



Research Article

Judgment of Athlete Action Safety in Sports Competition Based on LSTM Recurrent Neural Network Algorithm

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Athlete injury has always been an important factor that plagues sports. In order to reduce the probability of athletes' sports injury and improve the judgment of athletes' action safety, the inherent laws of sports actions are fully excavated, the development of action safety is promoted, and learners and instructors are caused to fully understand the safety of actions. This study uses the LSTM (long short-term memory) cyclic neural network algorithm to judge the safety of athletes in sports competitions. The experiment verifies the effectiveness of the LSTM cyclic neural network algorithm in basketball segmentation and recognition. Sports injury is one of the important factors affecting the performance of all sports, and the problem of athletes' injury is worrying, so it is very necessary to effectively prevent potential sports injuries. Through the investigation of different professional athletes, the LSTM cyclic neural network algorithm is used for the whole process of extracting an independent motion action including continuous actions. It is used to distinguish key postures and nonkey postures in an action, and to judge the correctness of the action. Basketball skills here are mainly the movements of basic skills such as moving, passing the ball, dribbling, shooting, breaking with the ball, personal defense, grabbing the ball, stealing the ball, and grabbing the ball. The research results prove that the LSTM recurrent neural network algorithm has a good effect on the safety of athletes. For athletes, 41.9% of people can improve the safety of their movements by strengthening strength training.

1. Introduction

Physical education coaches ignore the general laws of human body movement and play football games with high intensity without warm-up. According to the characteristics of physical education and training, the preparatory activities should follow the principle of step by step. In recent years, due to the frequent occurrence of sports safety accidents, the safety of sports competitions has attracted extensive attention from all walks of life. In particular, the occurrence of school sports accidents not only endangers students' health but also puts a certain pressure on the school's teaching control. There are constant disputes between parents and schools, endangering students' lives. Because the nonprofessional athletes do not understand the sports safety

knowledge, the evaluation of sports ability is insufficient, they often carry out some sports beyond their scope, and the identification of external risk factors is insufficient. These reasons lead to frequent sports safety accidents in recent years. The occurrence of sports safety accidents will bring a series of problems.

Deep learning evolved from machine learning, and deep neural networks evolved from artificial neural networks with deep network structures. The LSTM recurrent neural network is an improved version of the RNN neural network. It mainly solves the problem of gradient disappearance, which can make the network remember the content for a longer time and make the network more reliable. This feature of LSTM is caused by the improvement of its hidden neuron structure and does not need to change the training method of the network.

For action recognition, many experts at home and abroad have been researched. Guo et al. extracted features from the initial 200 ms EMG, applied Kohonen and the supervised Kohonen neural network, and compared the results with the BP neural network. Experimental results show that the supervised Kohonen neural network is better than the other two algorithms, and the average recognition rate can be increased to 88.4% [1]. Zaborski et al. believe that standard-based morphometric methods or modern genetic analyses are not always reliable enough and may be replaced by multivariate statistical methods, especially discriminant analysis and cluster analysis, and the Kohonen artificial neural network included in data mining. The hypothesis of the complex species of *Amidostomum acutum* is divided into three different species [2]. Yong et al. use the local mean decomposition (LMD) method and supervised Kohonen neural network (SKNN) for sound signal analysis. The optimal SKNN model is obtained after training samples. Experimental results show that the comprehensive recognition rate of the coal-rock interface is as high as 89%. The interface can be effectively identified through sound signal analysis [3]. Martin et al. proposed a new dual-temporal convolutional neural network (TSTCNN). When applied to table tennis, it can detect and recognize 20 table tennis shots. The model has been trained on a specific dataset, the so-called TTStroke-21, which was recorded under the natural conditions of the School of Physical Education of the University of Bordeaux [4]. In order to improve the recognition rate of sports athletes, this study analyzes the motion recognition system based on clustering regression and improved ISA deep network. The network data collection method is used to construct the athlete's action video library, the basketball event is taken as an example for analysis, and identification is performed through feature judgment [5]. Shih and Lin compared the expected performance of taekwondo athletes, weightlifters, and non-athletes and then linked these performances to their emotional recognition performance. This study mainly found that accurate motion prediction does not necessarily depend on the dynamic information of the motion. The results show that facial emotion recognition plays an important role in the action prediction of fighting sports such as taekwondo [6]. Ramesh and Mahesh initially tried to evaluate the performance of the deep convolutional neural network architecture on the ordered frame sequence of sports video. It believes that the main purpose of sports video classification is to help viewers find videos they are interested in for training and improving performance. Convolutional neural networks can be widely used as a powerful classification model for image recognition problems [7]. These studies have improved the effective reference for this study, but due to the limitations of related experiments, such as data sources and too many variables in the experiment process, the results of the experiment are questionable.

Compared with the total score of the FMS test, there is no significant difference in the total score of the FMS test of athletes with different competitive abilities, training years, and BMI. Feature action recognition methods based on gesture selection, most human action recognition

algorithms contain many parameters that need to be manually adjusted, which seriously affects the realization of the algorithm's real-time function. In this study, the LSTM recurrent neural network is used to extract the features of the human body. It solves the problem of traditional feature extraction. The clustered keyframes are used as the hidden state, and the parameters are initialized to enhance the applicability of the algorithm. It is helpful to take differentiated processing according to the weight of the information contained in the subsequent recognition work, focusing on the recognition and calculation of those gestures of great significance, which helps to improve the degree of automatic analysis and reduce the complexity of analysis. Guided by the theory of sports injury risk assessment, combined with the results of expert interviews, the indicators were designed to form the screening indicators and methods for the risk of sports injuries in youth; the scientificity of the screening indicators for the risk of sports injuries in adolescents was verified, and the evaluation standards were established.

2. Judgment Method of Operation Safety

2.1. LSTM Recurrent Neural Network. An artificial neural network is a system that intelligently processes input information by imitating the functions of the human brain. The basic processing unit of a neural network is a neuron, which is often called a "processing unit" [8, 9]. Artificial neuron abstracts the process of biological neuron processing information and then describes it in mathematical language. It is a simulation of the structure and function of the biological neuron and finally expressed by a model [10].

The LSTM transforms the skeleton into another coordinate system, replacing the original skeleton as input, to gain robustness to scale, rotation, and translation, and then extracts salient motion features from them. The sigmoid forget gate in LSTM determines whether the information is retained during the process of information transmission between neurons. As shown in Figures 1–5, the dots represent allowed information transmission, and the crosses represent information truncation [11]. If allowed, the information will continue to be passed to the next node or the next hidden layer; if not allowed, the information will be ignored. In LSTM, the truncated information will not affect the calculation of subsequent neurons, and the released information will affect the subsequent calculations. It is through these switches that we can decide whether to pass on the influence of previous information. The LSTM memory valve is shown in Figure 6:

The advantages of the Kohonen network: the Kohonen network can map the human input pattern into a one-dimensional or two-dimensional graph at the output layer and keep its topology unchanged; the network can make the weight vector space and the probability of the input pattern through repeated learning of the input pattern. The distribution area is consistent, that is, probability retention. Each neuron in the input layer sends the input information to each neuron in the output layer through the weight coefficient vector. The neural network through repeated self-

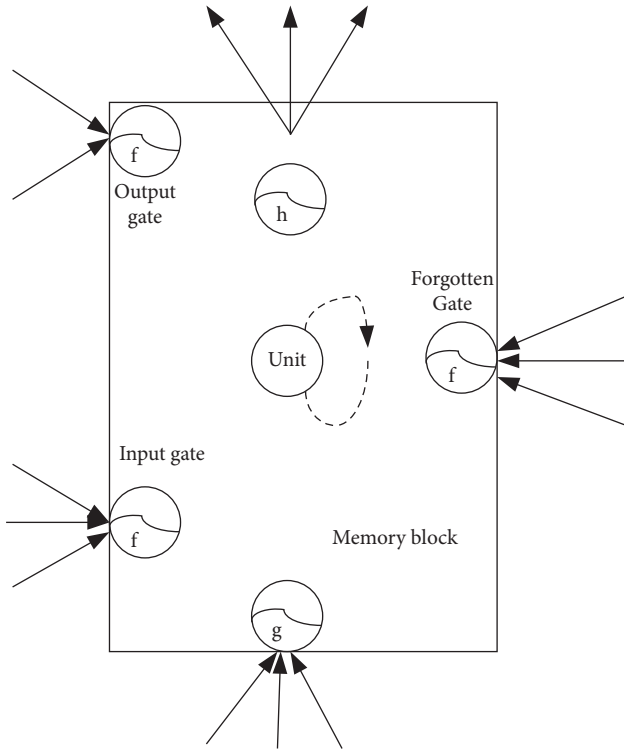


FIGURE 1: The internal structure of the LSTM memory block.

organization learning of the input layer mode connects the spatial distribution density of the weight coefficient with the input mode. The probability distribution tends to be the same. At this time, the spatial distribution density distribution of the connection weight coefficient can reflect the characteristics of the input mode [12, 13].

This study uses the sigmoid function. According to the characteristics of the sigmoid function, the value is between 0 and 1. g is the input function of the unit, and h is the output function of the unit. They usually use the tanh function or the sigmoid function%. The tanh function is generally used in the state and output, which is the processing of data. The multiplication gate will provide the output value to the nodes in the other network of the memory block. The activation functions of the input gate, output gate, and forget gate all use the sigmoid function to generate values between 0 and 1. The internal structure of the memory block of LSTM is shown in Figure 1:

We can regard the basic processing unit of the LSMT recurrent neural network as a neuron. For an n -dimensional input pattern, then, there are n input neurons. These neurons are connected to the output neurons to a certain degree, and the degree of weighting varies. The connection, that is, the connection right, is different. The output layer is a two-layer neural network structure, the neurons in the output layer are also connected to each other, and these connections have a certain weight [14].

One mode pk among the M learning modes is randomly selected as the input layer of the network, and the input mode is normalized.

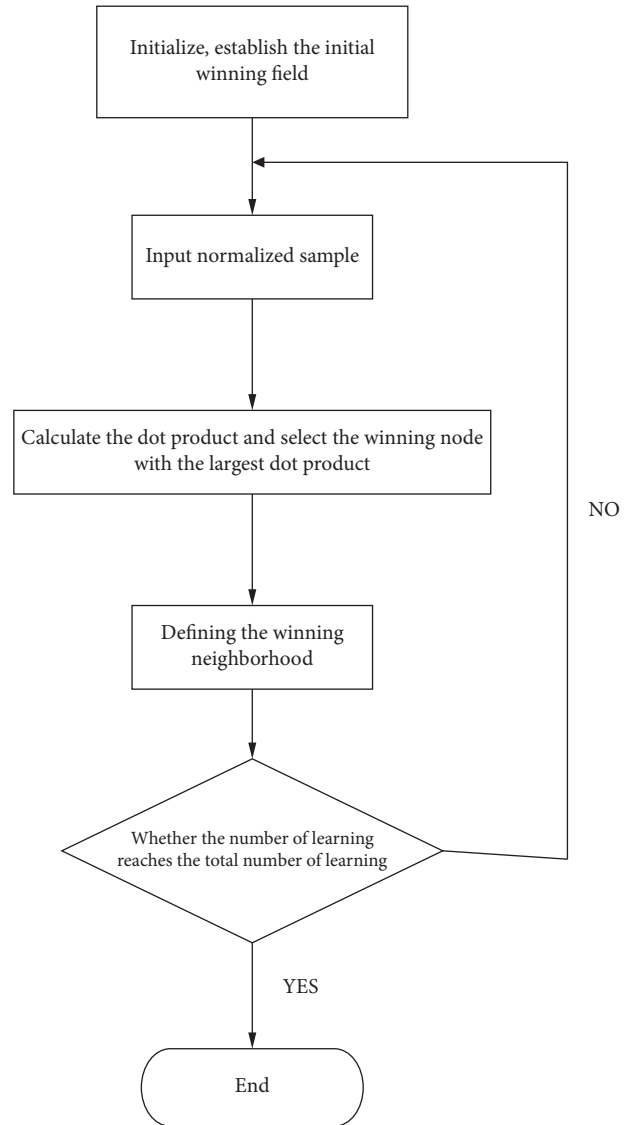


FIGURE 2: Kohonen neural network algorithm flow.

$$\bar{P}_k = \frac{Pk}{|Pk|} = \frac{(P_1^k, P_2^k, \dots, P_n^k)}{\left[(P_1^k)^2 + (P_2^k)^2 + \dots + (P_n^k)^2 \right]^{1/2}} \quad (1)$$

At the same time, the connection weight vector is normalized, and then, the Euclidean distance between \bar{P}_k and \bar{W}_j is calculated as follows:

$$\bar{W}_j = \frac{W_j}{|W_j|} = \frac{W_{j1}, W_{j2}, \dots, W_{jm}}{\left[(W_{j1})^2 + (W_{j2})^2 + \dots + (W_{jm})^2 \right]^{1/2}} \quad (2)$$

$$dj = \left[\sum_{i=1}^N (\bar{P}_i^k - \bar{W}_{ji})^2 \right]^{1/2}$$

After all the N inputs are calculated, the minimum Euclidean distance d_k is found to determine the optimal matching neuron g . The calculation formula is as follows:

$$d_g = \min [d_j], j = 1, 2, \dots, M. \quad (3)$$

The connection weights are adjusted, and the connection weights between all neurons $N_g(t)$ in the neighborhood of the output layer and the neurons in the input layer are modified.

$$\overline{W}_{ji}(t+1) = \overline{W}_{ji}(t) + \eta(t) * [\overline{P}_i^k - W_{ji}(t)]. \quad (4)$$

Correspondingly, $\eta(t)$ and $N_g(t)$ are updated, that is, the learning rate and neighborhood range are updated.

$$\eta(t) = \eta(0) \left(1 - \frac{t}{T}\right). \quad (5)$$

Among them, $\eta(0)$ is the initial learning rate, t is the number of learning, and T is the total number of learning.

The correction formula of the neighborhood function is as follows:

$$N_g(t) = INT \left(Ng(0) \left(1 - \frac{t}{T}\right) \right). \quad (6)$$

This kind of network simulates the function of self-organizing feature mapping of the brain nervous system. It is a kind of competitive learning network, which can conduct unsupervised self-organizing learning in learning. The role is played by the neighborhood and its adjustment. In the SOM network, the neighborhood defines the range of neurons that can adjust the connection weight at the same time as the winning neuron. In the initial stage of learning, the range covered by the neighborhood is relatively large, generally within the amplitude of the output layer array, or it can cover the entire output layer [15]. As the learning progresses further, the range of the neighborhood gradually $N_g(t)$ becomes smaller, eventually reaching the expected range. The algorithm flow is shown in Figure 2:

At present, the traditional moving image collection or feature extraction method generally uses a horizontal camera or an overhead camera to collect video images with moving actions. Since the horizontal camera detects the moving image of a target above a certain height in the horizontal direction, there will be many interference images, so it is difficult to set a clear detection area. The input of the system training data is X , the expected output is Y , and then, the general input of each neuron in the hidden layer is as follows:

$$H_j = \sum_{i=1}^n \phi_{ij} x_i. \quad (7)$$

In order to simplify the calculation, the output results of each hidden node can be obtained:

$$net_j = f(H_j), \quad j = 1, 2, \dots, l. \quad (8)$$

The input of each output node is as follows:

$$O_k = \sum_{j=1}^l H_j w_{jk} \quad k = 1, 2, \dots, m. \quad (9)$$

Suppose we expect the value of the i -th output neuron to be d_i , then, the prediction error of the i -th neuron is $e_i = d_i - y_i$, and then, the error function of the output layer is as follows:

$$E = \frac{1}{2} \sum_i e_i^2 = \frac{1}{2} (d_i - y_i)^2. \quad (10)$$

For each input $X(k)$, the output $Y(k)$ of each layer is calculated:

$$Y(k) = [y_1(k), y_n(k)], y_j^i(k) = \phi(s_j^i(k)) = \frac{1}{1 + e^{-s_j^i(k)}},$$

$$s_j^i(k) = \sum_{i=0}^{N_{i-1}} W_{ji}^i y_i^{i-1}(k) = (W_{ji}^i)^t Y^{i1}(k),$$

$$\begin{aligned} (W_{ji}^l)^T &= [w_{j0}^i, w_{j1}^i, \dots, w_{jN-1}^i], w_{j0}^i = -\theta_j^i, (Y^l(k))^t \\ &= [1, y_1^i(k), \dots, y_{N1}^i(k)]. \end{aligned} \quad (11)$$

Therefore, the general situation can be obtained, that is, for any i -th layer, there is the following:

$$\Delta w_{ji}^l(k) = \delta_j^l(k) y_i^{l-1}(k). \quad (12)$$

Therefore, the error data transfer equation between the input layer and the hidden layer is as follows:

$$\Delta \phi_{ij} = -\eta \frac{\partial E}{\partial \phi_{ij}} \quad i = 1, 2, \dots, n. \quad (13)$$

Because of the sigmoid function $f'(x) = f(x)(1 - f(x))$, the result obtained is as follows:

$$\Delta w_{jk} = -\eta (d_i - y_i) y_i (1 - y_i) net_j. \quad (14)$$

Also because

$$\frac{\partial y_k}{\partial net_j} = \frac{\partial y_k}{\partial O_k} \frac{\partial O_k}{\partial net_j} = y_k (1 - y_i) u_{ki}, \quad (15)$$

$$\frac{\partial net_j}{\partial w_{ij}} = \frac{\partial net_j}{\partial H_i} \frac{\partial H_i}{\partial w_{ij}} = net_j (1 - net_j) w_j.$$

Then, the formula can be further expressed as follows:

$$w_{ij}(t+1) = w_{ij}(t) + \eta \sum_{k=1}^m (d_k - y_k) y_k u_k net_i (1 - net_i) x_j. \quad (16)$$

The neural network is used to train the data according to the above steps. Due to the characteristic that errors can be transmitted backward, in the process of using data to train the network, the weights between each layer are continuously adjusted until the obtained data are close to the expected result. The centroid of the variables of the samples corresponding to each neuron after classification is calculated, the median of the variables of the corresponding

samples is used as the centroids, and the centroids of the variables of the corresponding samples are used to update the connection weights of each neuron.

2.2. Sports Action Safety. Usually due to irregular movement, adverse climate factors, or sudden environmental factors, such as wet road after rain, insufficient light, high or low temperature, jet lag factors, and altitude changes, sports safety is threatened. As an important part of human life, sports become one of the values pursued by human society because it can meet the different needs of human society [16, 17]. Sports competition is a basic form of sports, which is determined by the competitive nature of sports and sports competition as a social and cultural system. All practical activities of competitive sports are guided by competitive competitions. The selection and training of athletes must be based on the requirements of modern sports competitions for the intensity of competitive competitions, determine the direction and standards of selection and training, and form sports teams through competitive sports. The role of sports competitions in various sports academies is very common. With the rapid development of sports, many competitions also appear from time to time.

At present, the distribution of sports injuries in track and field events is mainly on the limbs and trunk, and soft tissue injuries are more common. Lack of knowledge of sports healthcare and insufficient attention to the prevention of sports injuries are the potential factors causing sports injuries [18]. Sports specialty students' training time is short, the training system is not strong, coupled with factors such as unreasonable training arrangements, improper preparation activities, poor physical fitness, and movement skills, and difficult training environments, and they are prone to sports injuries. Without adequate rest and treatment, training with injuries is more likely to lead to aggravation of injuries or induce new injuries. Therefore, the prevention of sports injuries and the treatment and recovery after sports injuries are particularly important for sports specialties [19]. In addition to the above points, the reasons for athletes' sports injuries are the movement problems that this study wants to discuss. Sports movements are generally divided into regular movements, unconventional movements, and wrong movements. Conventional actions generally refer to standard actions. Unconventional technical actions are different from wrong actions. Unconventional technical actions are a kind of performance in the game, and wrong actions are contrary to the standard of action and are easily injured by athletes [20].

As the main body of competitive sports, the country has invested a lot of mental, human, and financial resources to train an outstanding athlete. Athletes have invested precious youth and hard work to achieve good results and reflect their social value by virtue of their own competitive ability. The development of competitive sports athletes and the improvement of competitive sports levels may be restricted due to sports injuries, hindering the career development of athletes. Therefore, having a healthy body is one of the important reasons for athletes to extend their sports career

life, and the prevention and rehabilitation of sports injuries are very important [21]. Therefore, the research of sports movements also appears to be particularly critical.

In recent years, more and more attention has been paid to the training of sports injury prevention and treatment personnel, but the injury protection system of athletes has not been perfected. At this time, athletes' own sports injury prevention is more important. Athletes' awareness of sports injury prevention may affect their time and method of medical treatment and their attitude toward treatment, which in turn affects their recovery speed after injury. Therefore, understanding athletes' cognition of sports injury knowledge and discussing related influencing factors can provide important information for coaches or people involved in sports injury protection.

2.3. Action Feature Extraction. The current action feature extraction methods can be roughly divided into two categories: (1) extraction based on feature parameters; (2) extraction methods based on model measurement [22]. The basis of this classification is whether they used the model, and the model is equivalent to the advanced processing products after feature parameter extraction, so the model method obviously has higher reliability based on the feature parameter method, but the corresponding processing calculation method is more complex, so which feature extraction method should also be selected according to the specific situation of the studied problem [23].

The feature-based extraction method is a relatively basic extraction method that has been studied for a long time and is relatively mature and simple. This extraction method does not involve the establishment of a human body model, so the amount of calculation is usually much smaller than that of model-based extraction methods. Because of the nature of the extracted feature parameters, the apparent features are usually extracted from the area of the moving human body, usually some two-dimensional information such as contours, colors, heights and widths, and perimeters [24]. Then, these characteristic parameters are used to match with the human body movement to achieve the purpose of recognition and analysis.

In the feature-based extraction method, various apparent feature parameters are extracted, and the contour feature is one of several important ones. Although the methods are different, their steps are relatively similar. They can usually be divided into background subtraction, human body monitoring, processing to eliminate noise, and feature extraction.

For video information, color information occupies a very important role as one of the information. The information contained in color information when information is usually obtained through human vision occupies a large proportion of the total amount of information obtained from video. Therefore, in the research of automatic recognition of action behavior, color is often selected as the characteristic parameter because of its characteristics [25]. The application of color in the research is diverse. Researchers have set up human bodies and backgrounds with large color differences

to more highly extract human bodies from video. This ideal situation is relatively rare in reality. Therefore, in order to solve the problem of complex background colors, methods for marking colors in images were proposed. For example, based on RGB and HSV color space and grayscale-based colors are two more popular marking methods.

There are significant differences in the FMS test scores of athletes of different genders, age-groups, with or without injury history, and training bases. There are significant differences in the patterns. Based on the model method to identify the characteristic information of the moving human body, the first step is to establish a human body model. The establishment of this model requires a lot of preliminary work. It needs to use human body structure and a large number of examples to verify to establish a human body model. The second part is to extract feature parameters from the underlying features to match this model to drive this model, so as to obtain various information that was about the moving human body. This model can be used to characterize any individual, so it has a better recognition effect than the feature method for humans with different shapes, and even if the feature acquisition is inaccurate and it is difficult to match the model, the motion law can be made according to the estimation of the human body posture. The real human movement is restored to the greatest extent. These advantages are also the reason why the model method is becoming more and more common and gradually becoming the main direction of the development of human movement consciousness.

3. Judgment Experiment and Results of Action Safety

3.1. Database. Functional movement screening is a screening system that predicts exercise risk based on the basic movement patterns of the body. It is widely used in various fields due to its easy operation and remarkable screening effect. In the database conceptual design stage, it considers the constraints and processing requirements of the data in the position of all participants in the competition and designs a data model based on the concept of system participants—a conceptual model. The conceptual model is concretized to refine the requirements analysis. The conceptual structure abstracts the real world. By abstracting things in reality into an information structure independent of specific machines, the tasks at each stage are single, reduced in complexity, and independent of a certain DBMS. We use the statistics of student athletes in a middle school in this city, combined with the widely used human motion data in human motion recognition. The database service can record and alert database risk operation behaviors such as database injection and risk operation. The athlete action database and ECS self-built database are supported and provide security diagnosis, maintenance, and management capabilities for the action database. The motion database is shown in Figure 3:

Let us take a basketball player as an example. We use sensors to analyze the player's movements. The experiment starts at an angle of 0 degrees and continues to rotate the

sensor node at an angle of 1,080 degrees, sampling data every 90 degrees. The experiment is divided into two groups. In order to compare the compensation effect of the Kalman filter on the angle calculation, the first group of the experiment does not use any compensation method and directly obtains the rotation angle of the sensor through the angular velocity integration; the second group uses the extended Kalman. The filtering method compensates for the angle output of the sensor node. The compensation results are shown in Table 1.

The comparison of the error data before and after compensation is shown in the table. After rotating by 1,080 degrees, the angle calculation error without any compensation method has reached 10 degrees, while the compensated angle calculation error is only 0.37 degrees. It can be seen that the algorithm can effectively compensate for the error caused by the angular velocity integral and improve the human body.

Some athletes have weak shoulder and hip flexibility, stability and core strength, poor coordination, and serious body asymmetry. In the process of data collection, the tester's 9 types of actions such as walking, running, jumping without the ball, standing dribbling, walking dribbling, running dribbling, shooting, passing, and receiving the ball when the tester is without the ball are collected. The basketball action is shown in Figure 4:

As the basketball action progresses, the aspect ratio of the moving human body in the image sequence will also change. These changes in the aspect ratio can reflect information such as the speed of movement outside of the contour feature, and the human body in action can be drawn according to the amount of change. The result is shown in Figure 5:

In the data collection process, according to the different placement positions of the sensor nodes on the body, the collected upper limb movement and lower limb movement data will be separately discussed and identified. Therefore, for upper and lower extremity movements, classifiers are separately constructed for recognition. Through the combination of upper and lower extremity movements, the movements made by athletes can be determined. In this study, the classification characteristics of different classifiers are analyzed and the basketball gesture recognition of different classifiers is compared. For classification performance, according to the movement data of different limbs, the corresponding classification algorithm is constructed for training, and the recognition effect is analyzed from the accuracy rate and recall rate. The upper and lower limb movement test results are shown in Tables 2 and 3:

It can be seen from the table that the recognition effect achieved by the LSTM cyclic neural network is better for the classification of different limb movements. The average accuracy rate of upper limb movements reaches 93%, the average recall rate reaches 92.1%, the average accuracy rate of lower limb movements reaches 98.1%, and the average recall rate reaches 99%.

3.2. Action Comparison. We express the recognition result in the form of a confusion matrix graph, where the diagonal line is the correct recognition rate of the corresponding category, and the off-diagonal line is the recognition rate of



FIGURE 3: Movement database.

TABLE 1: Error before and after output angle compensation.

Rotation angle	Error after compensation	Error before compensation
0	0.24	0.01
90	0.31	0.03
180	-0.01	-0.51
270	-0.03	-0.07
360	-0.43	2.69
450	0.14	2.02
540	-0.03	3.02
630	0	3.51
720	-0.04	8.27
810	-0.01	9.13
900	-0.69	7.89
990	-0.03	8.85
1080	0.36	9.15

the wrong category. From the comparison of the two confusion matrix diagrams, it can be seen that the recognition result using only static features is significantly lower than the recognition result of combining static features and dynamic features. The addition of dynamic features can improve the recognition effect, and the combination of dynamic features and static features can improve the recognition effect. Strong ability to characterize actions is more suitable for action recognition, as shown in Figure 7:

We compare the recognition results without frame selection and after frame selection, where the abscissa is the specific eight types of actions, and the ordinate is the recognition rate. The result is shown in Figure 8:

Due to the different levels of exercise, the sports skills they accept are also different, the injuries caused and the number of injured parts experienced are also different, and there are obvious differences in the recognition of sports injury names. Figure 9 shows the analysis of differences in cognition of injury names among physical education students of different specialties:

It can be seen that there is little difference in the scores of sports majors of different specialties for injury names. The highest score is 4.90 for “basketball”; the lowest score is 4.81 for “wushu.” The one-way analysis of variance on the cognitive differences of sports majors in different specialties showed that there was no significant difference between the groups.

For basketballs that are prone to action safety, we surveyed professional athletes and counted the training they believe can effectively prevent related work. The results are shown in Figure 10:

It can be seen that most athletes believe that the prevention of physical factors such as strengthening strength training and agility training is very important. Among them, 41.9% felt that strengthening strength training had a great effect on preventing injury, 35.3% felt that the effect was large, and 21.1% felt that the effect was general. From the aspect of project characteristics, the prerequisite for successfully completing difficult movements is to ensure sufficient muscle strength and good physical agility, which requires strengthening of strength and agility.

4. Discuss

With the rapid development of the electronic information industry today, artificial intelligence has been greatly improved compared to the past. With the popularization of video capture equipment and the improvement of computer performance, computer vision technology has also ushered in a rapid development period. At the same time, human body action recognition is closely related to our lives and has huge potential value. Human action recognition technology based on computer technology and image recognition technology is also a hot field of research today. The application of the LSTM recurrent neural network to the safety recognition of sports actions has also become a trend.

This study selects a segmentation method of continuous motion human motion in video based on human motion



FIGURE 4: Basketball action collection diagram.

feature parameters to realize a sports motion recognition method with simple calculation and better real-time performance. In order to reduce the workload and improve the real-time performance during the video processing and analysis, the noncritical gestures can be eliminated for the

key gestures. Through the analysis of the specific actions of the moving human body, the extraction method based on the motion feature parameters is adopted. It is different from the model method in that it does not need to build a human body model, usually the calculation complexity is relatively

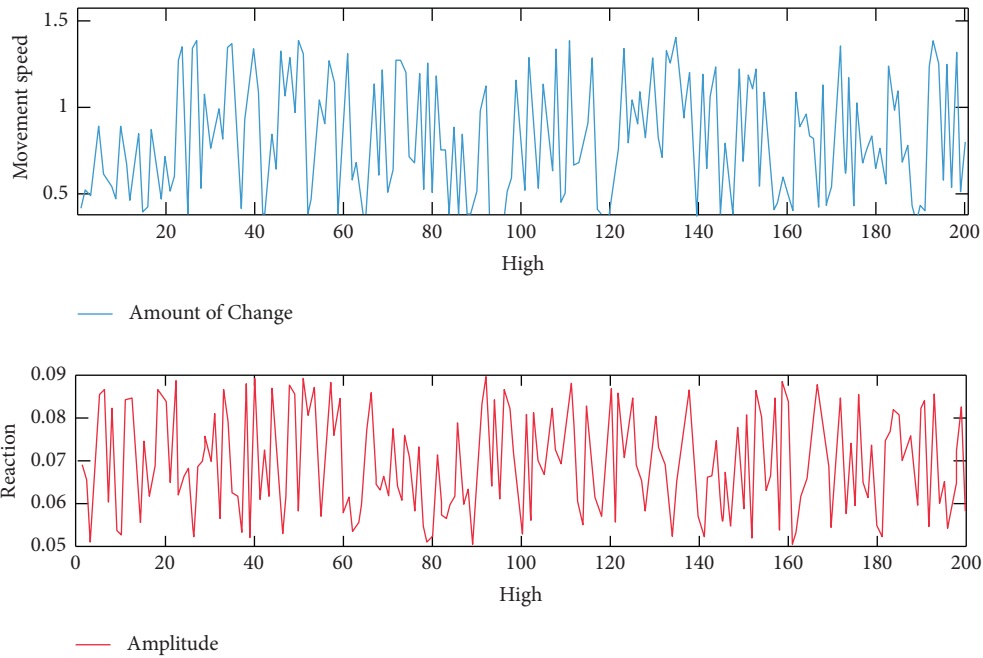


FIGURE 5: Basketball action speed curve.

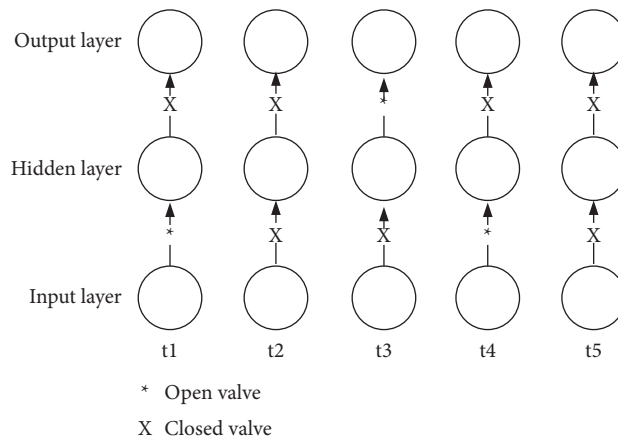


FIGURE 6: LSTM memory valve.

TABLE 2: Basketball upper limb movement test.

Action	C4.5		SVM		BN		LSTM	
	Recall rate	Accuracy	Recall rate	Accuracy	Recall rate	Accuracy	Recall rate	Accuracy
Catch the ball	0.928	0.943	0.954	0.965	0.884	0.918	0.954	0.967
Pass	0.909	0.921	0.965	0.989	0.925	0.945	0.972	0.971
Shot	0.914	0.908	0.977	0.983	0.947	0.904	0.968	0.971
Walking dribble	0.876	0.852	0.921	0.907	0.789	0.934	0.922	0.907
Standing dribble	0.775	0.756	0.806	0.548	0.768	0.702	0.894	0.866
Running dribble	0.771	0.811	0.681	0.851	0.803	0.746	0.864	0.886

low, and the motion feature can carry enough parameters that can be used for the recognition and analysis of the moving human body. Due to the serious jump problem when extracting the feature parameters, the method of

increasing the dimension to reduce the sensitivity of the vector modulus is used for optimization.

For sports, it is necessary to establish a sound competition operation mechanism. The operation mechanism

TABLE 3: Lower limb movement test results.

Action	C4.5		SVM		BN		LSTM	
	Recall rate	Accuracy	Recall rate	Accuracy	Recall rate	Accuracy	Recall rate	Accuracy
Jump	0.986	0.983	0.972	0.988	0.968	0.965	0.974	0.988
Run	0.972	0.971	0.987	0.968	0.944	0.964	0.986	0.974
Walk	0.969	0.965	0.977	0.985	0.979	0.947	0.992	0.983
Average	0.973	0.973	0.989	0.987	0.971	0.969	0.981	0.989

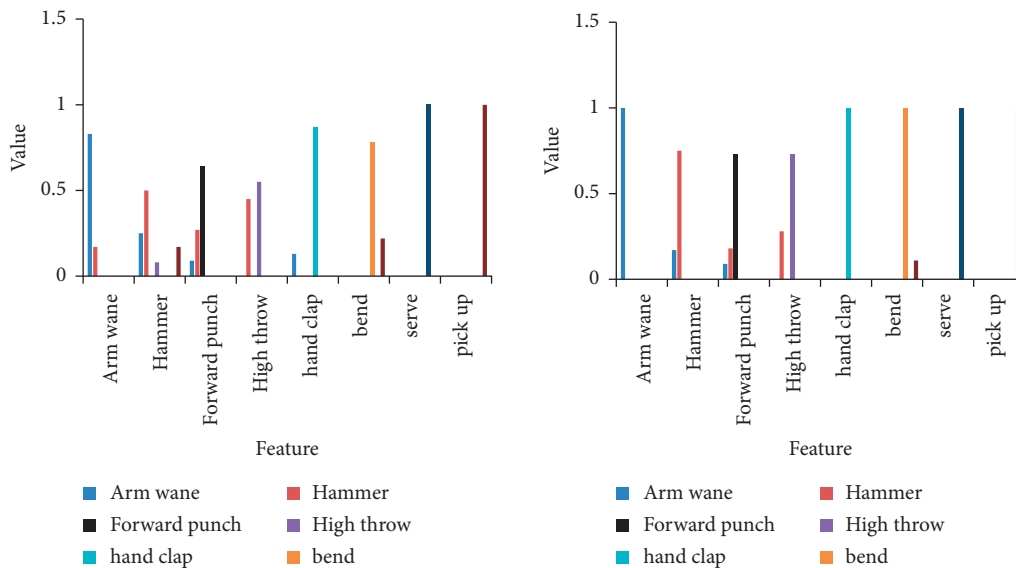


FIGURE 7: Dynamic recognition and static recognition.

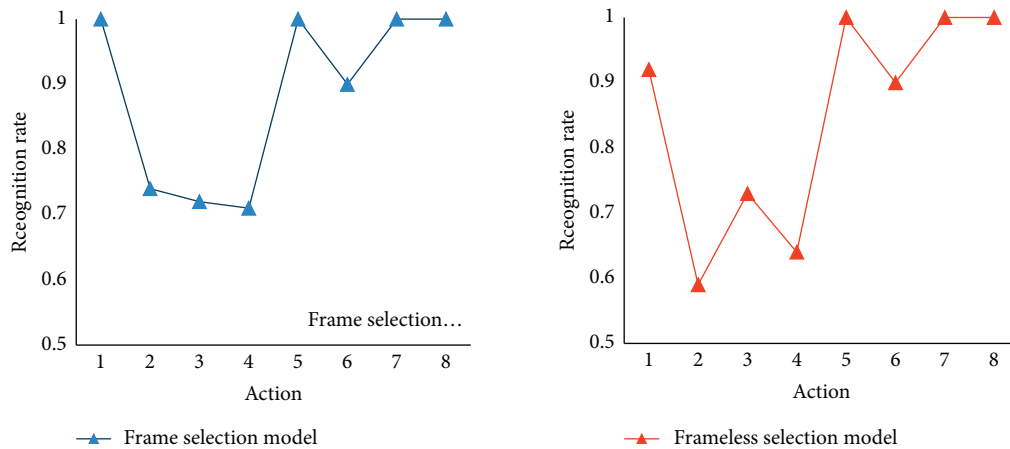


FIGURE 8: The action is recognized in the presence or the absence of frame selection.

refers to a mechanism in that people try to establish a certain goal and realize a certain desire and demand as the starting point and ending point. The national sports academies' competition operation mechanism is the process in which the various constituent factors have an impact and play a role in the process of completing the development goals of the cooperative association competition. The development of national sports college competition activities meets the needs of three different levels: one is the highest level, that is,

it meets the needs of the country's education and sports development; the other is the need for the middle level, that is, the development of each cooperative unit, the need for mutual communication to promote and improve; the third is the need for microlevel, that is, to meet the personal development needs of participating athletes and coaches. These three different levels of needs that constitute the needs of the development of competition activities in national sports colleges and universities and are the power source to

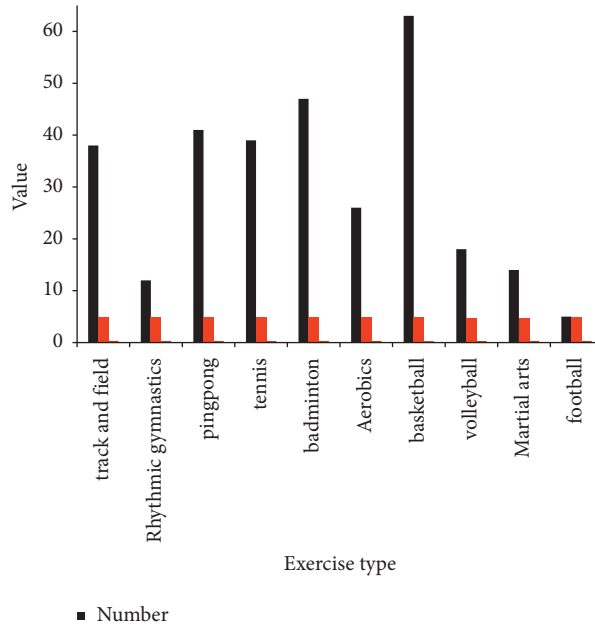


FIGURE 9: Cognitive difference analysis diagram.

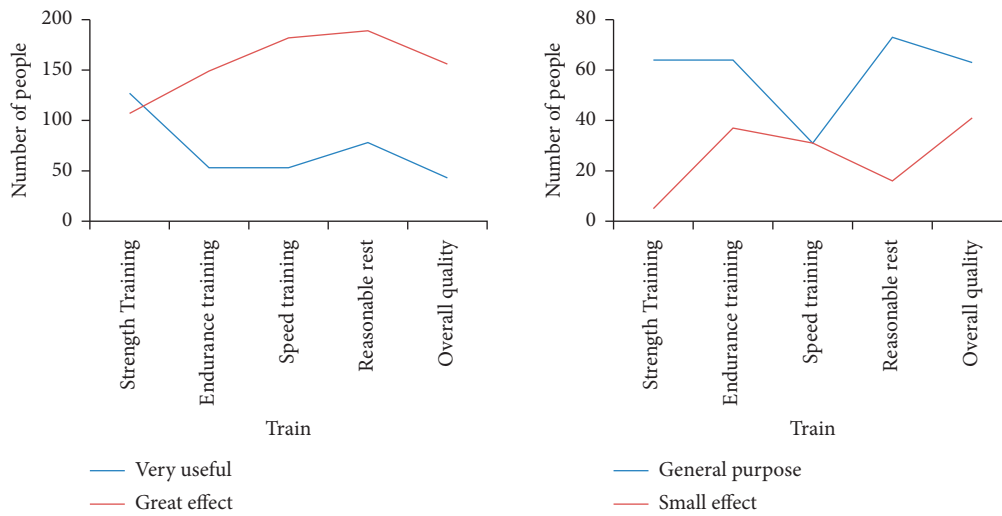


FIGURE 10: Training to prevent wrong movements.

promote their development. Only by meeting the needs of these three levels and integrating them, the operation of national sports colleges and universities can be unblocked and the competition development goal of national sports colleges and universities can be realized.

In terms of the implementation of corrective training, due to the influence of competition, technical, and tactical training content, athletes cannot complete corrective training content in quality and quantity during the correction period and are affected by various objective factors, so they should pay attention to the preparation work before class, competition, and activities. Sports equipment is complete, and physical condition is good. Establishing a reasonable competition operation mechanism is a guarantee system for the development of competition activities

in sports colleges across the country. The further improvement of the competition system is to fully mobilize the enthusiasm of schools, society, and the country to participate, improve the level of competition, make the competition better serve education and sports, and serve the development of individuals and society. Therefore, the arrangement of competition activities should be scientific and reasonable, and the needs of systematic teaching and training should be met to the greatest extent. At the same time, multiperiod competition activities should be developed to meet the needs of different levels and different levels of competition teams, and necessary single competitions should be carried out. The reform meets the needs of market competition and makes the development of the project realize a virtuous cycle. Through the

continuous improvement of the competition system, the competition management goal of conforming to the market and serving teaching, scientific research, and training is achieved.

For athletes, attention should be paid to body relaxation and physical recovery after exercise. The study of professional courses for undergraduates majoring in physical education is particularly important, but the study of technical courses cannot be ignored. The level of physical fitness of students greatly varies. For students with average physical fitness, thin or obese students, they should pay attention to relaxation after class and physical recovery to ensure the normal progress of the next class to avoid excessive fatigue and cause sports injuries. A good job of self-monitoring is done. Before class, before the game, before the activity need to check whether the sports equipment is complete, whether the physical condition is good (no discomfort symptoms, injury recovery), and whether the warm-up activity is sufficient. If you realize that your current physical condition is not able to complete the task, you must not force yourself instead of making self-adjustment and consulting a teacher or see a doctor in time.

5. Conclusions

Due to the limitation of monitoring and correction training time, only one training base was selected for intervention, and the sample size was too small. In addition, this study only compared a single group of experiments before and after, and no control group was designed, which could not prove the effect of the correction training program to a certain extent. Human action recognition is a research direction that combines computer vision and artificial intelligence. Kohonen neural network has been applied in the fields of abnormal human behavior recognition, intelligent nursing, and action comparison. It is one of the important technologies for the intelligent development of people's lives and has great practical significance. From the experiments in this study, it can also be seen that the LSTM recurrent neural network can play an important role in sports action recognition. The recognition of simple actions has obtained good results, but the recognition of actions in complex environments, complex interactive actions, and group action recognition still faces many difficulties and challenges. There is still a lot of room for improvement in the recognition rate. The deep features of the Kohonen neural network alone cannot accurately identify the movements of the human body. Combining the extracted human body features with the surrounding environment can eliminate ambiguity and more accurately recognize complex scenes and human body movements. In addition, in many real scenes, it is the interaction of multiple people. How to track and recognize the actions of multiple people still face great challenges.

Data Availability

No data were used to support this study.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this article.

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