Study on Optimization of Basketball Technique and Tactics Teaching Based on Genetic Algorithm

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Abstract: with the rapid development of computer technology, the information revolution is rapidly changing our lives. There has also been a rapid increase in the data of the technical movements of basketball games, and only a small part of these massive data sets is what we care about and need. In order to control the competition in time, implement effective management, using advanced computer technology for technical action analysis has become imperative. On the other hand, the data form is generally unstructured rather than structured data form in the traditional database, which makes the database-based mining technology not applicable. Therefore, mining in such data sources and extracting interesting and potentially useful patterns and hidden information in the technical actions of basketball matches is a new application subject of genetic algorithm.

1. Introduction

Data preprocessing is an essential and important stage in data mining, and it is also a part of heavy workload. Often the collected data will contain a large number of records and redundant items that are irrelevant or weakly relevant or even irrelevant to mining, which needs to be processed to obtain the form of data transaction suitable for mining tools (software) mining.

Data preprocessing is generally to clean up the collected data, remove noise and correct inconsistent data. Then data integration is carried out to combine data from multiple sources into consistent data storage. Data transformation can also be used, for example, the specification can change the accuracy and effectiveness of mining algorithms involving distance measurement; [1] data reduction can be compressed by clustering to remove redundant features or clustering. These pretreatment technologies can greatly improve the quality of data mining mode and reduce the time needed for actual mining before mining.

1.1 Data Collection

Basketball is a highly rated sport with a large audience. With the development of communication technology, satellite broadcasting, tv broadcast and broadband network can bring the picture of basketball games far away to thousands of households in an instant. Games are recorded on video and over broadband networks, and then recorded on cd. Collect game data by collecting data from various websites on the broadband network and repeatedly watching the disc by yourself.

The original data studied in this paper is to save the Basketball game scenes of the National Basketball league (NBA) via broadband network broadcast on hard disk, and also copy the data about the game on various websites. The video of the game is then recorded on a VCD disc by a burning machine; finally, through repeatedly watching the game for artificial statistics, combined with the data collected by major websites. [2]

Artificial statistics are conducted according to the rules of the NBA. According to the NBA, a game lasts 48 minutes, divided into four periods of 12 minutes each. The first two periods are called the first half and the second half. They can be suspended midway through the game, so each game is basically played for two and a half hours, not counting the occasional overtime (five minutes if 48 minutes is a draw, and so on). Each attack must be completed within 24 seconds (24 seconds included) (depending on the basketball hitting the blue basket or the blue circle), otherwise, the ball will be lost. If you play well, you can finish the attack in seconds or less. If you don't play well, or if your opponent's defense is airtight and you can't find a shot, you could run out of time for 24

seconds. Therefore, at the time of statistics, take an offensive turn as the time period (0~24 seconds), as shown in table 3.1, which is the statistics of partial turns 8, 15 and 102. A ball has 100 to 200 turns.

1.2 Data Cleaning

For data incompleteness and inconsistency, we can use filling vacancy value to correct data inconsistency.

1) Fill the vacancy value

For the missing data item, define a default value according to the meaning of the data item, and then replace the missing vacancy value with it. [3]

There are no 3-point, blocked, free throw, breakthrough and other technical actions in this attack round of T8. To fill in (note: this article uses the mining software WEKA, in which the symbol "? "Is used in the WEKA tool. May represent the vacancy value). But if you have an assist on an offensive turn, and you're missing two or three points, you're going to have a statistical error, and you're going to have to fill in the gap, and you're going to fill in the most likely two points.

2) Error correction

Data collected sometimes have inconsistent data (what is inconsistent data? If "dribbling" and "dribbling" are the same technical moves, they are not consistent. There is A certain correlation between some data. A and B correlation can be measured by the following formula:

$$r_{A,B} = \frac{\sum(A-\bar{A})\,(B-\bar{B})}{(n-1)\delta_A\delta_B}$$

Among them, $\bar{A}, \bar{B}$is average, $\bar{A} = \frac{\sum A}{n}, \bar{B} = \frac{\sum B}{n}$

The multiple product of δ_A, δ_B is the standard deviation of A and B: $\delta_A = \sqrt{\frac{\sum(A-\bar{A})^2}{n-1}}, \delta_B = \sqrt{\frac{\sum(B-B)^2}{n-1}},$

1.3 Data Integration

To store multiple data sets together in a consistent data store. There are data on the network and through video manual statistics, now to be consolidated storage, before the same technical action data to be merged.

In the combined table, the "dribble" action occurs several times, where they can be combined into one. Similarly, "pick-and-roll" also appeared several times, also merged into one.

2. Genetic Algorithm

The genetic algorithm was first proposed in 1975 by professor J.Holland of the United States. Genetic algorithms start from a population that represents a potential solution set of the problem, and a population consists of a certain number of individuals that are genetically coded. [4] Each individual is, in effect, an entity with a characteristic chromosome. Chromosome is the main carrier of genetic material, namely the collection of multiple genes. Therefore, the mapping from phenotype to genotype needs to be realized at the very beginning. Original population is generated according to the principle of survival of the fittest and the evolution, each subsequent generation evolution produces better approximate solution, in each generation, according to the individual problem domain size to choose the fitness of individuals, and by means of natural genetics, genetic operators are combined crossover and mutation, produced on behalf of the new solution set of the population. This process will result in a population that is similar to the natural evolution of the post-generation population more adaptive to the environment than the previous generation, and the optimal individuals in the last generation of the population can be decoded as the approximate optimal solution to the problem.

2.1 Principle of Genetic Algorithm

In genetic algorithms, the solution to an optimized problem can be considered as an individual, commonly referred to as a chromosome, which can be simply expressed as a string or a string of Numbers, or as a special representation. [5] The process of expressing a chromosome is a coding process. Firstly, the algorithm can be randomly generated or artificially assigned to a certain number of individuals. The difference is that the artificial assignment can improve the quality of the initial population and the efficiency of the algorithm operation. Individual of each generation can calculate corresponding fitness value through fitness function.

The basic process of genetic algorithm includes selection, crossover and variation. Selection refers to the selection of an individual from the old group to the new group with a certain probability. The probability that the individual is selected is related to the fitness value of the individual. The greater the fitness of the individual, the greater the chance of being selected. Crossover operation refers to the process of selecting two individuals from an individual and generating new individuals through the cross combination of two chromosomes. The process is to randomly select two chromosomes from the population and randomly select one or multiple chromosome positions for exchange. The mutation operation involves selecting a chromosome from a population, and selecting a point in the chromosome to carry out the mutation in order to produce a better chromosome.

2.2 The Process of Genetic Algorithm

(1) Genetic algorithm coding

Coding is the basis of GA model construction, which can be called the key to determine how the next selection, crossover and mutation process will proceed. [6] The coding process requires that any part of the problem be transformed into a genetic internal gene and that the constituent genes correspond to candidate solutions. Traditional coding methods include binary coding or real coding. Binary encoding is to follow the process of pre-confirmation to transform the data and other contents to be processed into binary. It is simple but has a long composition over long shortcomings. In this paper, it can be divided into four sections, including the weights connecting the input layer and the hidden layer, the thresholds of the hidden layer, the weights connecting the hidden layer and the output layer, and the thresholds of the output layer.

(2) Fitness function design

To evaluate the relative merits of different chromosomes in a population, we need to manipulate all chromosomes, and we need to use specific operations. The application of genetic algorithm quantifies individual quality. In this paper, the sum of the absolute error between the predicted output and the expected output is taken as the fitness value.

(3) Select operation

The process of screening out undesirable chromosomes is called selection. Its function is to find out how to select the solutions within the previous generation to enter the latest generation, mainly to retain excellent data. This method relies on the chromosome fitness evaluation condition, and the general methods include roulette method and the best individual preservation method.

(4) Cross operation

The crossover operation is mainly to combine the information from the parent population to produce new individuals. The two selected individuals will be taken as the parents, and the exchange combination of chromosomes will be carried out to produce better individuals. As shown in figure 1.

Fig1.Cross

(5) Variation operation

The mutation operation is to select one arbitrarily from within the chromosome according to a certain possibility, and artificially process the value of a certain position of the chromosome, which can guarantee the richness of species and improve the effect of genetic algorithm to find the optimal solution in many aspects. Combined with crossover operation, it can completely change the factors of bad effect and maintain the smooth operation of genetic algorithm to some extent. As shown in figure 2.

Fig.2 Variation

2.3 Characteristics of Genetic Algorithm

As a search algorithm, genetic algorithm can satisfy both local search and global search, as well as the solution of many complex problems. Therefore, compared with traditional methods, genetic algorithm has obvious advantages.

(1) Wide application

Genetic algorithm (GA) is widely used because it can process many kinds of data and simplify the complexity of the problem. It often appears in various high-tech industries, including machine learning artificial intelligence.

(2) Global search

The genetic algorithm operates simultaneously on many chromosomes and has a better global search function, instead of determining the rule processing algorithm, which can avoid the disadvantages of local optimization caused by gradient or high derivative of the related algorithm of the objective function.

(3) High search efficiency

Genetic algorithm does not use certain rules to search, but uses global search, the search process is more flexible, compared with the traditional starting from a single point, the search information is less, search efficiency is low, genetic algorithm has broken through the limitations of the traditional algorithm, with higher efficiency.

3. Implementation of BP Neural Network Algorithm Based on Genetic Algorithm Optimization

The optimization of BP neural network can be divided into three parts: the establishment of BP neural network algorithm model, the optimization of BP neural network by genetic algorithm, and the prediction of BP neural network after optimization. Based on the model established above, we have determined the parameters to create the population. In this paper, the real number coding method is selected, the input layer is 6, the hidden layer is 7, and the output layer is 1. Then 6*7+7*1=49 weights, 7+1=8 thresholds, that is, the length of chromosome is 49+8=57.

Firstly, the input information is trained and output, and the error of the result is set to the fitness value of chromosome. The calculation formula of fitness function is:

$$\mathrm{F} = \mathrm{k}\left(\sum_{i=1}^{n} abs(y_i - O_i)\right)$$

In the formula, n is number of output nodes in the network, y_i is the actual result of the ith node in BP neural network, O_i is the predicted result of the ith node, and k is the coefficient.

Secondly, the basic process is mainly selection, crossover and variation, and the error of prediction is taken as the individual fitness value. [7]

(1) Select operation

In this paper, the selection method is roulette. The advantage of this method is that the chromosome with better fitness value has a greater chance of being selected to enter the next generation, while the chromosome with less fitness value also has a chance. This ensures the

diversity of individuals in the group. At the same time, each generation of chromosomes can be approximated to the optimal solution to avoid local extreme. In this paper, the roulette method is selected, and the formula is as follows:

$$f_i = {}^{k}/_{F_i}$$

$$p_i = \frac{f_i}{\sum_{i=1}^{N} f_i}$$

(2) Cross operation

Cross processing requires finding a pair of chromosomes in the individual, and the new individual is obtained at the crossing point according to a certain probability. The position of the crossover is random. The formula is as follows:

$$\left.\begin{aligned} a_{mj} &= a_{mj}(1-b) + a_{Ij}^{b} \\ a_{ij} &= a_{ij}(1-b) + a_{mj}^{b} \end{aligned}\right\}$$

Where, b is a random number between [0, 1]. The crossover probability in this paper is 0.6.

(3) Variation operation

The mutation operation needs to find a chromosome randomly from which the gene varies according to a certain probability of variation to produce new individuals. The variation treatment formula is as follows:

$$a_{xy} = \begin{cases} a_{xy} + \left(a_{xy} - a_{mn}\right) * f(g), r > 0.5 \\ \{a_{xy} + \left(a_{mn} - a_{xy}\right) * f(g), r \leq 0.5 \end{cases}$$

Finally, after obtaining the optimal initial weights and thresholds required by BP neural network through genetic algorithm, the weights and thresholds are substituted into BP neural network for prediction.

4. The Objective and the Research Method

4.1 Research the Opposite Image

The statistics system of basketball technology is internal and internal

4.2 Research Method

4.2.1 Document Law

This article refer to the Chinese periodical net of the statistic index system research literatures, summarized our country basketball technical statistical indicators for the overall level of development, through Google scholar browsing foreign database about the basketball technical statistical indexes related literature, summarized present state of technical indicators, through research the domestic basketball statistic website, to get the actual application level of domestic basketball technical statistical indexes, through access to study overseas basketball statistic website, access to foreign basketball technical indicators of application levels. The application of basketball technical statistical indicators was obtained through the investigation and interview of the national and international basketball technical statistical indicators professional BBS. [8] On this basis, the author systematically studied the foreign works on the statistical analysis of basketball technology, which provided theoretical support for the research of this paper. At last, the materials are summarized and screened systematically, so as to make material preparation and basis for the study of this paper.

4.2.2 Logic Analysis

The material and data are analyzed logically by using the method of coincidence, deduction, comparison and synthesis.

4.2.3 Video Analysis

Through this article research statistic index system, selection of basketball lamb with 2013-2014 NBA finals five games blend line of empirical research, sweet CBA and NBA, basketball professionals, technical statistics four technical statistics index system to analyze the game, the statistic index system for the game to reveal different degree and the function value, thus basketball statistic index system can be divided into level, set up suitable for different target groups of basketball statistic index system. 2.2.4mathematical statistics

Use Excel software to make statistical analysis of relevant technical statistical index data of the competition, draw the data into tables and charts, and display the research results more intuitively

4.3 Technical Specifications of Basketball Are of Great Significance

Basketball technical statistics is one of the methods used in the scientific research work of sports. Through the statistics of basketball games, we can analyze the situation according to the statistical data, study the countermeasures, make the game plan and strive for the victory. According to the statistical data, combined with the field observation, the game can be objectively summarized and analyzed to find out the cause of the game failure. Through the accumulation of statistical data of basketball games, the technical archives of basketball teams and athletes can be established to provide reliable data for the study of athletes' growth and the examination of the mixed situation of skills and tactics of the games. [9] These data can also provide the basis of technical and tactical indicators for basketball teams and athletes. Therefore, the statistical work of basketball technology is an indispensable part of the work of basketball competition.

Basketball technical indicators, the indicators standard and scale must be unified, the basketball match is in rapid, intense, fight, its technical and tactical statistics depends not only on the accuracy of the statistics that righteousness validity of standardization, scale, more parties play depends on the statistics personnel of basketball technical and tactical project standard, the scale of a correct understanding, judgment, reaction ability and mental focus.

5. Main Problems Existing in Campus Basketball and Optimization Countermeasures

5.1 Major Problems

5.1.1 Relatively Weak Faculty

Configuration in the survey found that school physical education teachers far cannot satisfy the needs of the school basketball characteristic activities, the school is equipped with the basic physical education teachers have larger course tasks, each teacher each week course average section 12 above, some schools even reached more than 20 knots, larger work pressure for physical education teachers, teachers in addition to the courses for their own row, there is no time and energy according to the characteristics and actual situation of the school to develop other sports activities. Among these teachers, there are all kinds of special graduates, and the teachers assigned to the direction of basketball is even more rare. Teachers are the precondition of physical education and physical activity, and also the leading role in the curriculum. According to the survey, among the public recruitment of PE teachers in recent years, the recruitment of primary school teachers is the largest, and the number of PE teachers in junior middle school and senior high school is decreasing. Part of the reason is the deployment of teachers from local middle schools, but after all, there are differences between primary school teachers and middle school teachers, and teachers should be increased from social personnel and new graduates, rather than just from local deployment.

5.1.2 Lack of Policy Traction

The promulgation and implementation of the policy has a traction effect on all aspects of school development, and sports activities are no exception. From the perspective of the current development of campus football, the policy has brought great impetus to campus football, and campus basketball also needs the guidance of a wind of policy. It can be seen from the results of

factor analysis that the policy orientation has the greatest influence on the whole campus basketball development. At present, there is no perfect policy and development direction for the development of campus basketball, which is oriented by the curriculum of physical education and related courses and contents. Relevant training mechanism, relevant goal requirements, relevant policy guidance and the goal to be achieved are not expected to be improved. Therefore, the current development of campus basketball is relatively arbitrary, based on the school's existing resources and physical education syllabus to develop teaching tasks.

5.2 Optimize Countermeasures

5.2.1 Strengthening of Teachers

Teachers are direct participants in the vigorous promotion and implementation of campus basketball. The quantity and quality of teachers determine the effect of the popularization of campus basketball. [10] Firstly, the training of special teachers on campus basketball should be enhanced on the basis of existing teachers, and the training work at national, provincial and local levels should be set up. Some key basketball teachers should be selected for direct training. Secondly, we should vigorously integrate social resources, implement education comprehensive reform related requirements, promote the vigorous development of campus basketball, learn from the development of European and American campus basketball, and introduce foreign advanced basketball education concept according to existing resources and conditions. Third, set up relevant reward mechanism to drive the inflow of talents and prevent the brain drain.

5.2.2 Policy Traction and Integration Drive

Campus basketball has a good mass base, but there is a lack of relevant policies to integrate and develop existing resources. The development of campus basketball can be guided by relevant policies of campus football, and relevant policies can be formulated from the national level, local government and school level. The sports administrative departments and all levels of education sports management agencies should integrate, organize and manage vigorously, and formulate related goals, implementation measures and financial support. Through the development of campus basketball, the development of basketball is promoted in an all-round way, and a part of schools are selected as characteristic schools of campus basketball to promote, popularize and optimize campus basketball.

Training and exchange, cultural camps to promote the development of the campus. In terms of funding, emphasis should be placed on increasing access to these areas

The funding and infrastructure of the school ensure adequate resources to carry out the relevant popularization. The second is

It provides a platform for communication and learning between schools

6. Conclusion

Through the analysis of the experimental results of the optimization of teaching methods, it is shown that under the existing teaching conditions, it is feasible to carry out the optimization of teaching methods in accordance with the physiological and psychological characteristics of students. Through the optimized teaching experiment of teaching methods, the experimental group was significantly higher than the control group in the mastery of basic basketball technology and basketball theory. Although there was no significant difference in other indicators, the degree of improvement of the experimental group was better than that of the control group. The optimal teaching method is to teach students according to their aptitude with students as the subject and respect the differences between students to carry out individual education, which can fully meet the maximum needs of students' individual development. The teaching method of basketball optional course is optimized, enabling different individuals to give play to their initiative and creativity, effectively stimulating students' learning initiative, changing passive learning into active practice and exploration, activating the classroom atmosphere and improving the teaching effect. In

basketball optional course teaching, how to make students master the basic knowledge and skills of basketball as soon as possible in a short teaching time, can fully mobilize students' enthusiasm for learning, improve their interest in learning, and find an optimal teaching method has always been a problem that PE teachers keep studying and exploring. Due to my limited knowledge, had little contact time with the theory of teaching optimization. Therefore, this paper has many shortcomings from experimental design to the selection of experimental methods, from the control of experimental process to the analysis of experimental results. I sincerely hope that teachers and peers who are interested in applying the theory of optimization will continue to study in the field of physical practice teaching and promote the continuous improvement of physical practice teaching.

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