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Research Article

Pattern Recognition Characteristics and Neural Mechanism of Basketball Players' Dribbling Tactics Based on Artificial Intelligence and Deep Learning

Xuhui Song[1] **and Linyuan Fan**[2]

[1]*Department of Sports, Capital University of Economics and Business, Beijing 100070, China*
[2]*College of Mathematics and Data Science, Minjiang University, Fuzhou 350108, Fujian, China*

Correspondence should be addressed to Linyuan Fan; fanlinyuan@mju.edu.cn

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There are many factors that affect a player's overall basketball ability, and different factors will have different effects. The effect is mainly manifested in the difference of offensive and defensive data of basketball players in basketball games. In the basketball field, the formulation of existing training plans mainly relies on the manual observation and personal experience of coaches. This method is inevitably subjective. The pattern recognition of dribbling tactics is one of the important factors. A proper dribbling tactic can make the team achieve better results. In order to discover different dribbling characteristics, reanalyze the connotation and manifestation of basketball speed and strive to analyze the factors that affect basketball speed reasonably and accurately. The deep learning algorithm simulates the thinking process of the human brain neurons through the computer method and then realizes the function of the computer to automatically learn the data characteristics and complete the complex data analysis task. We use artificial intelligence and deep learning to simulate various dribbling tactics of players and find out the rules to improve players' abilities. The results of the study prove that developing a suitable dribbling tactical model for basketball players can increase their competitive ability by more than 10%, reduce the damage to players, and prolong their careers. Generally speaking, athletes' injuries can be reduced by more than 15%. This shows that the pattern recognition characteristics and neural mechanisms of dribbling tactics are extremely important to basketball players.

1. Introduction

With the rapid developments of economic globalization and the expanding exchanges between countries, the level of development of sports has become an important indicia to measure the social development of a country or region and the progress of human civilization [1]. There are many forms of sports classification, which can be broadly divided and classified into mass sports and voluntary sports, mainly including sports culture, sports education, sports-related activities, sports competitions, sports infrastructure, sports organizations, sports technology, and many other elements [2].

By being part of the social infrastructure, the sports business is an important part of the modern service business. The high-speed development of the sports sector is a new economic and employment driver for the socioeconomic growth of the region [3]. It is now the pillar for developed economic world. In North America, Western Europe, and Japan, the industrial value of sports and its related industries has been located among the top ten of the national industries in terms of years of production. Under the environment of sustained and stable development of our country's macroeconomic economy, with the increase in per capita income of residents, the substantial improvement of people's living standards and people's growing spiritual, cultural, and material needs will continue to promote the development of sports in the country. The dribbling tactics pattern recognition feature can provide suitable training methods according to the individual characteristics of the athletes,

improve the training level of basketball players, and provide support for high-level basketball games [4]. Scholars at home and abroad have related research on the pattern recognition characteristics and neural mechanisms of athletes' dribbling tactics; Taniguchi fixed a type of sensor equipment on the back of a player's hand in basketball to collect accumulative and angular accelerations data of the player's hand over the jump shot process. The jump throw process is divided into a four phase process, and the pitch position of each phase is analyzed and remedied by voice feedback to help the athlete correct his shooting posture. However, the jump shot posture of the athlete is reflected by the motion of his arm and leg postures [5]. Paul compared the physical performance of performers in different forms of competition and training, proving that wearables are effective. The quantification of basketball is very helpful but does not involve specific basketball quantification studies [6]. Nguyen and Yang used acceleration sensors to construct a basketball gesture recognition system, collected the lower limb data of basketball players, and completed the basketball movement. For the recognition of 8 kinds of actions, the article only uses acceleration data as a reference, the constructed data set has a single feature, and its average recognition accuracy is less than 70% [7].

Deep learning is not originally a stand-alone learning method but itself uses both supervised and unsupervised learning methods to train deep neural networks. However, due to the rapid development of the field in recent years and the introduction of specific learning tools (such as residual networks), it is increasingly seen as a separate learning method. Initially, deep learning was a learning process that used deep neural networks to solve feature representations. Deep neural networks themselves are not a completely new concept and can be broadly understood as a neural network structure containing multiple hidden layers. In order to improve the training of deep neural networks, adjustments have been made to aspects such as the method of connecting neurons and the activation function. Many of these ideas have been developed in the early years, but due to the lack of training data and computational power at the time, the results were not as good as they could have been. Deep learning has decimated a wide range of tasks, making seemingly every machine-assisted function possible. Driverless cars, preventative healthcare, and even better movie recommendations are all close at hand, or on the horizon.

This article aims to study some of the ideas that we have generated based on previous research results. In recent studies at home and abroad, few have included the dribbling mode of basketball players into the comprehensive evaluation of players. This article highlights the role of players' dribbling patterns in the comprehensive evaluation. When evaluating the offensive and defensive abilities of players, some new variables are also added to replace outdated variables. This paper analyses the characteristics of basketball players' technical and tactical use, particularly in relation to key games and key points, in order to discover the common characteristics of basketball players' technical and tactical use. Through comprehensive and detailed research and analysis, the future directions are drawn in the conclusion part, a new method of comprehensive evaluation of basketball players is drawn, and the structural equation of comprehensive evaluation constructed is used to analyze the relative importance of various indicators of players and conclude the determinants of player value. Cluster analysis was used to calculate the dribbling patterns of the athletes and a new cluster evaluation function was added to guide the cluster analysis process. The scientific validity of the experimental protocol was verified by comparing the experimental group with the control group.

2. Dribbling Tactics Pattern Recognition Characteristics and Neural Mechanism Research Methods

2.1. Basketball. Sports itself has its own unique characteristics: physical activity is used as a means to exercise the body. In basketball training, the basic skills training mainly includes technical training such as ball control, dribbling, passing, catching, shooting, and step adjustment [8, 9]. In specific training, the coaches need to carefully explain the basic movements and demonstrate the correct technical movements and promptly correct various problems that arise during the training of the athletes, so as to encourage the athletes to master the correct and standardized technical movements [10]. In the training practice of basketball shooting techniques, many athletes often have irregular technical movements during the training process due to their own movement habits and do not fully respect the objectiveness of basketball shooting. The law cannot realize the reasonable control of the ball by the body, thus affecting the improvement of basketball technical training results and the improvement of shooting percentage. In order to ensure that athletes are proficient in basic basketball movements, athletes spend most of their training time on repetitive training of single movements [11].

Sport is about developing healthy behaviours, appreciating the spirit of sport, and regulating the rhythm of the mind and body. Sport is a behavioural activity involving a set of rules, bound by habits, involving physical strength and skill, often of a competitive nature. Whether you are a professional athlete or an ordinary person, a certain amount of daily exercise is good for your physical and mental health and relaxes you.

It is very important to make sure that the cardinal action is performed with standard accuracy. In the training practice of basketball shooting techniques, many athletes often have irregular technical movements during the training process due to their own movement habits and do not fully respect the objectiveness of basketball shooting. The law cannot realize the reasonable control of the ball by the body, thus affecting the improvement of basketball technical training results and the improvement of shooting percentage. In order to ensure that athletes are proficient in basic basketball movements, athletes spend most of their training time on repetitive training of individual movements. For the specification of basic movements, it is a necessity to have the supervision and tutorials of a coach to provide real-time guidance and advice to the athletes [12]. This manmade

guidance requires a lot of time and is a complex work for the coaches. Basketball players have great training intensity. A reasonable intensity is conducive to improving the athlete's competitive ability. However, too high intensity can easily cause damage to the athletes:

One-handed approach: take a right-handed in situ one-handed over-the-shoulder shot as an example. Start by holding the ball with both hands; then, lead the ball over the front of the right shoulder with the right arm bent at the elbow, the elbow joint slightly inward, the upper arm about level with the shoulder joint and the forearm about 90 degrees to the upper arm. The five fingers of the right hand are naturally open, the wrist is bent back, the palm is free, the outer edge of the palm and the part above the root of the fingers are used to hold the ball at the bottom of the back, and the left hand holds the left side of the ball.

How to hold the ball with both hands: take a two-handed chest shot in situ as an example. The five fingers of both hands are naturally open, and the ball is held by the back side of the ball above the root of the fingers, with the two thumbs forming a figure of eight opposite each other and the palm hollowed out. Both elbows are naturally down and the shoulders are relaxed, placing the ball between the chest and jaw.

Direct hit aiming point: usually aim for the point of the basketball rim closest to you. This method aims at a solid target and is suitable for shooting hollow-point baskets from any position on the court. It is also advocated to aim at the centre of the rim, a target that is consistent with where the ball will land and facilitates force.

The aiming point for a touchboard shot: this is the point at which the ball is thrown at the rim to make it rebound into the basket. If the shooter is located in an area with an angle of 15 to 45 degrees to the rim, the effect of the touchboard shot is better, especially in areas close to the 30 degree angle. The aiming point of the touchboard shot should be reasonably chosen according to the angle, distance, and curvature of the shot. The general rule is that the smaller the angle, the further the distance and the higher the arc and the further and higher the touchboard point is from the rim; conversely, the closer and lower it is.

Low arc: the ball's flight path is short and the power is easy to control, but because the flight path is low and flat, the basketball rim is exposed to a small area under the ball and it is not easy to shoot. Medium arc: the highest point of the ball's flight arc is roughly on a horizontal line with the top edge of the rim, with most of the basket exposed underneath the ball, making it a more suitable throw. High arc: the ball falls close to vertical direction, the area of the rim is almost completely exposed underneath the ball, and the ball can easily get into the basket. However, the flight path of the ball is too long and not easily controlled, which can actually reduce the hitting rate.

2.2. Basketball Player Injury Detection. Various injuries that occur in sports are called sports injuries. Basketball is a high-frequency sports event with sports injuries due to its multiple physical contact, fast speed, and strong antagonism [13]. However, there are many reasons for sports injuries, such as an insufficient sense of self-protection, preparatory activities, incorrect technical movements, and poor physical condition. Among them, there are reasons that account for a larger number of factors. Whether in an incidental movement in training or competition, most sports injuries are so unpredictable that it becomes crucial to reduce them. Action patterning is the process by which the muscles, fascia, and histotoconia execute the corresponding action program stored in the brain under the control of the mesocortical system. This executed process takes part in certain temporal and spatial steps [14].

There are many actions to prevent basketball sports impairment. Traditional preventions of basketball sports injuries mainly be concentrated on pregame warm-up, postgame relaxation, and flexibility and strength training; however, the appearances of functional exercise have brought new ideas and functions to the prevention of sports and athletic injuries. Training is stressed on the importance of movement, that is "space is movement," and the correct movement pattern is the key to the prevention of sports injury. From this perspectival point of view, simply stretching and strengthening muscles do not change their original mis-sporting habits. Wrong motion habits are the key culprit of sports injuries. Therefore, in athletic injury prevention, it is necessary to improve the nerves. Further correction of faulty motor patterns or habits based on flexibility and stability can truly reduce the odds of sports injuries [15].

Current procedures for measuring body mass include overall body mass measurement and select body mass measurement. Among them, the measurement the whole body composition includes measurement methods of bioresistance resistance, total potassium estimation algorithm, body water treatment, DXA method, and a submersible weighing method.

Bioresistance immunoassay: it is a method to determine the fat content of the human body that is derived from the electrical resistivity of the human body. Its basic approach is to use the electrical resistance of human cells and the organization to determine the electrical conductivity of the human body components and then test its resistance level; the more the water from the organization, the stronger its electrical conductivity and the lower its resistivity, and conversely, the less the water from the organization, the weaker its electrical conductivity and the higher its electrical resistivity. For example, the fatter the body's tissue with a low water concentration, the lower its conductive properties and the higher the electric resistivity. The higher the water content of music muscles, the more conductive they are and the lower their resistivity [16, 17]. The fat mass of the body is then estimated by inference. This method is in an economic and practical

way and is widely used in various medical institutions and in general for households.

Total potassium algorithm for calculation: this method focuses on determining the body fat levels and lean body masses based on the total potassium content of the body. It is generally accepted that the potassium content in the fat-free body weight of the human body is constant, so that the body fat content and lean weight can be calculated by calculating the total potassium in the body (mainly by having measured the 40k content in the body; this is in view of the fact that 40k represents 0.00118% of the total potassium composition) [18]:

$$q = \beta * \partial * \left[\left(\frac{t_1}{100} \right)^4 - \left(\frac{t_2}{100} \right)^4 \right]. \tag{1}$$

Body water technique: this is a procedure to estimate both the body's lean body mass and body fat by a measurement of the total amount of body water. The reason for this has been that the water content is stable for lean body mass. By delivering certain chemicals (bilin, ethanol, etc.) to the body, the degree of dilution of these chemicals can be used to estimate the total amount of volume of fluid in the body and then the body fat weight and slender body mass of the body can be also to be calculated [19].

$$Q = \frac{\gamma}{t} A_n (T_m - T_n). \tag{2}$$

The DXA is the method of calculating the body component (bone mineral content, body fat, muscle, etc.) by an absorption measurement of X-rays. The basic technique is to use high and low with low-energy X-rays to determine the absorption of human and fatty tissues, including dual-energy X-ray absorptiometry and spectroscopic photon assays [20].

$$\alpha = \frac{2.057 f * (v * p)^{0.8}}{d^{0.2}}. \tag{3}$$

Underwater weighing method: use water as a medium to measure the body's volume and body density and then calculate the proportion of body fat to calculate the body fat and lean body weight. This is a more classic body composition method [21].

$$T = \frac{\sqrt{(a_{x1} - a_{x-1})^2 + (a_{y1} - a_{y-1})^2 + (a_{z1} - a_{z-1})^2}}{100}. \tag{4}$$

Sports can improve body composition and reduce body fat. Especially for people who often insist on physical exercises, not only can their various functions of the body be greatly improved but their athletic ability can also be significantly improved, so athletic ability and body composition can influence and promote each other, thereby improving people's good health and physical fitness.

2.3. Neural Mechanism. The concept of neural mechanism is opposite of biological neural network. People are inspired by the organization of biological neurons and build artificial neural networks. Therefore, there are similarities in the organization of the entire network from the most basic unit neuron. A neuron receives different signals from different neurons from several dendrites and performs a complex summation process in the cell body. The output of neurons is

$$y = f\left(\sum_{i=1}^{n} w_i x_i - \delta \right), \tag{5}$$

where δ represents the threshold, assuming that there are q pairs of samples; for the p-th sample, the error is defined as

$$J(W,b)_p = \frac{1}{2} \| y^n - y \|^2. \tag{6}$$

Find the average loss for the entire sample set, and then perform a uniform gradient descent:

$$J(W,b) = \frac{1}{q} \sum_{p=1}^{q} J(W,b). \tag{7}$$

Find the partial derivatives and find out their respective contributions to the final error. This process can be expressed by the following formula:

$$w_{ij}^{(l)} = w_{ij}^{(l)} - lr \frac{\partial (j(W,b))}{\partial w_{ij}^{(l)}}. \tag{8}$$

The convolutional layer is different from the ordinary fully connected layer in that it uses the method of local connection and weight sharing.

2.4. Model Recognition. For athletes' dribbling patterns, we can calculate them through cluster analysis. In general cluster analysis, because the distribution characteristics of the clustered data sets are unknown, the limitations of individual cluster evaluations make the calculation results unclear. Ideally, usually the function that guides the trend of clustering results or the evaluation function of clustering results is often only one; that is, the analysis process is actually a single-objective optimization process, and the clustering results obtained often depend on an evaluation index. Its distribution characteristics are not known in advance, so the evaluation mechanism for clustering processing should not be determined and the applicability of the clustering algorithm is not high. The intraclass distance and the interclass distance of each cluster can be considered at the same time as the evaluation mechanism of clustering. Therefore, this paper adds a new cluster evaluation function to guide the cluster analysis process. It can be processed with the following functions:

$$F(u) = \int |Du| \mathrm{d}x \mathrm{d}y + \frac{1}{2} \lambda \| u - u_0 \|^2. \tag{9}$$

The corresponding equation is

$$-\operatorname{div}\left(\frac{\nabla u}{|\nabla u|}\right)-\lambda\left(u_0-u\right)=0. \tag{10}$$

An optimization problem can be transformed into a function; let the error function be

$$E(x,y)=\operatorname{div}\left(\frac{\nabla u}{|\nabla u|}\right)-\lambda\left(u-u_0\right). \tag{11}$$

Assuming that the final output is an ideal model, we can get

$$\begin{aligned} u(x,y)&=N\left(u_0(x,y),w\right),\\ t(s)&=\exp\left(-\int_0^s \kappa(t)\mathrm{d}t\right). \end{aligned} \tag{12}$$

From it, we see that

$$\partial=1-t(s)=1-\exp\left(-\int_0^s \kappa(t)\mathrm{d}t\right). \tag{13}$$

When Δs approaches zero, use the following differential equation to illustrate the change:

$$\frac{dI}{ds}=T(s)*\rho(s)*A=T(s)*\kappa(s). \tag{14}$$

We used generally the following equations:

$$x(k+1)=Ix(k)+Jv(k),k=1,2,.. \tag{15}$$

The two-party group has the following targets for performing the test:

$$K=\sum_{k=1}^{\infty}\left[x^i(k)Jx(k)+r^i(k)cJ\right], \tag{16}$$

where the weighting matrix Q is

$$Q=\frac{1}{2a^2r^{-1}}\left(\frac{2b^2}{a^2r^{-1}}p-t\right)^{-1}\left[a^2r^{-1}t^2+2\left(1-b^2\right)t\right]. \tag{17}$$

Clustering is an important technique and method in the process of data mining and is a crucial part of the data mining process, which makes it an important research direction in the field of data mining. The process of clustering means that objects are grouped into a certain category or objects with similar properties are grouped together according to their characteristics. The essence of cluster analysis is to use an effective clustering algorithm to obtain classes of data and to group the data with large differences into different clusters, so that the resulting clusters are a collection of data objects. Cluster analysis does not require knowledge guidance, and it obtains meaningful data classification directly from the data and is a form of unsupervised learning. Clustering techniques generally start from the data, and there is no fixed classification standard. Clustering results usually vary depending on the clustering method, and the same data set may show different clustering results if different clustering methods are used.

The difference between clustering and classification is that the classes required for clustering are unknown. Cluster analysis is very rich and includes systematic clustering, ordered sample clustering, dynamic clustering, fuzzy clustering, graphical clustering, and cluster forecasting. Classification refers to the grouping of species, classes, or properties.

Characteristics of clustering methods: cluster analysis is simple and intuitive. Cluster analysis is mainly used in exploratory research, the results of its analysis can provide several possible solutions, and the selection of the final solution requires the subjective judgment of the researcher and subsequent analysis; regardless of whether there are really different categories in the actual data, using cluster analysis can obtain a solution divided into several categories; the solution of cluster analysis depends entirely on the clustering variables selected by the researcher, and adding or deleting some variables may have a substantial impact on the final solution. The researcher should pay particular attention to the various factors that may affect the results when using cluster analysis. Outliers and special variables have a large impact on clustering .When categorical variables are measured on inconsistent scales, prior standardisation is required.

In general, the clustering analysis algorithm is divided into the following steps: data preprocessing including data standardisation, data denoising, data feature selection, etc. The main role is to transform the original data into a form of data that can be easily processed, so as to improve the quality of the clustering results. This process gives the data new features by extracting the data features, selecting a suitable feature set, effectively removing isolated points, and preparing the groundwork for subsequent processing. Definition of data similarity: the measure of similarity between different data objects in the same feature space has a great impact on clustering, and due to the diversity of data features and types, similarity must be defined carefully. Typically, differences between data are assessed by defining a distance measure in the feature space, with Euclidean distance being the most commonly used method. Clustering or grouping: this step is used to group data objects into classes, commonly used in division-based and hierarchical methods. This step is the core of the cluster analysis process, and the choice of cluster analysis algorithm is crucial. In addition to the two clustering methods mentioned above, there are model-based clustering algorithms, density-based clustering algorithms, and grid-based clustering algorithms. The data stream clustering analysis algorithm studied in this paper is the grid density-based data stream clustering algorithm. Output and evaluation of results: after the above steps, the results are output and evaluated, i.e., the evaluation of the quality of clustering, and the results are analysed according to certain evaluation rules, which is also the process of measuring the merits of clustering algorithms. The output of the results is generally presented to the user certain clustering results, including clustering accuracy, clustering efficiency, clustering results shape, etc., and different clustering analysis algorithms play to present different forms.

3. Athletes' Dribbling Tactics Pattern Recognition Characteristics and Neural Mechanism Experiments

3.1. Subject. This article first randomly selects 5 members of the school team as the experimental group and the remaining 5 members of the school team as the control group. Combined with the current level of players' dribbling, a three-week experiment was conducted using the developed training plan. The training plan was developed by the same coach, and the training and testing were carried out in their respective training venues. The experimental group used new indicators for intervention training. Its difference and effectiveness are compared, and they are analyzed with reference to the coach's observation and evaluation of the athletes. The control group adopts traditional training methods, strictly controls the entire experimental process, and allocates phase tasks reasonably. After the third week of training, the experimental subjects will be tested on all indicators again, and the experimental group and the control will be compared qualitatively through the athletes' performance in the competition. Differences between groups are used to verify the scientific nature of the experimental program.

3.2. Data Collection. The data were collected by E-Prime software, and the analysis index is the reaction time and accuracy rate of sports decision-making. The data obtained in the formal experiment only are analyzed. Data (1.5%) for which decision-making response time and correct response time were greater than or less than three standard deviations were excluded. Due to the "biological wall" time of simple visual reaction, the limit time of reaction was 220 ms. Therefore, the data that were less than 220 ms in response time (accounting for 2.51%) were removed. SPSS17.0 statistical software package was used to perform repeated measures analysis of variance on behavioral data. We will display some of the collected data, as shown in Figure 1.

3.3. Experimental Purpose. This study uses general situational decision-making tasks to explore the behavioral characteristics and cognitive mechanisms of high-level basketball players in colleges and universities.

4. Athletes' Dribbling Tactics Pattern Recognition Characteristics and Neural Mechanism Experimental Analysis

4.1. Status of Players. We first make statistics on the current basketball level of the two groups of players in order to compare the changes in various data after receiving the dribbling pattern and tactical recognition, as shown in Table 1.

As shown in Figure 2, before the athletes selected in our school undergo separate training, although there is a certain gap in the parameters of their dribbling, in general, the gap is not obvious. The athletes dribble on the spot and turn around to dribble. Such skill levels are basically around 2. We also conduct statistics on the physical fitness of these athletes and compare their changes before and after tactical pattern recognition. The details are shown in Table 2.

As shown in Figure 3, the physical fitness of basketball players is higher than the average level of the average person. There is not much difference between the players selected this time, and the contrast changes are more representative. In general, the players maintain a good level of physique and muscles, the value is basically around 2.2, the performance of the lower limbs is not very satisfactory, and the score is only about 1.9 and needs to be strengthened.

4.2. Data Preprocessing. In the data acquisition stage, the data signals collected by the sensor equipment are usually affected by external or own interference. These interferences include jitter generated by the body during human movement or irregular signals generated by the peripheral environment; the signal acquisition equipment itself having measurement errors; and the signal being inaccurate due to the displacement of the node position during the movement. In practical applications, the collected raw data cannot be directly used for analysis and calculation. In order to obtain a more accurate signal, it needs to be preprocessed after the signal is collected. The collected data required for basketball are shown in Figure 4.

As for the dribbling mode, generally speaking, it can be divided into five types, namely, high dribble, low dribble, emergency stop dribble, reverse dribble, and turn dribble. Statistics of skills and difficulty are shown in Table 3.

As shown in Figure 5, different dribbling methods have different requirements and the physical needs of athletes are also different. We can see that in turn dribble, the skills and physical fitness required by athletes are the highest overall, more than 15% higher than other dribbling methods. The high and low dribble requires the least, so the high and low dribble is the most common dribbling method in basketball. We make statistics on the mastery of each dribbling mode of the school basketball team members, as shown in Table 4.

As shown in Figure 6, in the two groups of athletes tested, people have the best mastery of the simplest high and low dribble, with an average of about 2.2, and the mastery of stopping dribbling and turning dribbling is also about 2, reaching the passing line. The higher the overall strength of the player, the higher the overall level of the player and even the overall level of the team.

4.3. Changes after Training. We divided the players into groups and trained for 3 weeks. We tested the indicators of the two groups of players again and compared the changes of the two groups of players, as shown in Table 5.

After group training, the players using the traditional training method have little improvement in various indicators, only less than 20%, while the training indicators of the players after the dribble tactical pattern recognition are of quality. The improvement of dribbling tactics by more than 50% shows that pattern recognition of dribbling tactics can have a huge effect on the competitiveness of players.

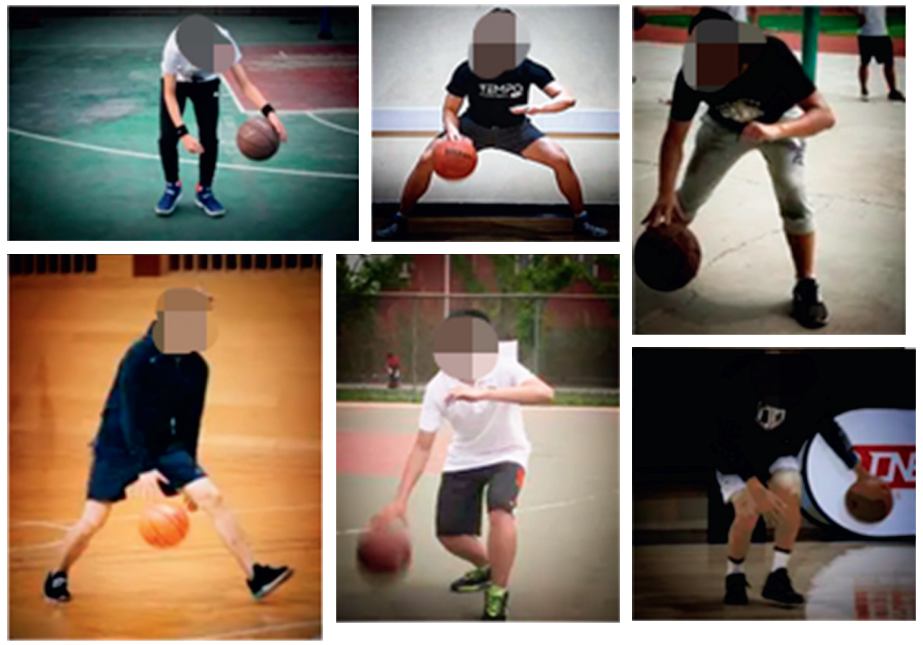

Figure 1: Part of the collected data.

Table 1: Current level of athletes.

	Test group					Control group				
	1	2	3	4	5	1	2	3	4	5
Dribble	2.38	2.06	1.92	1.81	2.08	2.48	2.08	2	2.43	1.89
Travel height	2.02	1.99	1.92	1.93	2.4	2.35	2.09	1.98	2.42	2.48
Low dribble	2.41	2.13	1.98	1.82	2.25	2.17	2.05	2.16	1.91	2.36
Dribble	1.86	1.85	2.18	2.25	1.96	2.32	1.83	1.83	2.14	2.01
Turn dribble	2.5	2.18	2.48	2.5	2.26	2.47	2.25	2.15	2.27	2.28

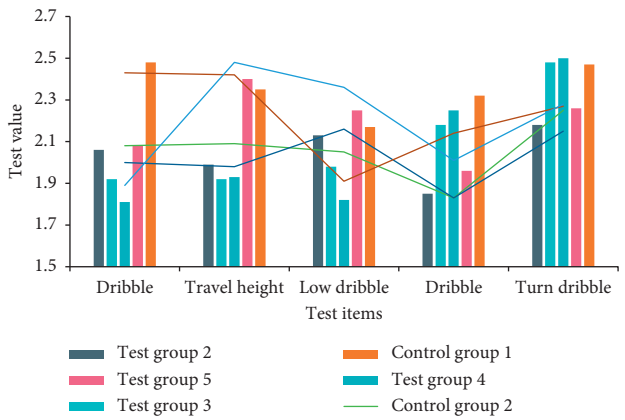

Figure 2: Athlete level test.

Table 2: Physical fitness of basketball players.

	Test group					Control group				
	1	2	3	4	5	1	2	3	4	5
Muscle	2.27	2.28	2.13	1.89	1.92	2.03	2.28	1.83	1.97	1.96
Fascia	1.89	2.09	1.81	1.91	2.34	2.21	1.88	2	2.18	1.81
Joint	2.39	2.42	1.84	2.14	2.24	2.29	1.98	2.24	2.01	2.23
Body fat	1.97	2.24	2.12	2.25	1.92	2.16	1.82	1.96	2.26	1.84
Lower limb ability	1.86	2.23	2.42	2.49	1.86	2.39	2.2	2.25	1.92	2.1

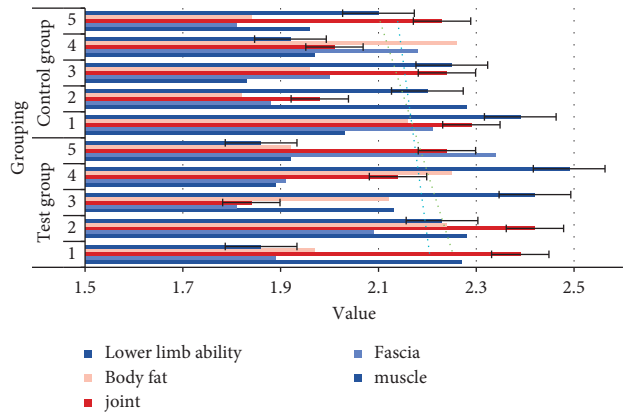

Figure 3: Physical fitness statistics of athletes.

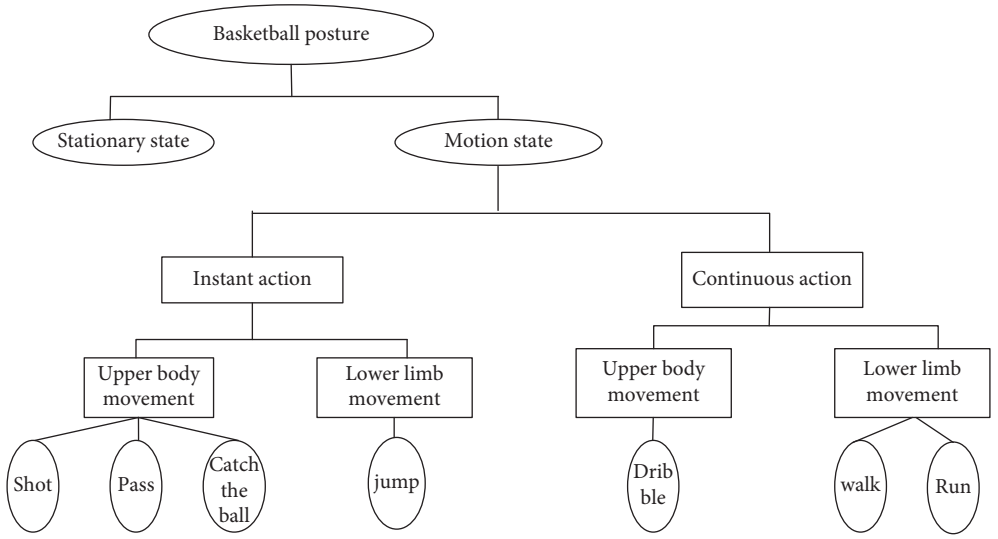

Figure 4: Basketball gesture recognition.

Table 3: Ways of dribbling.

	Skill	Training time	Lower limb ability	Physical coordination	Difficulty
High dribble	4.56	4.35	4.96	4.34	4.89
Low dribble	5.38	4.96	4.74	5.15	5.21
Emergency stop dribble	5.77	5.3	5.57	5.19	5.35
Reverse dribble	6.16	6.2	6.18	6.3	6.03
Turn dribble	6.45	6.68	7	6.42	6.89

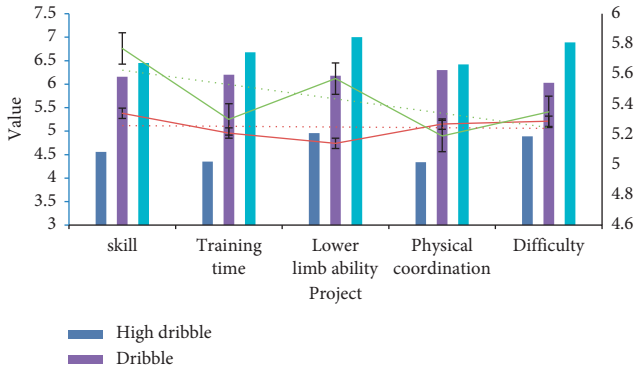

Figure 5: Skills required for different dribbling methods.

Table 4: Players' mastery of dribbling methods.

	Test group					Control group				
	1	2	3	4	5	1	2	3	4	5
High dribble	2.24	1.99	2.1	2.16	2.01	2	2.13	1.88	2.28	2.01
Low dribble	1.93	2.47	2.21	2.27	1.94	2.09	1.81	2.15	1.85	2.21
Emergency stop dribble	1.97	2	2.13	2.5	2.24	2.48	2.18	1.94	2.35	2.43
Reverse dribble	1.92	2.09	1.98	2.17	2.33	1.97	2	1.89	2.38	2.44
Turn dribble	1.95	2.37	1.89	2.41	2.03	2.46	2.26	2.21	2.32	2.26

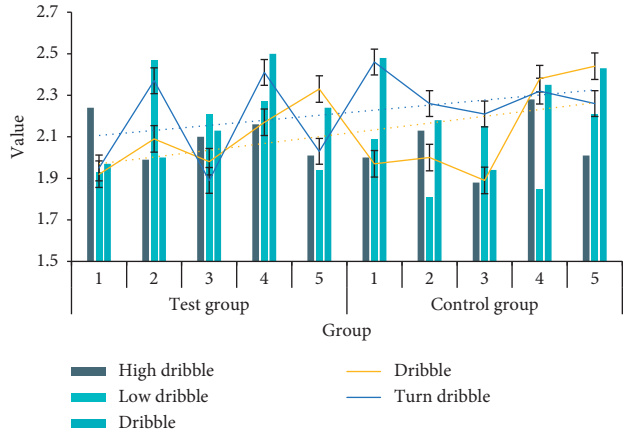

Figure 6: Players' mastery of different dribbling methods.

Table 5: Changes in players after training.

	Test group					Control group				
	1	2	3	4	5	1	2	3	4	5
Dribble	2.29	2.28	1.85	2.33	2.05	4.74	5.15	5.21	5.14	5.33
Travel height	2.88	2.53	2.7	2.53	2.95	5.57	5.19	5.35	5.55	5.69
Low dribble	3.16	3.47	3.21	3.42	3.59	6.18	6.3	6.03	5.86	4.27
Dribble	3.85	3.41	3.77	3.86	3.34	5.12	4.42	4.89	4.47	4.51
Turn dribble	3.14	3.31	3.28	3.07	3.18	5.52	5.85	5.21	5.72	5.82

Table 6: Injury degree of different groups of players after training.

	Test group					Control group				
	1	2	3	4	5	1	2	3	4	5
Muscle	4.7	5.37	5.12	5.38	4.96	2.08	1.83	2.01	2.02	2.35
Fascia	5.81	5.16	5.95	5.77	5.3	2.03	2.28	1.83	1.97	1.96
Joint	5.78	5.82	6.07	6.16	6.2	2.21	1.88	2	2.18	1.81
Body fat	6.78	6.47	6.88	6.45	6.68	2.29	1.98	2.24	2.01	2.23
Lower limb ability	7.62	7.98	7.93	7.7	7.68	2.16	1.82	1.96	2.26	1.84

And, after finding a suitable dribbling method for the player, the player's injury was also effectively contained, as shown in Table 6.

From Figure 7, we can see that after the training of two groups, the physical injury indicators of the players using the traditional training method are much higher than those of the players after the tactical pattern recognition. This is because after the dribble, there is pattern recognition. According to the athlete's own situation, the coach allows the players to adopt a suitable dribbling method, which improves training efficiency and reduces physical injury.

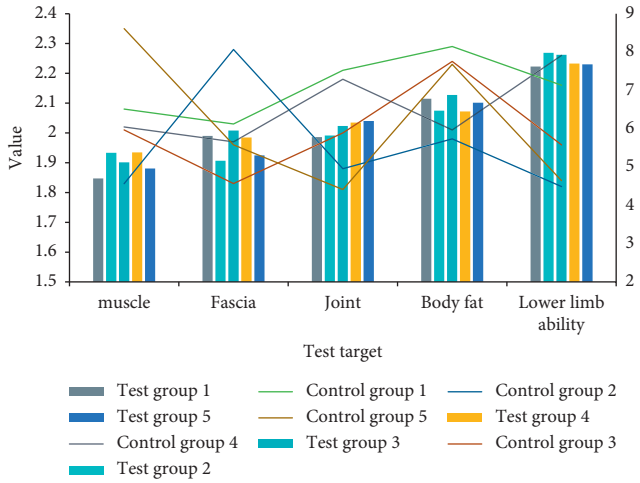

Figure 7: Two groups of injuries after training.

5. Conclusion

In recent years, with the development of wireless sensor network and microelectronic equipment technology, body area network technology has been extensively developed and human body recognition has attracted much attention in various fields, such as medical treatment, sports, games, movies, etc. Based on the human body gesture recognition, this paper studies and analyzes the movement gesture recognition of athletes in the field of basketball sports. By detecting the movement state information of the human arms and legs, the recognition of basketball dribbling patterns is completed, a method of basketball gesture recognition based on unit action division.

The analysis done in this paper is just for posing, and there are many shortcomings in the evaluation of players' overall ability. For example, the valuation of potential influencing factors is incomplete, and three factors are initially selected for such evaluation. In this way, the evaluation is rather single and incomplete in consideration of the player's overall ability. There may be some potential factors that are worth noting here. The acquisition of data for measurable variables is not comprehensive, and the measured variables identified for the relevant latent polarities are not comprehensive enough to fully reflect the meaning of the latent variables. The obtain analysis results are not very satisfactory. There is still a lot of work waiting for us to do, which needs to be continued by the latecomers. We hope that the research results of this paper can enlighten the later ones and better contribute to the game development of basketball. Future research should refine the assessment of athletes' overall ability, with comprehensive data collection on measurable variables.

Data Availability

No data were used to support this study.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Acknowledgments

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