

Research Article

Fuzzy Theory in the Prediction of Athletes' Competitive State Based on Information Security

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In today's highly competitive market, a large number of high-tech products have been used by the athletes in various academic competitions. At present, a large number of athletes have used their own rigorous theories to predict the effects of modern games. In this study, the fuzzy theory calculation method based on information security is used to install related detection equipment on athletes. Through long-term data collection, the data is input into the computing system. After analysis, we can get the athlete's body cycle, 6 days is a short cycle, 28 days is a medium cycle, and 128 days is a long cycle. Through the adjustment of training items and training time, the athlete's competitive state can be adjusted to achieve good results in the competition. This article also tested and experimentally studied the differences in the emotions and mental states of the athletes in coping with the competition, and tested the mental states of the two groups of athletes before the start of the competition. The results showed that the data for active response, balanced response, and negative response were 36%, 32%, and 32%, respectively. Under the coach's guidance and persuasion, the data on athletes' coping styles from negative to positive has been significantly improved, reaching 67%. The experiments of this research prove that through the use of fuzzy theory based on information security and related high-tech equipment, it is possible to effectively predict and adjust the athlete's competitive state. Before the arrival of important events, adjust the training intensity from the 6-day and 28-day cycles to make the athletes' competitive state reach the expected excellent condition.

1. Introduction

In the prediction of athletes' competitive state, various measuring equipment and theories are emerging endlessly. Especially with the rapid development of science and technology, almost every year, there will be relevant measurement techniques and approaches to the competitive state. In the measurement of athletes' competitive state, most of them use the induction measurement of the power grid, that is, to transfer the athletes' body state to the computer with some devices and then measure them. But this measurement method is time-consuming and expensive and impacts the athletes' bodies. Therefore, measuring athletes' economic status based on fuzzy theory came into being. This

measurement method has a significant breakthrough for the accuracy of the measurement results so that the athletes' body state can be reliably presented in the measurement equipment through complex calculation.

For the application of fuzzy theory based on information security in the prediction of athletes' economic status, a large number of researchers at home and abroad have obtained their own research results. Korobkin et al. used the experimental method and case study method in their study on fuzzy theory, compared the state of athletes after physical training with that before physical training, and concluded that the use of fuzzy theory can get better prediction results by eliminating interference factors under different physical conditions of athletes [1]. Sun used the investigation method

and experimental research method in its research to exclude other interference factors among different athletes. In the application of fuzzy theory, it is concluded that the use of fuzzy theory can make athletes' physical fitness state tests reach a certain accuracy, and then predict the state of athletes in the future [2]. Yusmye et al., showed that the test method and case study method are combined to make time analysis of different competitive states of track and field athletes. It is concluded that there is a certain difference between using fuzzy theory and using other theories to predict the economic status of athletes [3]. And it is proved that fuzzy theory has its own unique advantages.

Many scholars in China have made considerable achievements in this field. Jie used the method of distinguishing condition prediction and interview, and flexibly use fuzzy theory to study the difference between the two groups of athletes' sports state in the condition of high and low competitive level, and draw a conclusion that the competitive state of athletes has a great relationship with sleep, physiological cycle and diet [4]. In Kindler et al. study, the experimental research method and case analysis method are used, and the fuzzy theory is applied to predict the different competitive states of athletes, and it is concluded that the fuzzy theory is very helpful to analyze and obtain the competitive state of athletes [5]. In Vales et al. study, a large number of case studies and experimental investigation methods are used. A large number of test instruments are placed on the athletes, and then the fuzzy theory is used to calculate. Then the results are used to predict the competitive state of athletes, and finally, the athletes get good play [6].

In this study, the athlete's competitive state is input into the computing system, and the calculation method based on the fuzzy theory of information security is used to calculate the athlete's competitive state and physical fitness cycle. It can predict the time for athletes to reach their best state within a certain period of time. Use the test method to input the athlete's movement data into the calculation software. After calculation, we can know that the athlete's physical condition is the peak period and when is the average value period, and then predict the athlete's competitive level. By adjusting and predicting the cycle of the competitive state, athletes can achieve good performance in the game.

2. Fuzzy Theory in the Prediction of Athletes' Competitive State

2.1. Framework Design Based on Fuzzy Theory of Information Security. The B/S (Browser/Server) structure is used in the upper layer of fuzzy theory in the prediction of athletes' competitive state, and the C/S (Client/Server) structure is used for data collection of bottom-level athletes. These systems include an online prediction auxiliary system, data acquisition system, and data management system. The overall framework of online auxiliary system cooperates with each other to jointly calculate the competitive state of athletes [7, 8]. The article will then look at the structure of the system to explore the role of each of its levels.

- (1) The online prediction assistant system is the upper application platform of the whole prediction system. The prediction behavior of the whole system is included in the system and directly contacts the athletes. It includes prediction management, forecast equipment use, athlete detection, line management, excuse management, log setting and historical data management, and other functional modules [9, 10].
- (2) The data management system mainly uploads the data from athletes to the equipment, and provides all kinds of information for the upper application of the equipment, which is divided into the real-time database and historical database. Since the detection of the system needs real-time monitoring, there is a lot of information. In order to timely feedback on the data in the application, the latest information is set in the real-time database, and the past information is set in the historical database, which is used as the system query and various data analyses, and the most important is to predict the competitive state of athletes.
- (3) The data acquisition system is generally responsible for the existence of sensors in the prediction process, and at the same time collects the real-time physical fitness data of athletes.

Athletes usually upload the physical fitness data from their sensors to the analysis equipment and then get the specific state of physical fitness [11, 12]. During the process, the system also synchronizes the fitness data to the predictive assistance system so that athletes can tap into different dimensions of their improvement.

2.2. Application Design of Moving Average. Moving average refers to the concept of Dow Jones' average data as the theoretical starting point, and then to calculate the fluctuation of athletes' competitive state, and then reflect the competitive state of athletes in a period of time in the future. Ma is the expression of Dow's theory. Its essence is to use the average linear theory to calculate the change of data in the high-frequency stage. The moving average line can be divided into three categories: calculated average, weighted average, and exponential average [13, 14].

- (1) Use of calculation average: take the fluctuation of daily physical condition as an example, the cycle of each fluctuation is 6 days, and the moving average line is:

$$MA = \sum 6 \perp \varphi + \sum_2^4 3 - \sum 2. \quad (1)$$

The results show that the cycle of athletes' physical fitness changes is a small fluctuation of 3 days, a big fluctuation of 6 days, and a cycle of 24 days.

- (2) Use of weighted average: the theory of weighted average is based on the data of the latest day in the cycle of moving average to find out the day with

greater fluctuation of physical fitness in the future day, and then increase the preparation weighting for this day [4, 15].

- (3) Use of smooth average: the formula of this average is:

$$EMA = \sum_2^9 + \mp 5 - \sum 2, \quad (2)$$

This kind of smooth average lists the average value, which is relatively balanced, and can be used in the calculation of the competitive state of long-distance runners, and has a prominent effect on the calculation of physical fitness decline.

2.3. Application Design of Fuzzy Theory Model. According to the different processes, the analysis method of fuzzy theory can be divided into three forms.

- (1) Algorithm based on fuzzy relationship: this calculation method includes a clustering algorithm, which is established in the transmission of fuzzy theoretical relationships. It is an early calculation method, which collects the physical fitness data of athletes in physical training, and then records the fuzzy relationship algorithm. After a period of application and calculation, it gradually obtains the cycle of each physical change of athletes, and when sports participate in competitions, the peak value of athletes' physical fitness can be obtained and then adjusted [16, 17].
- (2) The calculation method based on fuzzy neural: This is a kind of fuzzy algorithm that was invented very late. It mainly uses the learning algorithm of the competitive state, and then uses this algorithm to guide the coach to adjust the athletes' movement, and then adjusts the cycle of sports state on the basis of the adjustment, so as to participate in the competition when the athletes are in the best competitive state.
- (3) The calculation method based on fuzzy function: the athlete's competitive state data is classified as the nonlinear data value of constraint. By classifying and planning the set of data values, the calculation method of the set is simplified, and the problem of wide data distribution is solved. Then, the function set of fuzzy theory is divided and classified, and the data is put into the calculation software to calculate, and then the peak value of the athletic state based on the function value is obtained [18, 19]. This calculation method is usually used for ball games, high jump and other athletes, and it is often used for sports with strong explosive force.

2.4. Application Design of New Fuzzy Neural Network Calculation

- (1) Before the network neural calculation data enters the computer for detection, the fuzzy calculation is used

to divide the data into two categories, namely average motion state data and peak motion state data [20, 21].

- (2) After that, the more realistic data is detected by fuzzy calculation, and some noninvolved operations are filtered out. At the same time, in the calculation, the detection equipment only observes the peak phase of the motion state, thus eliminating the dependence on the calculation. This greatly reduces the detection time and calculation time and improves the calculation efficiency and calculation results.

The fuzzy theory is used to define the test results, which is used to reduce the probability of inaccurate data and improve detection accuracy. And change the traditional calculation method, use a neural network to optimize the value of the detection equipment, and then get a wide range of detection equipment computing space. This improvement calculates sports competitive states more scientifically and accurately [22, 23].

2.5. Main Methods to Reduce Calculation Errors. The earliest step in processing the calculation data is to screen out the irrelevant data. In the original data, the data that affects the athletes should be selected and screened out, and the data that will form influence the calculation model can be further identified. Filter out the factors that often affect the value, such as filtering, noise, shaking, etc. This filtering method is used to minimize computational errors. The filtering method used in this study is nonlinear average method.

- (1) The filter damping equipment is placed on the athlete's body and installed during warm-up. After the athletes adapt for a period of time, through the detection and calculation of several processes, the calculation value of filtering in the athletes' sports state is obtained, and then it is imported into the calculation system [24]. The formula is as follows:

$$RT = \sum_3^2 3 - \overline{\overline{4}} - \sum_4 3, \quad (3)$$

$$RT2 = \sum_2 4 - \overline{\overline{6}} + \sum 3.$$

The average value and peak value of the filter are deleted. Finally, the athletes' competitive state is calculated, and the results can screen out the influence of filtering.

- (2) Noise reduction equipment is used to reduce the interference of noise. In the monitoring of the competitive state of sports, noise has a great impact on the changes in athletes' physical fitness. In the process of noise reduction, noise reduction equipment is installed on the arm of athletes, and an electromagnetic wave is used to eliminate white noise and black noise. Then the noise reduction value

is imported into the calculation system for calculation:

$$CT = \sum_3 4 - 6 + \sum_2 6, \quad (4)$$

$$CT = \sum_{2-\%} \sum_3 6 + \overline{4 + 2}.$$

By deleting the peak value and average value of noise interference, and finally calculating the competitive state of athletes, the results can greatly reduce the impact of noise.

- (3) Using shock absorption equipment to reduce the impact of shaking, in the detection process of athletes, the impact of shaking will increase the actual heart rate of athletes and the situation of a virtual high exercise state. In the installation of shock absorption equipment, it is necessary not to install it on the upper body, because there are many organs in the upper body, which is prone to data conflict. So in general, it is better to install it in the thigh. In the vibration reduction test, the damping equipment can reduce the interference of various vibration data, and then import the damping value into the calculation system:

$$YT = \sum_6^8 2 - 4 + 6 + \sum_8 3. \quad (5)$$

After the elimination of shock absorption interference, the average value and peak value of athletes' competitive state can be accurately calculated, and the results can greatly reduce the impact of vibration.

2.6. Design of Calculation Method for Detection Value.

The calculation methods of motion state are mostly completed by using computer software and numerical mobile phone detection equipment. The general calculation methods include the detection calculation method and random calculation method, and the calculation methods are as follows:

- (1) Detection calculation method can be divided into detection calculation, nondetection calculation, and semi-detection calculation according to different detection. Among them, the values of detection calculation are known values, and the input of these values is to calculate the known output values; nondetection calculation means that all the calculated values are unknown values, and the input of these unknown values is for the structure of detection results to be more accurate; and most of the calculation methods used in reality are semi detection calculation.

To make the detection equipment independent of external calculation, it is necessary to improve the accuracy of the detection equipment, that is to use

semi-detection calculation. The semi-detection calculation is more strict, because the values that can be collected in real scenes are known values, and it takes a lot of time to determine whether the values are known. The research of this study is to use semi-detection calculation, which decomposes, integrates, and classifies the values, and then carries out the integrated calculation efficiently. It can effectively reduce the uneven distribution of numerical values caused by fewer training times.

- (2) Random calculation method is a calculation method that uses the deduction method to predict. According to a variety of sports values, the average value and peak value of athletes' competitive state can be obtained. The core idea is determined by the training times and the testing value of athletes. In the process of athletes' training, the training time and information of athletes are detected independently, and the fuzzy calculation system is used to detect and calculate each change in athletes' competitive state, and the table of average and peak values of athletes' competitive state is constructed. Then, in the process of athletes' training, quantitative and dietary adjustments will be carried out. Finally, when the important events come, the athletes' competitive state will be adjusted to the best state. This kind of calculation method is more complex, which is generally used in the training of top athletes and can greatly adjust the athletes' sports state.

Based on these methods, the article combines a detection calculation method with a stochastic calculation method. In this process, a preliminary calculation of the athletes' movement status is carried out using computer equipment, and the preliminary design of the method is completed.

3. The Experimental Research of Fuzzy Theory in the Prediction of Athletes' Competitive State

3.1. Collection and Calculation System of Experimental Values.

In order to predict the competitive level of athletes, this study collects the sports data of athletes over a period of time through the experimental method and inputs the data into the calculation system by using the prediction calculation method and random calculation method. After a large number of complex calculations, we can get the position of athletes' competitive state level. Then, on the basis of experimental research, we use the experimental method to adjust the training categories and events of athletes, and then obtain a large number of sports data of athletes. On this basis, we can predict and calculate the sports state.

3.2. Experimental Methods

3.2.1. *Experimental Research Method.* In this study, we will collect the sports data of many athletes in different events, and collect the data of sports training items of many athletes

for up to three months. A large number of athletes' sports data are obtained. Through the detection algorithm, the athletes' sports data in a period of time are input into the formula, and the physical fitness data is calculated. The formula is as follows:

$$ST = \sum_1^4 - 3 + \sum_{7-1}^0 2. \quad (6)$$

The athletes' physical fitness data are input into the formula, and the prediction algorithm is used to get the athletes' physical fitness level, which is ready for the next calculation. In the above equation, ST represents the average fitness level of the athlete, which portrays the average fitness of the athlete.

3.2.2. Data Survey Method. This study calculates and summarizes the different emotions and coping styles of athletes in the face of competitions. In this process, the article uses the proposed fuzzy prediction method in combination with a computer to achieve real-time data collection and processing. The results show that athletes in the face of important events show different attitudes, and can know the level of their own sports state. Generally, athletes with high competitive levels will adopt a more positive coping style, while athletes with lower economic levels will have a relatively negative attitude towards important events.

3.2.3. Case Study Method. Through the state of many athletes in different sports events in the face of important events, it is concluded that different athletes will have different states in the face of different sports events. Through the coach's different guidance way, the athlete's psychological state can be adjusted to a better state. Athletes face different psychological attitudes when facing different events, so it is very important to conduct psychological guidance according to the individual differences of athletes.

3.3. Experimental Summary. Based on the data collection of different sports events and athletes' competitive state, we know that athletes will have different psychological states and emotions in the face of different sports events. Through a series of guidance from coaches, we can achieve a better state. At the same time, through the mobile phone data of athletes' competitive state, through fuzzy theory and related calculation, it is concluded that athletes will have different states in different sports cycles. Through the adjustment of sports, we can predict and calculate the best period of motion state.

4. Experimental Analysis of Fuzzy Theory in the Prediction of Athletes' Competitive State

4.1. Experimental Analysis of Athletes Facing Competitions. In the experiment, in order to understand the athletes' coping state in the face of competitions, this study calculated

the average and standard deviation of athletes' coping in each event.

It can be seen from Figure 1, on the whole, the way athletes use English competitions is mainly positive. In addition, emotional catharsis and other ways are also used by athletes. Before the start of the event, the relevant coaches should guide the athletes to use a more positive way to deal with it. In a variety of events, athletes' coping style has a certain impact on the performance and achievement of the event. Athletes in the face of pressure, need to find their own appropriate corresponding mode, and the use of a positive coping mode for the play on the field has a certain role in promoting. Therefore, the data of this study can be used as a reference for coaches to guide athletes' coping.

4.2. Research and Analysis on the Differences of Athletes' Attitude towards the Competition. Due to the differences in athletes' personalities, mental growth, experience, and other factors will affect the athletes' coping style, so for different athletes, whether their gender, age, family situation, and sports events will affect their coping attitude needs to be classified and studied.

The differences in gender, age, and family background may affect the coping style adopted. Therefore, variance analysis was carried out on the total score of coping style affected by gender, grade, an only child, from urban and rural areas, and whether the sport's major had an impact on the total score of coping style. Athletes' response before the event is shown in Figure 2.

For athletes of different ages, the results of coping styles are not the same. It can be seen that in the coping styles of athletes, the coping styles of restraining interference activities and seeking help from religion have different data for athletes of different ages. The results show that, in the study, different gender, age, whether the only child and whether from the city, in different athletes show different coping styles. Single children tend to seek religious and inhibitory interference activities and escape, while athletes from the city are more likely to respond positively. Older athletes have a more mature coping style. Through the research, we can see that different athletes need to use different strategies to guide them to use positive coping styles. Combining the above graphs we can conclude that the standard deviation of athletes seeking religious sanctuary before a match is basically 1.41 and the standard deviation of athletes fearing is distributed at 1.7. This is a good indication that athletes from different geographical areas react differently before a match and that there is a relatively large difference between the two.

4.3. Research and Analysis of Stochastic Algorithm in Predicting Competitive State. After the random algorithm calculation of athletes' competitive state, we use 5 days and 50% overlapping calculation to extract the value of athletes' physical fitness and use the nine attributes as shown in the figure to analyze the data. The results are is shown in Figure 3.

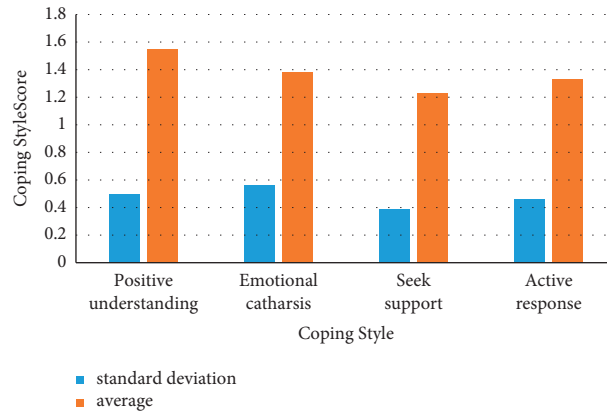


FIGURE 1: Experimental analysis of athletes facing competition.

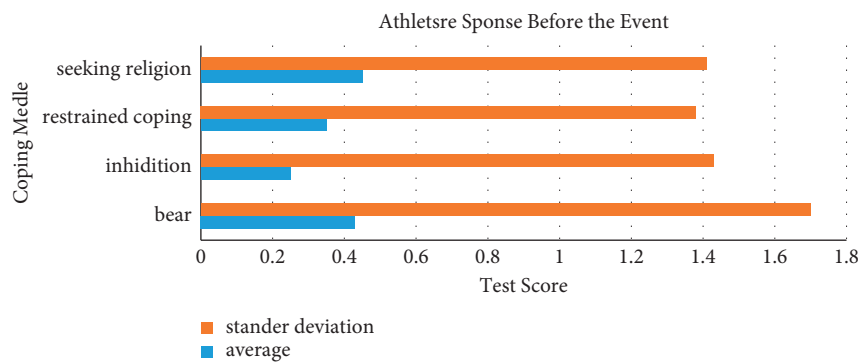


FIGURE 2: Athletes' response before the event.

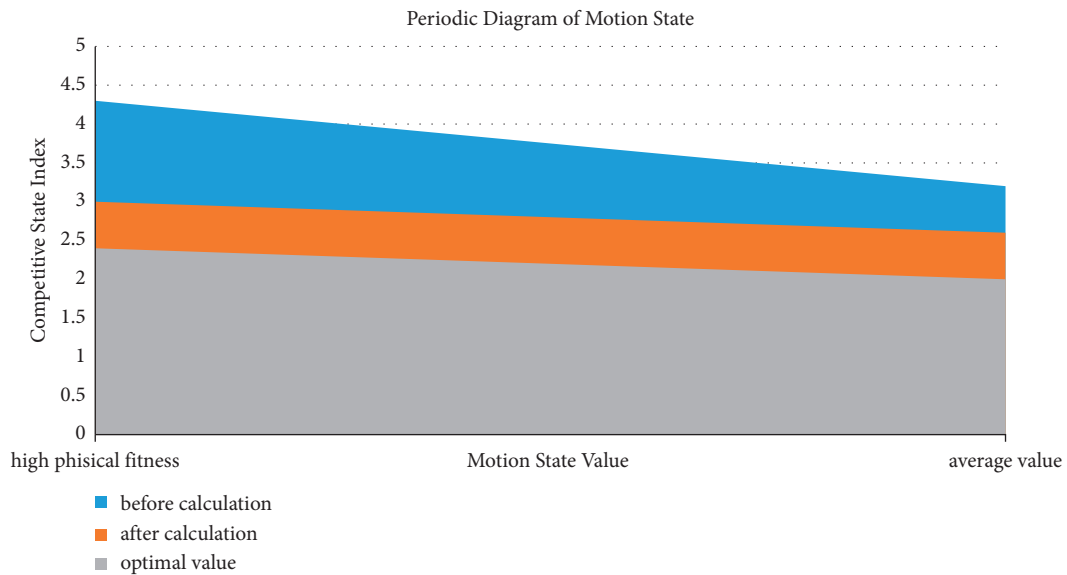


FIGURE 3: Periodic diagram of motion state.

In the physical fitness test, the experiment of this study is to let the athletes cycle for 20 km after a series of tests, including heart rate, lung capacity, grasping, and lifting force tests. By calculating the average value of the athlete's physical

fitness in a cycle of more than one day, it can be concluded that there is a big difference between the theoretical value of the athlete's physical fitness and that of the athlete's peak value in more than one day after the test. There are

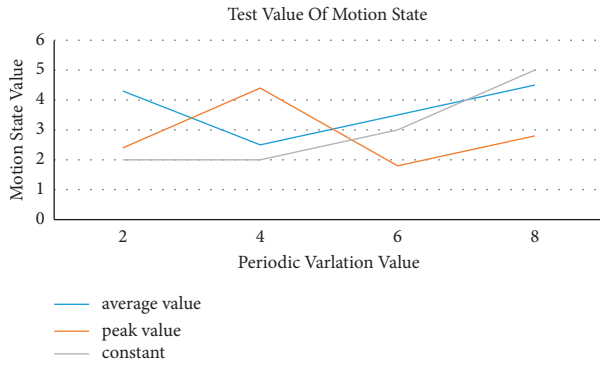


FIGURE 4: Test value of motion state.

individual differences in the physical cycle of athletes. Through the whole data, the athletes can maintain and adjust their physical fitness before they participate in important events. After a long time of training and physical training, the use of fuzzy theory to test athletes’ physical fitness will become more and more accurate with the increase of test times. And then get the best athletic state.

4.4. Experimental Analysis of Sports Competitive State Test Based on Fuzzy Theory. When establishing the random operation system, it is necessary to input the average value and peak value of the athletes’ sports state, and then install the data collector on the athletes. After three months of periodic detection, we can get the average and peak value of individual sports states of athletes, and then we can get the prediction data of athletes’ sports states. The test value of the motion state is shown in Figure 4.

Athletes after three months of testing, we can draw the peak value of athletes in a month between the 10th and 15th, the cycle is 28 days. The average value of athletes’ physical fitness is about 2 to 6, and the peak value can reach about 6.7. After testing and prediction, most athletes need to do some explosive sports before long-distance running, such as sprinting, which can wake up the muscle strength and enhance the level of exercise. Athletes need to do some aerobic exercise when sprinting, which can make the muscles more relaxed and then increase the sprint performance. After random tests and calculations, the core of the fuzzy theory is applied to calculate the athlete’s movement state periodically, and the best time for athlete’s movement state can be predicted.

4.5. Experimental Analysis of Athletic State Prediction on Athletes. After a lot of prediction and calculation, we can get the value of athletes’ sports state. There are individual differences in these data. Some athletes’ sports states can be accurately predicted, and some athletes’ sports state test has randomness. The details are shown in Table 1.

As can be seen from the table, athletes in different sports have different sports statuses. This is because the athletes are engaged in different main events. Athletes in different sports show different sports states, we can know the specific level of athletes in different sports states. It can be seen from the

TABLE 1: Motion state display table.

State	Sprint	Long-distance run	Hurdle	t	df	p
Good	0	2.16	2	1	0	3
Tired	3.8	1.68	1	0.48	4	1
Average	0.26	2	1.72	0.56	3	3

table that the value of fuzzy prediction is lower when athletes are in good condition, but higher when they are tired. For example, in the sprint event, the athlete’s competitive state is obtained by fuzzy calculation, and the random value is 0. In the long-distance running project, the value is 2.16. When athletes are tired, the data are 3.8 and 1.68 respectively. It can be seen that fuzzy theory can accurately predict the level of competitive state of athletes.

From the above analysis, it is clear that fuzzy theory plays a vital role in predicting the level of athletes. Based on this, athletes can adjust themselves according to the predicted situation and keep themselves in an optimal condition at all times.

5. Conclusions

This article adopts the method of installing test instruments on the athletes, adopts the calculation method based on the fuzzy theory of information security, and adopts the test calculation method and the random calculation method respectively. Input the athlete’s sports value into the computer equipment system, so that the athlete can show his maximum and average physical fitness in the instrument test. In order to calculate the value of the athlete’s competitive state and the change in a certain period of time. To predict the athlete’s competitive state. At the same time, the article also proposes some improvements based on prediction in combination with fuzzy theory and extends the application of fuzzy theory.

In this study, athletes show different results and data in different competitive events, and then use the interview method to summarize and collect the different emotions and psychological states of athletes in the face of important events. It is concluded that athletes in the face of different events will show different states. Through the analysis and summary of these psychological states, and then put forward the positive coping mode is helpful to improve the athletes in the sports field.

This study uses the experimental research method to analyze the differences in athletes’ sports states in different periods. Let athletes for three months each day to carry out the same physical training, in the athletes install the relevant test equipment, and record the athletes in a certain period of time in the state of movement. Then the fuzzy theory and calculation formula are used to calculate. Get the athlete’s sports state cycle. The experiment shows that the use of fuzzy theory can greatly improve the competitive state of athletes.

Data Availability

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

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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