

# *Optimization Algorithm of College Table Tennis Teaching Quality Based on Big Data*

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**Abstract:** In recent years, big data has quietly risen. Big data has been widely used in social practice. It has gradually formed a new trend and new trend of thinking that massive data catalyzes innovation and development, and regards data as big and respects objective data indicators. At present, with the continuous development of my country's sports industry, there is an increasing shortage of professional table tennis talents in society. Under this, many college students choose table tennis majors, making the college table tennis majors more and more popular. However, despite many college students participating in this industry, the teaching effect is not so ideal. The most important means of cultivating excellent table tennis talents is to reform teaching methods and innovate teaching methods. Selecting and cultivating the reserve forces of college student table tennis players, the two core links of the work of cultivating talents, has become an important scientific research topic. This article mainly discusses the deficiencies of the current education model based on the current status of the teaching quality of table tennis in colleges and universities in our country and the research situation of young athletes, combined with the optimization model of table tennis teaching in colleges and universities based on big data, and strives to break through the single dimension of traditional teaching mode, limitations such as method lag. This article conducts research on it through literature method and questionnaire method. Research shows that compared with the quality of the traditional teaching mode, the college table tennis teaching after optimizing the algorithm on the basis of big data has been improved overall.

## **1. Introduction**

In recent years, China's table tennis has achieved world-renowned achievements. Since the 2008 Beijing Olympics, it has included all the table tennis gold medals in the past three events, which has established my country's unsurpassed position in the table tennis world [1-2]. While the Chinese table tennis team has achieved brilliant results, it has gradually established an echelon of reserve talents from the country to the provinces and cities, and has continuously improved the system for the

transmission of my country's youth table tennis reserve talents. While table tennis players have achieved impressive results, we should also clearly realize that there are still many shortcomings in the grassroots sports management department in the training of young table tennis players [3-4]. Therefore, driven by big data, we must first change the traditional thinking concepts and create new ideas that adapt to the "big data era". At the same time, big data provides us with new ideas for analyzing the intricate data and information of the athletes themselves, and this change of thinking will improve the status quo of young table tennis players, and solve the two cores of selection and training in the work of young table tennis players. The problems in the link provide a feasible path [5-6].

In foreign countries, big data has been used in the training of athletes in competitive sports. Some outstanding athletes in developed countries are acquiring a large amount of relevant data through advanced technical means, and conducting in-depth mining and analysis to provide more intuitive and objective data support for technical and tactical improvement [7-8]. Even in some sports, big data monitoring of athletes' physical fitness has become the norm. The United States uses 3D Doppler radar technology to collect data on the trajectory, angle, speed and direction of the golfer's shot, and then analyze it through software simulation, and use visual data analysis to verify the existing Swing technique and shot angle affect the winning technique of the ball, and then conduct targeted training. Domestic research on table tennis is also becoming more mature. Wu Huanqun's article "The Impact of Ping Pong Ball on the State of the Game" investigated the speed of the ball, spin, number of rounds, attitude towards the big ball, and views on the reform of table tennis, and came to the following conclusion: the use of the big ball has been reduced. The rotation and speed of the ball increase the number of stalemate rounds of the ball. It also increases the spectacle of the game. After the table tennis becomes a large ball, it does reduce the threat of serving and relatively increase the stability of receiving and serving.

This paper takes the optimization algorithm of college table tennis teaching quality under big data as the research center, and analyzes the current teaching problems through the traditional throwing table tennis teaching mode, and compares the optimized college table tennis with it, making big data Effectively integrate with college table tennis teaching.

## **2. Application Research on Optimization Algorithm of Table Tennis Teaching Quality in Colleges and Universities Based on Big Data**

### **2.1. The Application of Big Data in Table Tennis**

#### **(1) Analysis of the application of big data in physical fitness**

From the analysis of the metabolic characteristics of physical energy, the table tennis project belongs to the alternation of anaerobic energy metabolism and aerobic energy metabolism, with aerobic metabolism as the main component. From the analysis of the technical characteristics of the project, it can be seen from the modular form of various human systems participating in exercise. In order: muscular system, nervous system, respiratory and cardiovascular system. Expanding the latitude of physical fitness data on the basis of the original physical fitness test indicators, comprehensively measuring the physical fitness of athletes with massive data, and selecting outstanding young athletes using big data according to the training and competition cycle can solve the physical fitness index selection to a large extent Problems encountered in.

## (2) Analysis of the application of big data in skills and tactics

The five major technical elements of table tennis include strength, speed, rotation, arc, and drop point. The technical characteristics are shown in the ability to have a flexible, accurate, and rapid sense of position movement, arm swing strength and speed, and accurate ball positioning. Texture, etc. with the help of the multi-dimensional features of big data, the main connotations of athletes in the selection process of skills and tactics are explored, so as to provide the most valuable basis for selection of athletes for the improvement and development of skills and tactics in the future, so as to determine the scientific basis that affects the selection of skills and tactics. In the future, the improvement of professional system training level determines the optimal selection of conditions.

## (3) Application analysis of big data in building education information platform

In the selection process of young table tennis reserve forces, we can use the advanced technology of big data application to actively build an information platform for the reserve force of young table tennis players in China to manage different levels of the country, province, city, and county, and to aggregate outlets at all levels. From the massive data of the basic test of selection of talents, excavate and refine the most valuable basis for selection and talent seedlings with training potential, and establish and provide scientific selection evaluation systems and intelligent management for different levels of sports authorities and sports team coaches. Paradigm, the application research of targeted big data in the selection and cultivation of young table tennis players can improve the precision of basic selection.

## 2.2. Overview of Gjk Algorithm

### (1) Overview

Assuming two convex bodies A and B,  $d(A,B)$  is the distance between A and B, then  $d(A,B)$  can be expressed by the following formula:

$$D(A,B)=\min\{\|x-y\|: x \in A, y \in B\} \quad (1)$$

The GJK algorithm can calculate the two points a and b with the closest distance between two objects, which satisfies

$$\|a-b\|=d(A,B) \quad a \in A, b \in B \quad (2)$$

Suppose  $v(C)$  represents the point closest to the origin in the convex set C, that is to say  $v(C) \in C$  and satisfies the following formula

$$\|v(C)\|=\min\{\|x\|: x \in C\} \quad (3)$$

Then the distance between A and B can be expressed as Minkowski difference:

$$D(A,B)=v(C) \quad (4)$$

### (2) Basic process

The GJK algorithm is an iterative algorithm for the monomorph on the boundary point of the CSO. Assuming that the newly generated simplex during the kth iteration is  $W_k$ , the point closest to the origin in this simplex is  $V_k$ . The detailed iterative steps of the GJK algorithm are shown below.

Initialize, let  $W_0=\emptyset$ ,  $V_0$  be any point in CSO.

- 1) Add  $n$  (the value of  $n$  is [1-4]) vertices in CSO to the set of simplex  $W_k$ .
- 2) Use the support function to calculate the point  $V_K$  closest to the origin in  $W_k$ .
- 3) If the nearest point  $V_K$  is exactly the origin. Then it means that the origin is in the CSO. At this time, the algorithm terminates and returns to the intersection of the two objects, otherwise the algorithm continues to be executed.
- 4) Let  $W_k = SA - B(-V_k)$  be the support point in the  $-V_k$  direction.
- 5) Compared with the vertex  $V_k$ , if the point  $W_k$  is not an extreme point in the  $-V_k$  direction, the calculation ends. At the same time, it returns the result that A and B do not intersect.
- 6) Add the point  $W_k$  to the monomorph  $W_k$  set. And delete the vertex  $V_k$  in  $W_k$ , and continue the loop execution.

### 2.3. Research on Ping Pong Tracking Problem Based on Image

Whether it is using the motion trajectory to reverse the rotation of the table tennis ball or predict the location of the table tennis ball, tracking the table tennis ball is an inevitable step. Table tennis has the characteristics of small size and light weight, and the momentary external force exerted by the athletes is very large, which leads to the fast movement of table tennis. Professional athletes can hit speeds of more than 20m/s. In the visual field, at least the complete tracking of the table tennis needs to cover the entire field of view of the desktop, which will cause the visual table tennis to have difficulties such as small size and fast speed. Although the effects of the pictures taken under different photography conditions are different, for the computer, the picture it sees is actually just a pixel matrix. It is necessary to design an algorithm to process the pixel matrix and find the pixel matrix of the area where the ping pong ball is located. The characteristics of the ping-pong ball, thus completing the identification and tracking of table tennis. However, the pixel matrix in a picture is too confusing. Directly handing it over to the computer for processing will cause difficulties such as excessive calculation and too complicated calculation methods. Therefore, it is necessary to preprocess the image to be processed to clarify the feature information of the image for easy follow-up.

### 2.4. Kinect-Based Motion Recognition and Rotation Prediction of Table Tennis Players

Pre-judgment refers to the ability of athletes to make partial or complete responses in advance based on the information clues sent by the opponent's posture and body parts before the opponent makes an action. In open fast ball sports, because the ball is flying fast and the flight path is uncertain, the athlete must make a certain prediction of the incoming ball in a very short time based on the previous information or the opponent's actions, and do it in advance. Be prepared for action, otherwise the turnover rate will increase greatly. In fast ball sports, high-level athletes need to predict the incoming ball information based on the opponent's actions. In table tennis, rotation information is the most difficult and most important feature information in prediction. Athletes need to predict the direction and strength of rotation according to the opponent's hitting action, so as to win the decision of return action time.

### 2.5. Kalman Filter Prediction

The process of Kalman prediction is to obtain  $X(k+1/k)$  at time  $k+1$  from  $Z(k)$  at time  $k$ , and

through error correction, to ensure that the predicted value has the smallest mean square error.

For the motion of general objects, the state equation can be described as follows:

$$X(k/k-1)=A(k)X(k-1/k-1)+W(k-1) \quad (5)$$

Among them,  $X(k/k-1)$  is the result of using the previous state prediction; matrix  $A(k)$  is the motion model, that is, the state transition matrix  $X(k-1/k-1)$  is the optimal estimation of the previous state Value,  $W(k-1)$  is the process noise. The observation equation for target motion observation is:

$$Z(k)=H(k)X(k-1)+V(k-1) \quad (6)$$

### **3. Experimental Research on Application of Big Data-Based Optimization Algorithm of Table Tennis Teaching Quality in Colleges and Universities**

#### **3.1. Subjects**

##### (1) Students

In order to ensure that the results of this experiment are more scientific and effective, the subjects of this experiment are students majoring in table tennis in the physical education department of a university in a certain place. The students invited this time are all juniors and above, and the juniors have completed most of the majors. Courses can better understand the problems existing in the teaching of table tennis in colleges and universities. This time, a total of 50 college students were selected to fill out the questionnaire, and the ratio of men to women was equal. To ensure the scientific nature of the experiment. This experiment will investigate the application of big data in college table tennis teaching mode from students.

##### (2) Teachers

This experiment interviewed teachers of physical education majors in colleges and universities, based on the quality of traditional college table tennis teaching models, and investigated the college table tennis teaching models after the optimization algorithm. The ten-point scoring system is used this time, "1" means disapproval, and "10" means approval. The degree of approval from 1 to 10 is from low to high, and the obtained data is obtained by using the analytic hierarchy process to obtain a more accurate result.

#### **3.2. Experimental Method**

##### (1) Document method

This article consults a large number of research reports by experts and scholars and the literature of predecessors. Collect the most cutting-edge table tennis teaching research data. These data not only provide a large amount of data support and theoretical basis for the topic selection of this article, but also provide sufficient theoretical and data support for the final prediction conclusion of this article.

##### (2) Field research method

Investigate the problems existing in the work of cultivating the talents of table tennis players in colleges and universities in a certain place, such as a table tennis education and training base and college sports majors.

(3) Questionnaire survey method

This paper sets up targeted questionnaires and adopts a semi-closed method to conduct questionnaire surveys to ensure the reliability of the results.

(4) Expert interview method

Conduct in-depth discussions with experts on the results obtained in the experiment, so as to provide a theoretical basis for optimizing the quality of teaching.

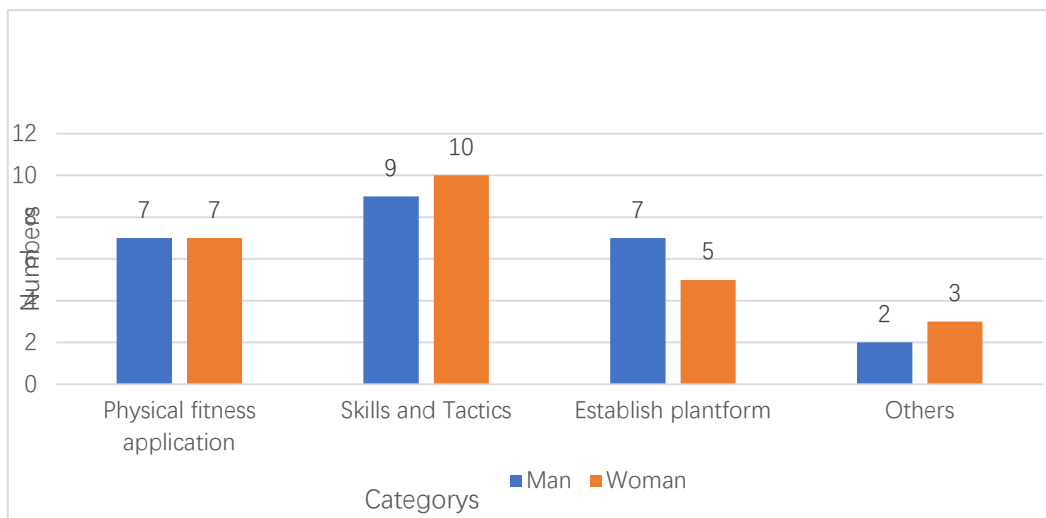
**4. Application Experiment Analysis of The Optimization Algorithm of College Table Tennis Teaching Quality Based on Big Data**

(1) Big data application analysis

This experiment selected 50 junior college physical education students to conduct a questionnaire survey to investigate the application of big data in physical fitness, skills and tactics, and platform construction. The results obtained are shown in Table 1:

*Table 1: Big data application analysis*

	Physical fitness application	Skills and Tactics	Establish platform	Others
Man	7	9	7	2
Woman	7	10	5	3



*Figure 1: Big data application analysis*

*Table 2: Analysis of Algorithm Optimization Table Tennis Teaching Mode*

	Physical fitness application	Skills and Tactics	Establish platform	Others
Man	7	8	8	6

Woman	6	8	9	7
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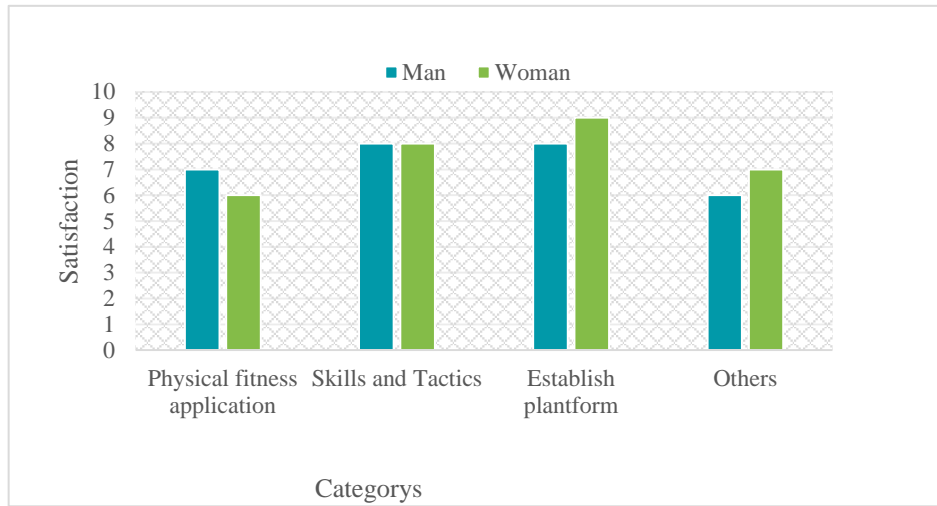


Figure 2: Analysis of algorithm optimization table tennis teaching mode

It can be seen from Figure 1 that most students are satisfied with the college table tennis education integrated with big data. Among them, about 40% of the students who are keen on big data skills and tactics have confirmed the optimization of college table tennis teaching based on big data.

(2) Analysis of algorithm optimization table tennis teaching mode

This experiment analyzes the teaching quality of table tennis in colleges and universities after the optimized algorithm based on the comparison with the traditional teaching quality of table tennis. In this paper, through interviews with teachers of table tennis majors in colleges and universities, the data obtained are shown in Table 2:

It can be seen from Figure 2 that compared with the traditional college table tennis teaching quality, the table tennis teaching quality based on the big data optimization algorithm is better. The teachers' overall evaluation of it is high, reflecting the improvement of teaching quality after the optimization of the college table tennis algorithm based on big data.

5. Conclusion

The long-term dominance of Chinese table tennis in the world table tennis is inseparable from the strong reserve of young table tennis players and the good echelon construction of sports teams at all levels. Therefore, it is particularly important to do a good job in cultivating table tennis in colleges and universities. Combined with the universal scientific research results obtained in the application of big data in competitive sports, it is feasible to apply big data in the practice of table tennis training for college students, which can solve the current practical problems in the work of training talents and provide a broader, more comprehensive, clearer and more objective perspective and innovative path.

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