and sports specialties. It is an educational process to realize the comprehensive and free development of individuals. Moreover, this literature clarifies the connotation and extension of the concept of school competitive sports in our country. The literature (Nasr et al., 2020) pointed out that as an important part of sports, competitive sports is an education process that mainly involves participating in inter-school sports competitions. The literature (Thành & Công, 2019) pointed out that after more than ten years of school competitive sports development, the school's development of competitive sports has effectively promoted the overall development of school sports. In the prospect of the development of school competitive sports in our country, the literature (Petrov et al., 2018) pointed out that school competitive sports will become the main force participating in international competitive competitions in the future. The literature (Hua et al.,

2020) believed that if China's competitive sports faces the future to seek development, it must pay attention to the establishment of an intensive training system that combines education and competitive sports. By discussing the relationship between s and universities and the interactive development of competitive sports, the literature (Aso et al., 2021) pointed out that competitive sports provide services for the development of competitive sports, and competitive sports provides guidance for the development of competitive sports. Through the study of foreign sports systems, the literature (Mehta et al., 2017) pointed out that in the international arena, especially in the United States, schools are the centers of training outstanding athletes. The literature (Liu et al., 2018) pointed out that the United States relies on the amateur training of elementary schools, middle schools, and universities to form the entire training system. Through a comparative study of the internal and external management systems of Chinese and American sports teams, the literature (Ershadi-Nasab et al., 2018) pointed out that American sports occupies a dominant position in the country and is the only way for most athletes to climb the peak of competitive sports. Through the research on the management of American intercollegiate sports competitions, the literature (Nie et al., 2018) pointed out that the important reason why American athletic sports are so perfect and has such great achievements today is that they have incorporated athletic sports events into school education. The development of competitive sports in Japan is mainly due to the formation of a three-level training network based on primary and secondary school sports training teams, with corporate clubs and comprehensive universities as the backbone, and national teams as the highest level (Nie et al., 2019). Australia also attaches great importance to the cultural learning of athletes, and the training of all athletes has never been separated from the educational process (Zarkeshev & Csiszár, 2019). Literature (McNally et al., 2018) through the study of some sports teams, it is proposed that the China University Sports Association can learn from the American sports competition system, establish my country's sports competition system, implement a classified competition model for intercollegiate sports competitions, and incorporate it into the country In the sports competition plan. Literature (Díaz et al., 2021) proposes that the development of school athletic sports should be led by s and universities, establish a school athletic sports talent training system, and speed up the improvement of sports competitions. Literature (Bakshi et al., 2021) pointed out that the development of school competitive sports should solve a series of problems such as the formation and management of high-level sports teams, and the improvement of the competition security system. Literature (Colyer et al., 2018) proposes that under the conditions of a market economy, the development of competitive sports in s and universities should start with the trial of the club system and increasing competition opportunities. Literature (Sárándi et al., 2020) pointed out that under the supervision of perfecting laws and regulations, American s and universities have established a complete competition system based on competition. Literature (Azhand et al., 2021) takes the American Springfield women's basketball team as an analysis case, and analyzes the management experience of American competitive sports events through the research on the management of competitive sports in American s and universities. Literature (Xu & Tasaka, 2020) focuses on the analysis of the NCAA competition system on the development model of competitive sports events in American s and universities, and points out that NCAA will formulate special market cultivation and development plans to develop sports events. NCAA unifies the management of sports competitions, seizes the characteristics of American education and the needs of the market, and leads the organization and operation of competitive sports events in s and universities to a market-oriented direction.

3. Application of Fuzzy C-Means Algorithm in Data Processing of Sports Events

We set the sample set to be classified as $X=\{x_1,x_2,\dots,x_n\}\subset R^{n\times s}$. Among them, n is the number of samples in the sample set, and s is the dimension of the feature space. At the same time, we set $X_k=\{x_{k1},x_{k2},\dots,x_{kn}\}\subset(1\le k\le n)$. Among them, $x_{kj}(1\le j\le s)$ is the j-th attribute value of the sample x_k. Bezdek gave a general description of the fuzzy C-means clustering algorithm:

$$J(U,V)=\sum_{i=1}^{c}\sum_{k=1}^{n}(u_{ik}^{m}\|x_k-x_i\|_2^2) \quad (1)$$

$$\sum_{i=1}^{c}u_{ik}=1\,,k=1,2,\cdots,n \quad (2)$$

The FCM algorithm is an iterative solution process that minimizes the above-mentioned objective function J (U, V). The Lagrangian operator is introduced to solve the minimum value of the above formula, and the process is as follows:

$$J(U,V)=\sum_{i=1}^{c}\sum_{k=1}^{n}(u_{ik}^{m}\|x_k-x_i\|_2^2)+\sum_{k=1}^{n}\lambda_k(\sum_{i=1}^{c}u_{ik}-1) \quad (3)$$

Among them, $\lambda=[\lambda_1,\lambda_2,\dots,\lambda_n]^T$ is the Lagrangian operator, and the above formula (3) is derivated to obtain:

$$\frac{\partial J(U,V)}{\partial\lambda}=\sum_{i=1}^{c}u_{ik}-1=0 \quad (4)$$

$$\frac{\partial J(U,V)}{\partial u_{ik}}=m(u_{ik})^{m-1}\|x_k-v_i\|_2^2+\lambda_k=0 \quad (5)$$

$$\frac{\partial J(U,V)}{\partial u_{ik}}=-2\sum_{i=1}^{c}u_{ik}^{m}(x_k-v_i)=0 \quad (6)$$

From the above formula (5), we can get:

$$u_{ik} = \left(\frac{-\lambda_k}{m\|x_k-v_i\|_2^2}\right)^{\frac{1}{m-1}} = \left(\frac{-\lambda_k}{m}\right)^{\frac{1}{m-1}}\left(\frac{1}{\|x_k-v_i\|_2^2}\right)^{\frac{1}{m-1}} \tag{7}$$

In formula (7), i is replaced by r and substituted into (4):

$$\sum_{i=1}^{c}\left(\frac{-\lambda_k}{m\|x_k-v_i\|_2^2}\right)^{\frac{1}{m-1}} = \left(\frac{-\lambda_k}{m}\right)^{\frac{1}{m-1}}\sum_{i=1}^{c}(\|x_k-v_i\|_2^2)^{\frac{1}{m-1}} = 1 \tag{8}$$

Formula (8) is substituted into (7) to obtain:

$$u_{ik} = \frac{(\|x_k-v_i\|_2^2)^{\frac{1}{m-1}}}{\sum_{i=1}^{c}(\|x_k-v_i\|_2^2)^{\frac{1}{m-1}}} = \sum_{i=1}^{c}\left(\frac{\|x_k-v_i\|_2^2}{\|x_k-v_t\|_2^2}\right)^{\frac{1}{1-m}} \tag{9}$$

From formula (6), we can get:

$$v_{ij} = \frac{\sum_{k=1}^{n}u_{ik}^{m}x_{kj}}{\sum_{k=1}^{n}u_{ik}^{m}} \tag{10}$$

The steps of the fuzzy C-means algorithm are as follows:

(1) The number of clustering categories c, the fuzzy weighting index m, and the iteration stop threshold ε are set, the membership matrix $U^{(0)}$ is initialized, and the constraints of formula (2) are satisfied;

(2) When the number of iteration steps is l (l = 1, 2,...), formula (10) and $U^{(l-1)}$ are used to update the cluster center $V^{(l)}$;

(3) Use equation (9) and $V^{(l)}$ to update the membership matrix $U^{(l)}$;

(4) If condition $\|U^{(l)} - U^{(l-1)}\| \le \varepsilon$ is met, the algorithm stops iterating, and the membership matrix and cluster centers are output; otherwise, there is $l = l + 1$, which returns to step (2), and the next iteration is performed.

Due to the simplicity and practicality of the FCM algorithm, many documents have carried out research and improvement on the FCM algorithm. The following mainly discusses the three aspects of the weighted index m, the similarity measurement and the algorithm implementation approach. The difference between the fuzzy C mean and the hard C mean is the introduction of the weighted index m. Bezdek pointed out in the literature that the parameter m controls the degree of sharing between fuzzy classes. When m=1, the objective function degenerates into hard clustering. It can be seen that the hard clustering algorithm is a special case of fuzzy C mean when m=1; when the value of m When approaching infinity, the sample membership degree of FCM algorithm clustering is 1/c, and the c cluster centers overlap and are the center of gravity of all sample data. Different distance measures are applicable to different types of data sets. The clustering algorithm based on the objective function is finally attributed to the mathematical optimization problem. The traditional FCM algorithm uses the alternate optimization method to solve the clustering center and the membership matrix, which is essentially a local search mountain climbing algorithm, and all mountain climbing algorithms. Similarly, traditional algorithm implementation approaches have problems such as sensitivity to initial values and easy to fall into local optima. In order to solve these problems, a series of related optimization and improvement methods have been produced.

The following is a brief description based on the research on the realization of intelligent optimization methods. Inspired by natural organisms, a series of heuristic algorithms such as genetic algorithm, ant colony algorithm, and firefly algorithm have been produced. Randomness, so it can avoid falling into the local optimal solution, and at the same time sacrifice the optimality of the solution in exchange for a faster global search speed. For a sample containing only two attribute information, each sample can only be missing at most one attribute value. If the sample lacks two attribute values at the same time, it is meaningless for clustering. Figure 1 shows the geometric structure of the complete sample in space coordinates. It contains 2 types, each of which is composed of 5 samples represented by solid dots. Figure 2 shows the geometric structure of the data set in Figure 1 after 20% of the attribute values are missing.

Among them, the solid dot represents a complete sample, the horizontal line represents the first attribute value of a sample is missing, and the vertical line represents the first attribute value of a sample. Therefore, all samples are represented by a horizontal line or a vertical line. Figures 3 and 4 show the two geometric structures of the largest missing ratio data set. For Figure 3, it is easy to obtain the estimated value of the missing attribute value based on the solid circle. For the geometric structure described in Figure 4, the dotted circle confuses the judgment of the cluster center, so it is not easy to obtain the estimated value of the missing attribute value. We set an incomplete data set $\bar{X} = \{\bar{x}_1, \bar{x}_2, ..., \bar{x}_n\}$, in which for each sample $\bar{x}_k = \{\bar{x}_{k1}, \bar{x}_{k2}, ..., \bar{x}_{kn}\}, 1 \leq k \leq n$, n is the number of samples, and s is the number of sample attributes. In order to facilitate the description of the relevant chapters below, we set:

$$\bar{X}_W = \{\bar{x}_k \in \bar{X} | \bar{x}_k \text{none of the sample attributes decreased}\}$$
$$\bar{X}_L = \{\bar{x}_k \in \bar{X} | \bar{x}_k \text{the sample contains at least one attribute missing}\}$$

$$\bar{X}_p = \left\{\bar{x}_{kj} | \forall 1 \leq k \leq n, 1 \leq j \leq s, \bar{x}_{kj} \text{the attribute value is not missing}\right\}$$

$$\bar{X}_p = \left\{\bar{x}_{kj} | \forall 1 \leq k \leq n, 1 \leq j \leq s, \bar{x}_{kj} is\ a\ missing\ attribute\ value\right\}$$

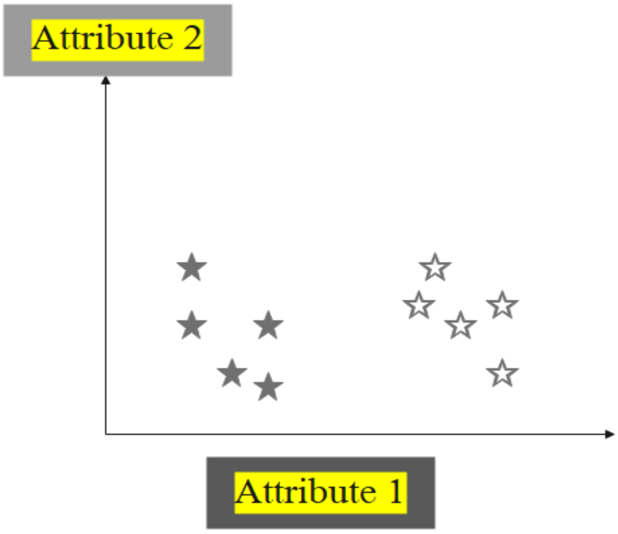

Figure 1: Two-dimensional complete data

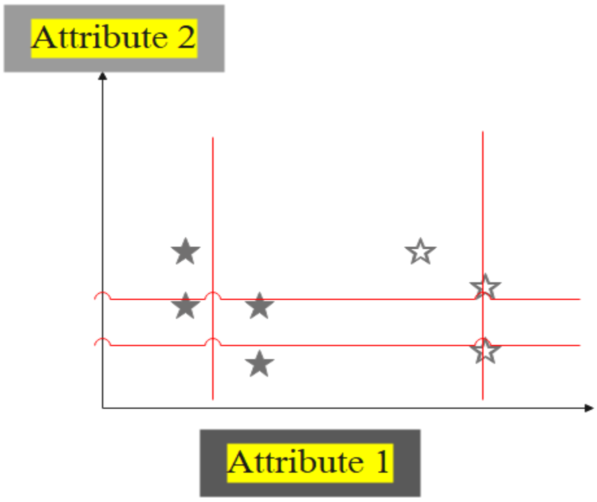

Figure 2: Two-dimensional incomplete data with missing 20% attribute values

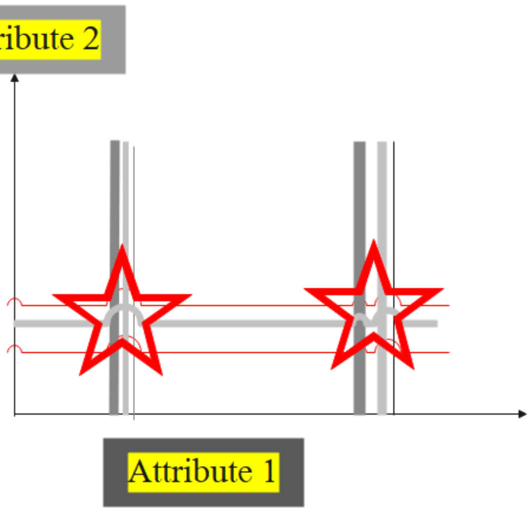

Figure 3: Two-dimensional incomplete data with missing 50% attribute values

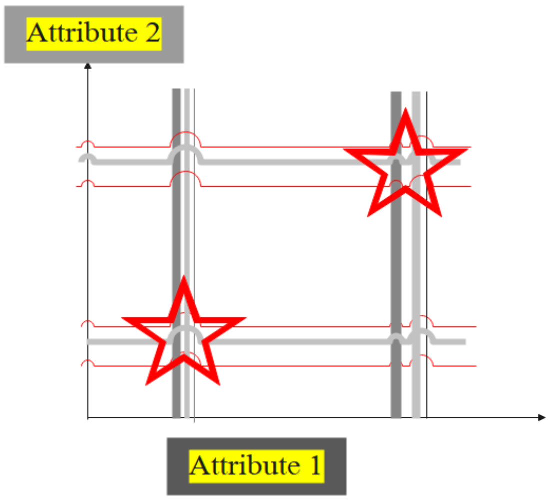

Figure 4: Two-dimensional incomplete data with missing 50% attribute values

The simplest and most straightforward way to deal with incomplete data is to delete all incomplete samples $\bar{X}_L$ in the incomplete data set $\bar{X}$, and then use the remaining complete samples $\bar{X}_W$ to perform fuzzy C-mean clustering. This method is called the incomplete data fuzzy C-means algorithm (WDS-FCM) of the complete data strategy (WDS). One of the difficulties of using FCM algorithm to cluster incomplete data is that the distance between the incomplete sample $\bar{X}_L$ and the cluster center cannot be directly calculated. After ignoring the incomplete sample $\bar{X}_L$, the WDS-FCM algorithm can directly use the complete sample $\bar{X}_W$ to calculate the cluster centers and the membership matrix U_W of the complete sample to each cluster center. The membership matrix U_L of each cluster center of the incomplete sample is calculated using the local distance introduced in section 2.22, and there is $U = U_W \cup U_L$. The WDS-FCM algorithm is described as:

(1) The number of categories c, the weighting index m, and the iteration stop threshold s are set, the membership matrix $U^{(0)}$ is initialized, and the constraints of formula (2) are satisfied;

(2) When the number of iteration steps is l (1=1,2,...), in the complete sample $\bar{X}_W$, formula (10) and $U^{(l-1)}$ are used to update the cluster center $V^{(l)}$;

(3) The membership matrix $U_W^{(l)}$ of the complete sample $\bar{X}_W$ is updated according to formula (9) and $V^{(l)}$, and the membership matrix $U_L^{(l)}$ of the incomplete sample $\bar{X}_L$ is updated according to formula (11), (13) and $V^{(l)}$. Then the membership matrix of all samples is $U^{(l)} = U_W^l \cup U_L^l$;

(4) If there is $\|U^{(l)} - U^{(l-1)}\| \leq \varepsilon$, the algorithm stops iterating and

outputs $U^{(l)}$ and $V^{(l)}$. Otherwise, there is l=l+1, and it returns to step (2) for the next iteration. PDS-FCM only ignores the missing attribute value $\bar{X}_M$ in the incomplete sample, and calculates the distance between the incomplete sample $\bar{X}_L$ and the cluster center using the following formula:

$$D_{kj} = \frac{s}{I_k}\sum_{j=1}^{s}\left(x_{kj} - v_{ij}\right)^2 I_{kj} \tag{11}$$

Among them, there is:

$$I_{kj} = \begin{cases} 0, if\ \bar{x}_{kj}\ defect \\ 1, other \end{cases}; 1 \le k \le n, 1 \le j \le s, I_k = \sum_{j=1}^{s} I_{kj}$$

For example, for incomplete sample vectors a=(1,?,3,?,5) and b=(2,4,6,8,10), "?" means that the attribute value at this position is missing, then the distance between samples a and b calculated by using the local distance is as follows:

$$D(a,b) = \frac{5}{5-2}(1-2)^2 + (3-6)^2 + (5-10)^2$$

The clustering centers and membership degrees of the PDS-FCM algorithm are updated according to the following formulas:

$$v_{ij} = \frac{\sum_{k=1}^{n} u_{ik}^{m} x_{kj} I_{kj}}{\sum_{k=1}^{n} u_{ik}^{m} I_{kj}} \tag{12}$$

$$u_{ik} = \sum_{t=1}^{c}\left(\frac{D_{ki}}{D_{kt}}\right)^{\frac{1}{1-m}} \tag{13}$$

The PDS-FCM algorithm is described as:

(1) The number of categories c, the weighting exponent m, and the iteration stop threshold s are set, the membership matrix $U^{(0)}$ is initialized, and the constraints of formula (2) are satisfied;

(2) When the number of iteration steps is l (1=1,2,...), formula (12) and $U^{(l-1)}$ are used to update the cluster center $V^{(l)}$;

(3) Formula (13) and $V^{(l)}$ are used to update the membership matrix $U^{(l)}$;

(4) If there is $\left\|U^{(l)} - U^{(l-1)}\right\| \le \varepsilon$, the algorithm stops iterating and outputs $U^{(l)}$ and $V^{(l)}$. Otherwise, there is l=l+1, and it returns to step (2) for the next iteration.

Because the PDS strategy discards less information about incomplete samples, the clustering effect of PDS-FCM is better than that of WDS-FCM when the proportion of missing attribute values is large. The OCS-FCM algorithm is an incomplete data fuzzy C-means algorithm based on the Optimal Completion Strategy (OCS). The objective function of the OCS-FCM algorithm is as follows:

$$J(U,V,\bar{X}_M) = \sum_{i=1}^{c}\sum_{k=1}^{n}(u_{ik}^{m}\|\bar{x}_k - v_i\|_2^2) \tag{14}$$

The Lagrangian algorithm is used to find the objective function of the above formula, and the necessary conditions for taking the minimum value are formulas (9), (10) and the following formulas:

$$\bar{x}_{ij} = \frac{\sum_{i=1}^{c} u_{ik}^{m} v_{ij}}{\sum_{i=1}^{c} u_{ik}^{m}} \tag{15}$$

The OCS-FCM algorithm is described as:

(1) The number of categories c, the weighting index m, and the iteration stop threshold s are set, the membership matrix $U^{(0)}$ is initialized, and the constraints of formula (2) are satisfied;

(2) When the number of iteration steps is l (1=1,2,...), formula (12) and $U^{(l-1)}$ are used to update the cluster center $V^{(l)}$;

(3) Formula (13) and $V^{(l)}$ are used to update the membership matrix $U^{(l)}$;

(4) If there is $\left\|U^{(l)} - U^{(l-1)}\right\| \leq \varepsilon$, the algorithm stops iterating and outputs $U^{(l)}$ and $V^{(l)}$. Otherwise, there is l=l+1, and it returns to step (2) for the next iteration. The incomplete data fuzzy C-means algorithm (NPS-FCM) based on the Nearest Prototype Strategy (NPS) is a simple variant of the OCS-FCM algorithm.

The steps of the NPS-FCM algorithm are basically the same as those of the OCS-FCM algorithm, except that step (4) of the OCS-FCM algorithm is changed to the following steps:

(4) For an incomplete sample, formula (11) is used to compare the distance D from all cluster centers, and the missing attribute value is calculated by using the following formula:

$$\bar{x}_{kj} = v_{ij}, D_{ik} = min\{D_{1k}, D_{2k}, \ldots, D_{ck}\} \tag{16}$$

In rare cases, in the iterative process of the NPS-FCM algorithm, the situation of $D_{ik} = min\{D_{1k}, D_{2k}, \ldots, D_{ck}\}$ and $i \neq t$ will appear, and other strategies need to be specified to select the value of x. In addition, the NPS-FCM algorithm sometimes does not converge.

4. The Framework of Sports Event Management System Based on Big Data

According to the construction principles of the overall framework of the sports competition information system, this paper combines the successful experience of comprehensive sports events at home and abroad to first use expert consultation and interview methods to determine the preliminary construction elements based on the original work experience, as shown in Figure 5.

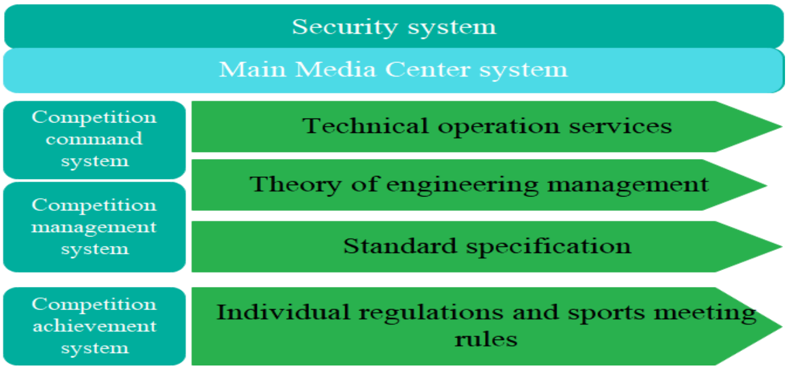

Figure 5: The frame diagram of the initial core elements of the sports competition information system

According to the development process of the sports meeting business, the business process of the sports meeting can be divided into three stages: pre-match publicity organization, during-match execution, and post-match summary. The specific business process is shown in Figure 6.

Figure 6: Business flow diagram of sports event management in s

According to the analysis of the business process of the sports meeting, the data flow diagram of the sports meeting management system can be drawn, which is the basis of the outline design and detailed design of the system. Therefore, the top-level data flow diagram is the verification process of system login, as shown in Figure 7.

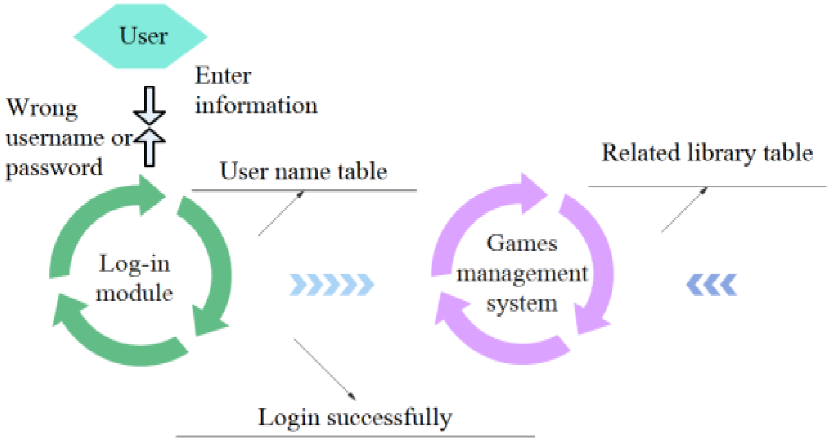

Figure 7: Top-level data flow diagram

The system utilizes a point-to-multipoint bridging architecture, leveraging the campus network infrastructure to deploy server-side applications on a centralized server. This configuration enables any computer equipped with a browser, both within the campus network and on external networks, to access the information management system. During the competition, we placed laptops with wireless network cards at each score processing points in the competition venue to directly process the information and scores of each event separately. Moreover, we use the wireless network of the sports venue for transmission, and other computers connected to the network can inquire about the game-related information or manage the game in the first time period. The network topology is shown in Figure 8.

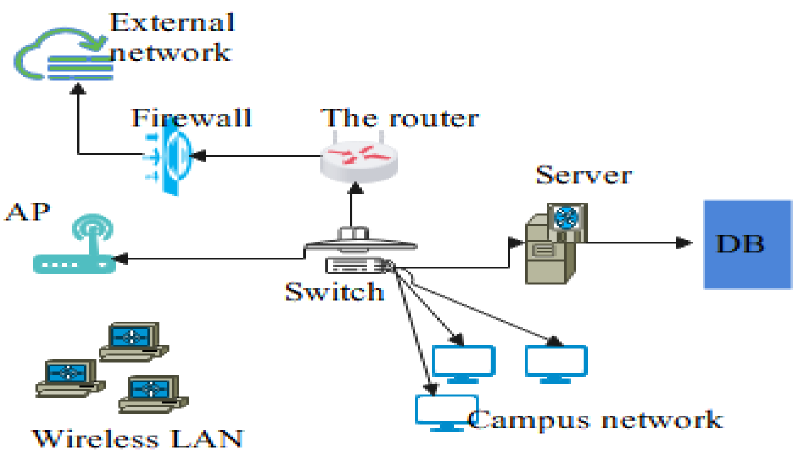

Figure 8: Network topology diagram

5. Assessment of the Impact of the Sports Event Management System Framework

Following the development of the aforementioned sports event management system leveraging big data technology, this study proceeds to evaluate the performance of the system framework outlined within. A controlled experimental design is employed, tailored to the prevailing conditions of sports event management. This paper constructs a simulation system reflective of real-world management scenarios, and the ensuing simulation test outcomes are detailed in Table 1 and illustrated in Figure 9.

Table 1: Performance verification of sports event management system based on big data

NO	DATA MINING	EVENT MANAGEMENT	NO	DATA MINING	EVENT MANAGEMENT
1	94.01	92.13	21	95.47	84.89
2	93.10	91.85	22	94.58	87.41
3	97.87	85.89	23	95.40	85.47
4	95.32	82.01	24	95.10	93.17
5	96.42	89.50	25	94.41	86.59
6	94.66	82.09	26	93.43	82.02
7	94.52	92.19	27	97.57	88.99
8	95.47	93.36	28	96.40	82.66
9	97.12	91.59	29	97.67	91.20
10	98.00	81.43	30	97.18	84.15
11	94.12	93.85	31	93.11	83.42
12	94.70	89.42	32	93.33	90.62
13	95.26	86.02	33	95.19	87.58
14	94.18	83.55	34	97.76	89.26
15	96.31	82.63	35	96.50	81.71
16	97.40	85.47	36	94.07	81.12
17	97.89	91.33	37	96.67	93.68
18	94.37	88.15	38	93.31	87.95
19	94.96	90.17	39	96.25	90.73
20	94.53	84.57	40	93.58	84.95

From the below experimental research, the sports event management system based on big data constructed in this paper has certain effects, so the system constructed in this paper can be used for auxiliary management in subsequent sports competitions.

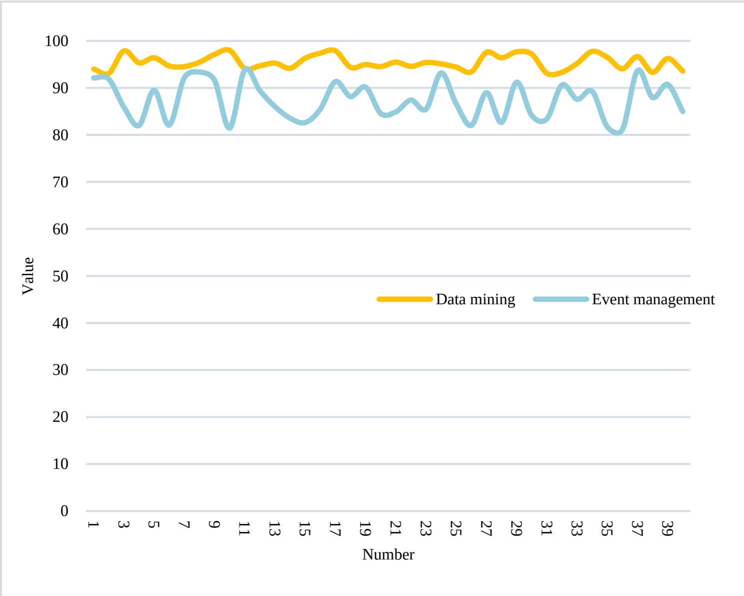

Figure 9: Simulation test results of the management system of sports events in s and Zhou, Z., & Liu, X. (2019). Multi-person pose estimation using bounding box constraint and universities

6. Conclusion

Starting from the actual needs of sports event management, this paper establishes a set of management systems that are in line with the reality of sports games through interviews with managers and participants, which is guided by the thought of software engineering. The development process of the system is the comprehensive application of computer technology, communication technology, and network technology. It changes the original traditional manual management mode, greatly facilitates the manager, effectively improves the work efficiency and management level, avoids human error, and ensures the fairness, fairness and openness of the game. At the same time, participants and those who are concerned about the Games can have a glance at the relevant information of the Games by simply logging in to the system through a browser. Moreover, this paper analyzes the system in detail and designs the overall system. According to the actual situation, this paper carries out role analysis, workflow analysis, functional requirement analysis and performance requirement analysis of the system. After the system is constructed, the performance of the system is verified through experimental research. From the experimental research, it can be seen that the sports event management system constructed in this paper has a certain effect.

Acknowledge

1. 2024 Xi'an Soft Science Research Project "Research on the Development Path of Sports Technology in Xi'an under the Background of New Economy" (Project No. 24RKYJ0057);

2. China Scholarship Council Western Region Talent Training Special Project (Project No. 202208615027).

REFERENCES

Aso, K., Hwang, D.-H., & Koike, H. (2021). Portable 3D human pose estimation for human-human interaction using a chest-mounted fisheye camera. In *Proceedings of the Augmented Humans International Conference 2021* (pp. 116-120).

Azhand, A., Rabe, S., Müller, S., Sattler, I., & Heimann-Steinert, A. (2021). Algorithm based on one monocular video delivers highly valid and reliable gait parameters. *Scientific reports*, *11*(1), 14065.

Bakshi, A., Sheikh, D., Ansari, Y., Sharma, C., & Naik, H. (2021). Pose estimate based yoga instructor. *International Journal of Recent Advances in Multidisciplinary Topics*, *2*(2), 70-73.

Colyer, S. L., Evans, M., Cosker, D. P., & Salo, A. I. (2018). A review of the evolution of vision-based motion analysis and the integration of advanced computer vision methods towards developing a markerless system. *Sports medicine-open*, *4*, 1-15.

Díaz, R. G., Laamarti, F., & El Saddik, A. (2021). DTCoach: your digital twin coach on the edge during COVID-19 and beyond. *IEEE Instrumentation & Measurement Magazine*, *24*(6), 22-28.

Ershadi-Nasab, S., Noury, E., Kasaei, S., & Sanaei, E. (2018). Multiple human 3d pose estimation from multiview images. *Multimedia Tools and Applications*, *77*, 15573-15601.

Gu, R., Wang, G., Jiang, Z., & Hwang, J.-N. (2019). Multi-person hierarchical 3d pose estimation in natural videos. *IEEE Transactions on Circuits and Systems for Video Technology*, *30*(11), 4245-4257.

Hua, G., Li, L., & Liu, S. (2020). Multipath affinage stacked—hourglass networks for human pose estimation. *Frontiers of Computer Science*, *14*, 1-12.

Li, M., Zhou, Z., & Liu, X. (2019). Multi-person pose estimation using bounding box constraint and LSTM. *IEEE Transactions on Multimedia*, *21*(10), 2653-2663.

Liu, S., Li, Y., & Hua, G. (2018). Human pose estimation in video via structured space learning and halfway temporal evaluation. *IEEE Transactions on Circuits and Systems for Video Technology*, *29*(7), 2029-2038.

McNally, W., Wong, A., & McPhee, J. (2018). Action recognition using deep convolutional neural networks and compressed spatio-temporal pose encodings. *Journal of Computational Vision and Imaging Systems*, *4*(1), 3-3.

Mehta, D., Sridhar, S., Sotnychenko, O., Rhodin, H., Shafiei, M., Seidel, H.-P., Xu, W., Casas, D., & Theobalt, C. (2017). Vnect: Real-time 3d human pose estimation with a single rgb camera. *Acm transactions on graphics (tog)*, *36*(4), 1-14.

Nasr, M., Ayman, H., Ebrahim, N., Osama, R., Mosaad, N., & Mounir, A. (2020). Realtime multi-person 2D pose estimation. *International Journal of Advanced Networking and Applications*, *11*(6), 4501-4508.

Nie, X., Feng, J., Xing, J., Xiao, S., & Yan, S. (2018). Hierarchical contextual refinement networks for human pose estimation. *IEEE Transactions on Image Processing*, *28*(2), 924-936.

Nie, Y., Lee, J., Yoon, S., & Park, D. S. (2019). A multi-stage convolution machine with scaling and dilation for human pose estimation. *KSII Transactions on Internet and Information Systems (TIIS)*, *13*(6), 3182-3198.

Petrov, I., Shakhuro, V., & Konushin, A. (2018). Deep probabilistic human pose estimation. *IET Computer Vision*, *12*(5), 578-585.

Sárándi, I., Linder, T., Arras, K. O., & Leibe, B. (2020). Metrabs: metric-scale truncation-robust heatmaps for absolute 3d human pose estimation. *IEEE Transactions on Biometrics, Behavior, and Identity Science*, *3*(1), 16-30.

Szűcs, G., & Tamás, B. (2018). Body part extraction and pose estimation method in rowing videos. *Journal of computing and information technology*, *26*(1), 29-43.

Thành, N. T., & Công, P. (2019). An evaluation of pose estimation in video of traditional martial arts presentation. *Journal of Research and Development on Information and Communication Technology*, *2019*(2), 114-126.

Xu, J., & Tasaka, K. (2020). Keep your eye on the ball: detection of kicking motions in multi-view 4K soccer videos. *ITE Transactions on Media Technology and Applications*, *8*(2), 81-88.

Xu, J., Tasaka, K., & Yamaguchi, M. (2021). fast and accurate whole-body pose estimation in the wild and its applications. *ITE Transactions on Media Technology and Applications*, *9*(1), 63-70.

Zarkeshev, A., & Csiszár, C. (2019). Rescue method based on V2X communication and human pose estimation. *Periodica Polytechnica Civil Engineering*, *63*(4), 1139-1146.