



# Application of Big Data's Association Rules in the Analysis of Sports Competition Tactics

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**Abstract.** The problem of low accuracy and poor ability of tactical analysis of current tournament analysis strategy, to improve the statistical intelligent analysis ability of the tactical analysis of sports games, it is necessary to carry out the tactical analysis and statistics of the sports games, and put forward a game strategy analysis and statistical model based on a large data association rule mining. firstly, a data acquisition and diagnosis analysis model of a sports game strategy analysis is constructed, and a sports game tactical analysis data information flow model is constructed, and the statistic characteristic quantity in the sports game tactical analysis is extracted, the method of fuzzy correlation fusion is used to analyze the interference of the statistical data in the tactical analysis of the sports game, and a plurality of known interference frequency components are removed. in that method, a large-data association rule mining algorithm is adopted to carry out statistical data identification and characteristic analysis in a sports game and tactical analysis, an optimization characteristic solution of the game and tactical statistical information analysis is established, and a self-adaptive optimization of the game and tactical statistical information analysis is carried out by adopting a simplified gradient algorithm, the feature analysis and data optimization recognition of the game tactics analysis are realized by combining the self-correlation feature matching method. The simulation results show that the method is used to carry out the tactical analysis of sports games and the accuracy of the statistics, so as to improve the ability of the tactical analysis of the sports games, so as to improve the effect of the competition.

**Keywords:** Big data · Association rules · Sports games · Tactical analysis · Statistical analysis

## 1 Introduction

In a large-scale sports event, that tactics of sports match is very important to win, it is necessary to construct the tactical analysis model of the sports game, carry out the tactical analysis of the sports game, extract the statistic feature quantity in the tactical analysis of the sports game, adopt the statistical analysis method, carrying out the tactical analysis and statistics of the sports games, constructing a distributed detection model of the statistical data in the sports game tactical analysis [1], carrying out the characteristic analysis of the tactical characteristics of the sports game according to the statistical data distribution state in the sports game tactical analysis, the research of the statistical data monitoring method in the related sports game tactics analysis is of great

concern to the people, the identification of the statistical data in the tactical analysis of the sports game is based on the statistical analysis of the tactical analysis data of the sports game, and a large data analysis method is adopted, Feature extraction and identification of statistical data in the tactical analysis of sports games [2].

Traditionally, the method of statistical analysis, fuzzy feature detection and particle swarm optimization for the tactical analysis and statistical methods of sports games is presented, and the statistical analysis model of statistical data in the tactical analysis of sports games is established, and the method of fuzzy-constrained clustering analysis is combined. And carrying out statistical data detection and identification in the sports game tactical analysis [3]. In reference [4], a statistical data detection method is proposed in the tactical analysis of the sports game based on the feature extraction of the spectrum, according to the spectrum analysis of the statistical data in the sports game tactics analysis by the self-adaptive spectrum detection method, the spectral characteristic quantity of the statistical data in the sports game tactical analysis is extracted, the method of the analysis and analysis is carried out by using the fuzzy correlation fusion analysis, the tactical analysis and the statistics of the sports game are realized, But the computational complexity of the method is high and the real-time performance is not good. In view of the above problems, this paper proposes a game strategy analysis and statistical model based on a large data association rule mining. Firstly, a data acquisition and diagnosis analysis model of a sports game strategy analysis is constructed, and a sports game tactical analysis data information flow model is constructed, and the statistic characteristic quantity in the sports game tactical analysis is extracted, the method of fuzzy correlation fusion is used to analyze the interference of the statistical data in the tactical analysis of the sports game, and a plurality of known interference frequency components are removed [5]. In that method, a large-data association rule mining algorithm is adopted to carry out statistical data identification and characteristic analysis in a sports game and tactical analysis, an optimization characteristic solution of the game and tactical statistical information analysis is established, and a self-adaptive optimization of the game and tactical statistical information analysis is carried out by adopting a simplified gradient algorithm, the feature analysis and data optimization recognition of the game tactics analysis are realized by combining the self-correlation feature matching method. Finally, the simulation experiment is carried out to show the superiority of the method in improving the tactical analysis and statistical ability of the sports game [6].

## **2 Collection of Statistical Data and Analysis of Characteristics in Tactical Analysis of Sports Competition**

### **2.1 Sampling of Statistical Data in Tactical Analysis of Sports Competition**

In order to improve the statistical intelligence analysis ability of sports competition tactical analysis, it is necessary to carry out sports competition tactical analysis and statistics. In this paper, the nonlinear feature sequence analysis method is used to

sample the statistical data of sports competition tactical analysis in real time [7]. The collected data are ECG information, real-time brain wave information, cardiac load information, lung flux information and so on. According to the data acquisition results, the intelligent feature analysis and recognition of statistical data in sports competition tactical analysis are carried out, the statistical data collection and information storage model in sports competition tactical analysis is constructed, a statistical analysis model containing physique physiological characteristic information is established, and the statistical data spectrum feature extraction in sports competition tactical analysis is carried out by using feature analysis method [8]. With the preliminary statistics and sampling of statistical data in sports competition tactical analysis, the univariable time series of statistical data in sports competition tactical analysis is constructed as follows: the information flow model of statistical data collection in  $\{x_n\}$ , sports competition tactical analysis is expressed as follows:

$$x_n = x(t_0 + n\Delta t) = h[z(t_0 + n\Delta t)] + \omega_n \tag{1}$$

Wherein,  $h(\cdot)$  is the multivariate quantitative value function of statistical data stream in sports competition tactical analysis,  $\omega_n$  is the adaptive weighting coefficient, and the real-time collected sports competition tactical analysis data is selected as the original data sample sequence, and the finite data set expression of statistical data in sports competition tactical analysis is obtained as follows:

$$U = \{U_1, U_2, \dots, U_N\} \tag{2}$$

Wherein  $U_i$  is a data transfer model with dimension  $d$  dimension, and the high-dimensional mapping vector for transmitting the tactical analysis data of the sports game is  $z_n \rightarrow z_{n+1}$  or  $z(t) \rightarrow z(t + 1)$ , so that the transmission time series  $\{x(t_0 + i\Delta t)\}$ ,  $i = 0, 1, \dots, N - 1$  of the transmission sports game tactical analysis data are obtained, and the peak parameter model thereof is expressed as follows:

$$X = [s_1, s_2, \dots, s_K]_n = (x_n, x_{n-\tau}, \dots, x_{n-(m-1)\tau}) \tag{3}$$

Wherein,  $K = N - (m - 1)\tau$ , represents the statistical characteristic quantity of statistical data in sports competition tactical analysis, and gives the statistical data  $s_i = (x_i, x_{i+\tau}, \dots, x_{i+(m-1)\tau})^T$  as a set of scalar sampling sequences in sports competition tactical analysis. Taking lung flux as original data, the characteristic analysis of statistical data in sports competition tactical analysis is carried out, and the statistical information flow is represented as  $\{x_i\}_{i=1}^N$ , assuming that the input initial information flow of sports competition tactical analysis data is  $C_0 = C_{N/2} = 0$ ,  $C_{N-n} = C_n^*$ ,  $n = 0, 1, 2 \dots N/2 - 1$ . The capacity of tactical analysis data for sports competitions is as follows:

$$P_r = \frac{P_t}{(4\pi)^2 \left(\frac{d}{\lambda}\right)^2} \left[ 1 + \alpha^2 + 2\alpha \cos\left(\frac{4\pi h^2}{d\lambda}\right) \right] \tag{4}$$

The data collection and diagnosis analysis model of sports game tactical analysis is constructed, and the data information flow model of sports game tactical analysis is constructed. The data compression performance of sports game tactical analysis is analyzed by Hession matrix, which is as follows:

$$P_S = p_{2D}^k(1 - p_{2D})^{N-1-k} \sum_{i=1}^{\infty} \lambda_S^i = \frac{\lambda_S}{1 - \lambda_S} \tag{5}$$

In the above formula, the  $\lambda_S$  is the information gain of the sports game tactical analysis data under the non-limited bandwidth and  $p_{2D}$  is the information gain of the sports game tactical analysis data under the non-limited bandwidth, According to the characteristic sampling analysis result, the sports game tactics analysis and the statistics are carried out [9].

### 2.2 Image Trajectory Segmentation and Information Enhancement Processing

In that method, the statistic characteristic quantity in the tactical analysis of the sports game is extracted, and a fuzzy correlation fusion analysis and analysis method is adopted to carry out the filter detection of the statistical data in the sports game tactical analysis [10], by using the matching projection method, the optimized characteristic solution for the analysis of the tactical statistical information of the game and the tactical analysis of the sports game is obtained, and the gradient information component of the output sports game tactical analysis statistical data X can be expressed as:

$$y(k) = s_1(k) + n_1(k); \varphi(k) = s_2(k) + n_2(k) \tag{6}$$

$$s_1(k) = AA_H e^{j(\Omega k + \theta_H)}; s_2(k) = AA_{H_B} e^{j(\Omega k + \theta_{H_B})} \tag{7}$$

Wherein,  $A_H, A_{H_B}$  and  $\theta_H, \theta_{H_B}$  are adaptive feature recognition functions for the statistical data of sports game tactical analysis, and  $H(z)$  and  $H_B(z)$  represent amplitude response and state feature response, respectively. The simplified gradient algorithm is used to decompose the statistical data in the tactical analysis of sports matches [11]. The boundary conditions of the distribution of statistical data in the tactical analysis of sports competitions are obtained as follows:

$$R_\beta X = U\{E \in U/R | c(E, X) \leq \beta\} \tag{8}$$

$$R_\beta X = U\{E \in U/R | c(E, X) \leq 1 - \beta\} \tag{9}$$

For any two sports competition tactical analysis statistical data blocks  $m_i$  and  $m_j$ , the basic block characteristic quantity of the sports competition tactical analysis statistical data is the  $m_{i,j}(1 \leq i \leq n, 1 \leq j \leq k)$ , sports competition tactical analysis statistical data information chain distribution is the  $\{\lambda_i : 1 \leq i \leq S\}$ , criterion  $\{R_j : 1 \leq j \leq L\}$ ,

sports competition tactical analysis statistical data reference frequency  $f$  and the key characteristic  $d_{\gamma_0}$  match degree is:

$$\lambda^n(d_{\gamma_0}) = \int_{-\infty}^{+\infty} f(t)d_{\gamma_0}^*(t)dt \quad (10)$$

According to the self-correlation feature matching method, the feature extraction of the statistical data in the sports game tactical analysis is realized [12], and the optimized iterative formula of the feature extraction of the statistical data of the sports game tactical analysis is described as follows:

$$\theta_1(k + 1) = \theta_1(k) - \mu \text{Re}[y(k)\varphi^*(k)] \quad (11)$$

Where  $\mu$  is the parameter to control the convergence speed and accuracy, which is called the step size of the sports game tactical analysis data recognition;  $\varphi(k)$  is the fuzzy parameter of the sports game tactical analysis and statistics, according to the feature extraction results, the sports game tactical analysis and statistical algorithm design [13].

### 3 Tactical Analysis and Statistical Optimization of Sports Competition

#### 3.1 Mining Algorithm for Large Data Association Rules

On the basis of the above-mentioned data acquisition and diagnosis analysis model for building the tactical analysis of the sports game, and carrying out the tactics analysis and statistics of the sports games on the basis of the construction of the information flow model of the sports game and the tactical analysis, In this paper, a game strategy analysis and statistical model based on large data association rule mining is presented [14]. The analytical model of the statistical data for building the tactical analysis of sports games is expressed as follows:

$$z(t) = x(t) + iy(t) = a(t)e^{i\theta(t)} \quad (12)$$

In the formula,  $z(t)$  represents the real component of the statistical data of sports competition tactical analysis,  $x(t)$  represents the analytical characteristic quantity of the statistical data,  $y(t)$  represents the inherent modal function of the statistical data signal, and decomposes the information component of the statistical data of sports competition tactics analysis into multiple sets of feature sets, and obtains the envelope feature item:

$$a(t) = \sqrt{x^2(t) + y^2(t)}, \theta(t) = \arctan \frac{y(t)}{x(t)} \quad (13)$$

Wherein,  $\theta(t)$  indicates the high frequency component of sports competition tactical analysis statistical data,  $a(t)$  and  $\theta(t)$  are the dynamic evolution feature sets of sports

competition tactical analysis statistical data, respectively. Using big data association rule mining algorithm, the similarity distribution of statistical data detection is obtained as follows:

$$f(t) = \frac{1}{2\pi} \times \frac{d\theta(t)}{dt} \tag{14}$$

Carrying out the game strategy analysis and the statistical process control to obtain the correlation rule mining characteristic distribution weight as follows:

$$w_{ij} = \beta \times w(e_p k_q) \quad (\beta > 1) \tag{15}$$

On the basis of comprehensive analysis, a large-data association rule mining algorithm is used to analyze and analyze the statistical data in the tactical analysis of sports games [15], and the optimization feature of the analysis of the statistical information of the game is established as follows:

$$r_1 = x(t) - c_1 \tag{16}$$

Based on the above-mentioned processing, a large-data association rule mining algorithm is adopted, and the optimization design of the game and tactical statistical information analysis model is carried out [16].

### 3.2 Analysis and Output of Competition Tactical Statistical Information

The simplified gradient algorithm is used for adaptive optimization of game tactical statistical information analysis, and the feature analysis and data optimization recognition of statistical data in sports competition tactical analysis are realized by combining autocorrelation feature matching method [17]. The feature transfer function of statistical data in sports competition tactical analysis is expressed as follows:

$$h(\tau_i, t) = \sum_{i=1}^{N_m} a_i(t) e^{j\theta_i(t)} \delta(t - \tau_i(t)) \tag{17}$$

By decomposing the tactical analysis information component into the positive phase sequence and negative phase sequence, the impulse response of statistical data in the game tactical analysis is obtained:

$$h(\tau_i, t) = \sum_{i=1}^{N_m} a_i(t) \delta(t - \tau_i(t)) \tag{18}$$

In the above formula,  $a_i(t)$  is the normalization feature solution of the statistical data of sports competition tactical analysis,  $\tau_i(t)$  is the time delay, and  $N_m$  is the feature reconstruction sequence of the statistical data in the sports competition tactical analysis.

The high-order statistical characteristics of the sports competition tactical analysis are obtained as follows:

$$x_k = \sum_{n=0}^{N-1} C_n \cdot e^{j2\pi kn/N} \quad k = 0, 1, \dots, N - 1 \tag{19}$$

Based on this, the data detection and recognition model in sports competition tactical analysis is constructed, and the time series state equation of data distribution in sports competition tactical analysis is described by using big data association rule mining algorithm:

$$A(x) = AJ(x)a(x) + B(1 - b(x)) \tag{20}$$

So that  $A = \{a_1, a_2, \dots, a_n\}$  is the feature attribute set of describing the statistical data of sports competition tactical analysis, and  $G = (V, E, W)$  represents the feature attribute set of describing the statistical data of sports competition tactical analysis. The attribute value of  $V = \{v_1, v_2, \dots, v_N\}$  is the adaptive learning weight of  $(u, v) \in E$ , the statistical information analysis of sports competition tactics is described as:

$$w_{ij} = \beta \times w(e_p k_q) \quad (\beta > 1) \tag{21}$$

Wherein,  $\beta$  is the close weight coefficient of the statistical data of sports game tactical analysis, and  $w(e_p k_q)$  represents the characteristic quantity of tactical state. Combined with big data mining technology, the fuzzy discriminant function of the statistical data of sports game tactical analysis is obtained as follows:

$$\hat{W} = \begin{cases} \text{sgn}(W)(|W| - \alpha Ts) & |W| \geq Ts \\ 0 & |W| < Ts \end{cases} \tag{22}$$

>At  $k + 1$  time, the integration state characteristic equation of the statistical data of sports competition tactics analysis is expressed as follows:

$$\begin{cases} w = w(t) * w_{start} & k \geq \alpha \\ w = w(t) * \frac{1}{w_{end}} & k < \beta \end{cases} \tag{23}$$

In which,  $\{\alpha, \beta\}$  is the fuzzy clustering center of the statistical data of the tactical analysis of the sports game, the method of the fuzzy C-means clustering analysis is adopted, the statistical characteristic of the statistical data of the sports game is analyzed, and the statistical function is established as follows:

$$J_m(U, V) = \sum_{k=1}^n \sum_{i=1}^c \mu_{ik}^m (d_{ik})^2 x_i = x_{imin} + cx_i \cdot (x_{imax} - x_{imin}) \tag{24}$$

Wherein,  $x_i$  is the sampling scalar time series of sports competition tactical analysis statistical data,  $x_{i\min}$  is the minimum clustering center weight coefficient,  $c$  is the nearest neighbor sample number of sports competition tactical analysis statistical data, the fitness coefficient is adjusted, the data length is assumed to be  $N$ , the simplified gradient algorithm is used for the adaptive optimization of game tactical statistical information analysis, and the statistical function  $G(Y_j, \omega_i)$  is obtained as:

$$G(Y_j, \omega_i) = \left[ p_1 * \sum_{j=1}^k l(x) \frac{\sum_{i=1}^r N(V_i)}{k} \right] + p_2 * N + p_3 * \frac{\sum_{i=1}^n (V_i)}{N_j} \quad (25)$$

Wherein,  $\{p_1, p_2, p_3\}$  is the adaptive weighted parameter of sports game tactical analysis and statistics,  $p_1 + p_2 + p_3 = 1$ . Based on big data association rules mining algorithm, sports competition tactics analysis and statistics are carried out [18].

### 4 Simulation Experiment and Result Analysis

In order to verify the application performance of this method in the statistical information analysis of competition tactics to realize the tactical analysis of sports competitions, Matlab and Visual C are used for simulation analysis. The initial sampling interval of physique data is 2 Ms, the collected data have maximum oxygen uptake (VO2max), heart rate and so on, and the discrete sampling frequency of the data is set to 1200 for the length of  $f_s = 10 * f_0\text{Hz} = 10 \text{ KHz}$ , sports game tactical analysis data. The interference signal-to-noise ratio of the test sample is-10 dB, and the time-domain waveform of sports game tactical analysis data is shown in Fig. 2.

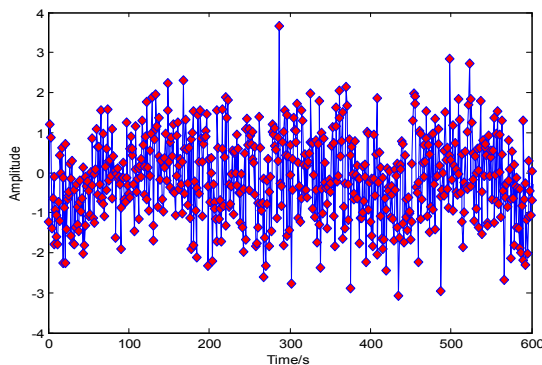


Fig. 1. Tactical analysis of time domain waveforms

Taking the data of Fig. 1 as input, the big data association rule mining algorithm is used to analyze the statistical data and feature analysis in the game tactical analysis, and

establish the game tactical statistical information analysis model, and the result of the game tactical statistical information analysis is shown in Fig. 2.

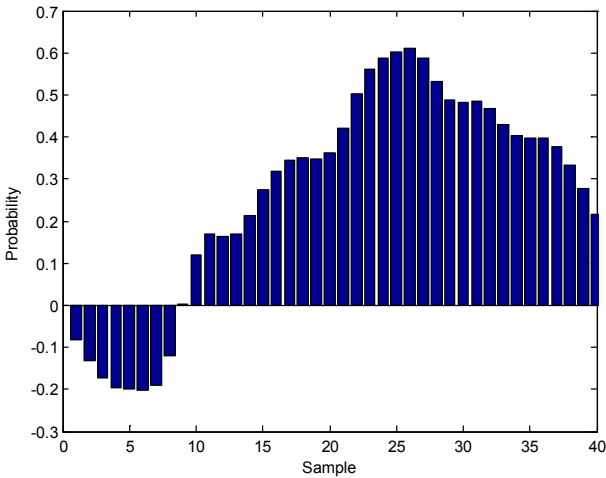


Fig. 2. Tactical information statistical analysis results

Analysis Fig. 2 shows that the method can effectively realize the tactical analysis and statistics of sports games and the exact probability of the test recognition. The results are shown in Table 1. The analysis Table 1 shows that the method is used to carry out the tactical analysis of sports games and the accuracy of the statistics.

Table 1. Comparison of tactical analysis and statistical accuracy of sports competition

Number of experiments	Proposed method	Reference [4]	Reference [5]
50	0.926	0.865	0.878
100	0.965	0.885	0.894
150	0.997	0.943	0.917
200	0.999	0.965	0.938

## 5 Conclusions

The distributed detection model of statistical data in sports competition tactical analysis is constructed. According to the distribution state of statistical data in sports competition tactical analysis, the characteristics of sports competition tactics are analyzed. In this paper, a sports competition tactical analysis and statistical model based on big data association rules mining is proposed. Firstly, the data acquisition and diagnosis analysis model of sports competition tactics analysis is constructed, and the data information flow model of sports competition tactics analysis is constructed, the characteristic

quantity of statistical data in sports competition tactics analysis is extracted, and the interference filtering of statistical data in sports competition tactics analysis is carried out by using fuzzy correlation fusion analysis method. Big data association rule mining algorithm is used to analyze the statistical data and features in the tactical analysis of sports competitions, and the optimal feature solution of statistical information analysis of competition tactics is established. Combined with the autocorrelation feature matching method, the feature analysis and data optimization recognition of statistical data in the tactical analysis of sports competitions are realized. It is found that this method has good accuracy and strong anti-interference ability in the analysis and statistics of sports competition tactics, which improves the adaptability and accuracy of sports competition tactics analysis.

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