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Research Article

Analysis and Application of Gymnastics Sports Characteristics Based on Artificial Neural Network and Intelligent Optimization

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Gymnastics has attracted people's attention in various competitions by virtue of its beautiful movements and difficult technical performances. The research and exploration of neural network theory are to make the process from receiving instructions to completing actions in one go while sending instructions. Compared with the previous competitive gymnastics, it mainly relies on personal understanding and coach's guidance to get high-scoring movements. Through intelligent calculation, it can decompose and calculate each movement in detail and adjust its strength, so as to further improve its excellent characteristics. We combined artificial neural network and intelligent optimization method to achieve more scientific and reasonable guidance for gymnastics, so that people can get better performance in performance and competition. The experimental summary of this paper is as follows: (1) Under the analysis of sample data 5000, it shows that the right segmentation curve is superior to the left segmentation curve and is relatively stable. (2) The BP neural network is obviously higher than the other two algorithms in the experimental test under different dimensions, and the qualified dimension value is controlled within the standard range. (3) In the experimental diagram of mean square error, the ideal error value is about 0.005, and it is possible to reach this target value only under the condition of perfect performance. (4) Convergence function is to explore the gracefulness of action analysis, and the convergence of its artificial peak group greatly shows the performance of global exploration.

1. Introduction

Gymnastics is actually a project to explore beauty. No matter from that point, it is a perfect fusion of physical and mental beauty. From the difficult movements of competitive sports to the flexibility of the body combined with the rhythm of music, it is the embodiment of aesthetics. In order to show this sport perfectly, this purpose is achieved by designing excellent calculation means. The global balance judgment is obtained. Combined with the specific analysis of related research fields, we can get balanced aesthetic characteristics without violating moral spirit. At present, sports events still need to go a difficult way in practice, so it is necessary to attach importance to the soul beauty of gymnastics development. This paper combines the development trend of gymnastics in algorithm skills. The purpose of making detailed goal planning is to make people who love this sport full of love. Combined with the background of the new era and in the context of governance modernization, this paper discusses the logical implication and practical strategy of comprehensively deepening the reform of professional sports in China [1]. It is pointed out that individual sports associations should improve their income-generating ability, aiming at promoting the smooth progress of the reform of individual sports associations in China [2]. The process investigation and logical analysis of the management mechanism of sports associations in China, combined with the reality, analyze the realistic challenges of the reform of the management mechanism of sports associations in China [3]. Through the interview method, the managers of multiitem sports associations were interviewed, and abundant first-hand research materials were obtained [4]. This paper

combs three modes of the current reform of national individual sports associations and puts forward countermeasures from the aspects of reform objectives and top-level design [5]. This paper probes into the historical evolution and contradictions of the development mode of competitive sports in China at present and provides theoretical ideas and operational suggestions for the new round of competitive sports reform and development [6]. This paper makes an in-depth study on the materialization development of Chinese Basketball Association and puts forward the path and policy suggestions to further promote the materialization development of Chinese Basketball Association [7]. This paper describes the "due" appearance of the reform and development of national individual sports associations from the perspective of national governance, examines the realistic prospect of the reform of project associations, and puts forward countermeasures [8]. It is pointed out that the perfection of sports governance system depends on the organic unity theory of government embeddedness and individual sports association autonomy, and the embeddedness governance theory puts forward the analytical framework of government embeddedness and association autonomy [9]. This paper combs the reform of China's sports management system and puts forward some ideas for the new round of sports management system reform [10]. Put forward the standard construction of "four modernizations" of sports associations, and then put forward the development and implementation path of sports associations, introduce relevant policies, and improve the corporate governance structure of associations [11]. This paper makes an in-depth analysis and research on the development of competitive gymnastics in China in recent 10 years, which shows that the development of competitive gymnastics in China presents significant regional characteristics and imbalance [12]. This paper discusses the problems existing in gymnastics textbooks at present, and it is of great significance to enrich the basic theory of gymnastics [13]. This paper probes into the continuation of the dominant position of competitive gymnastics in China and seeks the strategy of getting rid of the development dilemma of competitive gymnastics in China [14]. This paper reviews the traditional research on the evaluation index system of competitive sports and should adhere to the principles of sustainable development, self-organization, and operability [15].

2. Introduction of Intelligent Optimization and Artificial Neural Network

2.1. Basic Theory of Intelligent Optimization Algorithm.
According to the behavior of animals and the statistics of a large number of random samples, scientists have concluded that the population needs special physiological and psychological changes when taking certain behaviors. That is to say, in random search, a calculation range is determined, and the modeling process can be calculated by function calculus. An intelligent optimization algorithm is easy to implement, simple in theory, and excellent technology verified by experiments, which is a common skill for people to deal with complex problems.

2.1.1. Firefly Algorithm.
It is suggested that the relationship between absolute brightness of fireflies and objective function should be expressed as follows:

$$I_i = f(X_i), X_i = (x_{i1}, x_{i2}, \cdots, x_{iD}), \tag{1}$$

where N and D are group size and problem dimension, respectively.

To calculate the attraction between firefly populations, the mathematical formula is

$$\beta(r_{ij}) = \beta_o e^{-\gamma r_{ij}^2}. \tag{2}$$

It indicates the attraction between firefly x_i and x_j, and the light attraction at $r = 0$ is β 0. It is

$$r_{ij} = \|X_i - X_j\| = \sqrt{\sum_{d=1}^{D} (x_{id} - x_{jd})^2}. \tag{3}$$

The distance D between the two is the darker firefly's movement to the brighter, achieving better light absorption. The moving formula [16] is as follows:

$$xid(t + 1) = xid(t) + \beta(rij) \cdot (xjd(t) - xid(t)) + \alpha\tau. \tag{4}$$

T is the number of iterations, and $D = 1, 2, \cdots, D$.

2.1.2. Process Demonstration of Algorithm.
In order to show the evolution process of the algorithm more intuitively, it is realized through repeated experimental data support and iterative optimization. Detailed Figure 1 is shown.

The final parameters of this time are judged by the initial position and brightness of fireflies, and then the position and brightness of the next movement are updated.

(1) Fireflies have no gender distinction and attract each other mainly through light intensity

(2) The intensity of illumination is directly proportional to the attraction and inversely proportional to the distance between them, indicating that fireflies with darker brightness will move to brighter ones, thus realizing the dominant brightness of the group

(3) Its brightness is determined by physiological reflection and also affected by the environment

2.2. Basic Theory of Artificial Bee Colony Algorithm

2.2.1. Biological Theory of Bee Colony Algorithm.
The biological process significance of honey collection by bees lies in pollinating plants. In the process of honey collection, the work is carried out at three levels: food source, employment bee, and wandering bee. The implementation of the work should control any information to avoid omission, which can effectively improve the viscosity of bee sugar. The position transmission between bees and the emission of their own odor can cover all flowers in all aspects, so that each flower can pollinate.
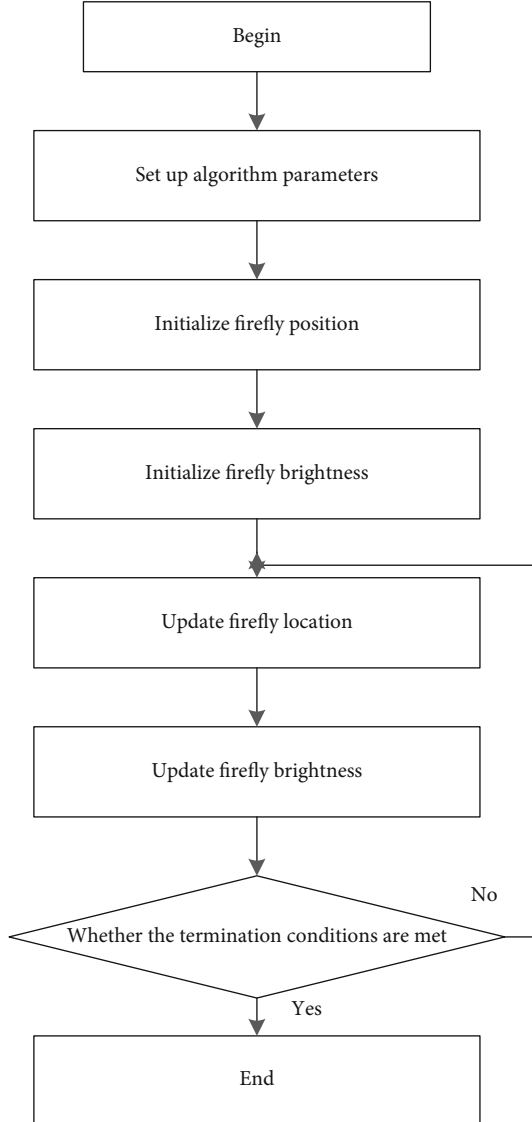
FIGURE 1: Flow chart of firefly algorithm.

2.2.2. Basic Principles of Calculation. Initialize the population [17]. The definition is

$$x_i = \left(x_i^1, x_i^2, \cdots, x_i^d\right). \tag{5}$$

Among them,

$$x_i^j \in \left(x_{\min}^j, x_{\max}^j\right), \quad i \in 1, 2, \cdots, N, \tag{6}$$

It represents the upper and lower bounds of the search space on the *J* dimension and obtains the dimension of *D*. In the process of initial population formation, it is necessary to divide the population according to the honey harvesting ability, which is aimed at not only rationally distributing the work but also effectively improving the quality and efficiency of honey harvesting.

The initial equation of population [18] is as follows:

$$x_i^j = x_{\min}^j + \mathrm{rand}\,(0, 1) \times \left(x_{\max}^j - x_{\min}^j\right). \tag{7}$$

Search for food sources

$$v_i^j = x_i^j + \mathrm{rand}\,(-1, 1) \times \left(x_i^j - x_n^j\right). \tag{8}$$

v represents the updated food location, and rand is any value between -1 and 1.

The probability of honey source [19] is as follows:

$$\mathrm{prob}(i) = \frac{\mathrm{fit}(i)}{\sum_{i=1}^N \mathrm{fit}(i)}. \tag{9}$$

Fit indicates the fitness of honey source, so as to judge the appropriate value. In terms of value, it is necessary to predict the honey amount that may appear in honey source and judge whether it meets the most basic requirements and whether it meets the daily work of the population. When an individual does not find a better source after searching for many times, he will use the existing resources to collect honey. With good food source information, the best food source can be obtained by iterative optimization for many times, which is the realization significance of this optimization.

The transformation of objective function [20] is as follows:

$$\mathrm{fit}(i) = \frac{1}{1 + fi}, \quad f_i \geq 0, \tag{10}$$

$$\mathrm{fit}(i) = 1 + abs(f_i), \quad f_i < 0. \tag{11}$$

f_i is the objective function of the food source, and abs represents the absolute value of f_i.

2.2.3. Basic Flow of Artificial Bee Colony Algorithm. Through the above analysis and calculation, a complete flow chart is constructed, and the experimental diagram is shown in Figure 2.

Through the hard work of hired bees and uninterrupted honey collection as the basic condition, we can find excellent source markers within a reasonable range, so as to get a better collection place.

2.3. Research on BP Neural Network Algorithm. The number vector of nodes between levels is calculated to construct the connection weight, and the output threshold is calculated.

In activating the function [21], the formula is

$$f(x) = \frac{1}{(1 + e^{-x})}. \tag{12}$$

The first-order function [22] is
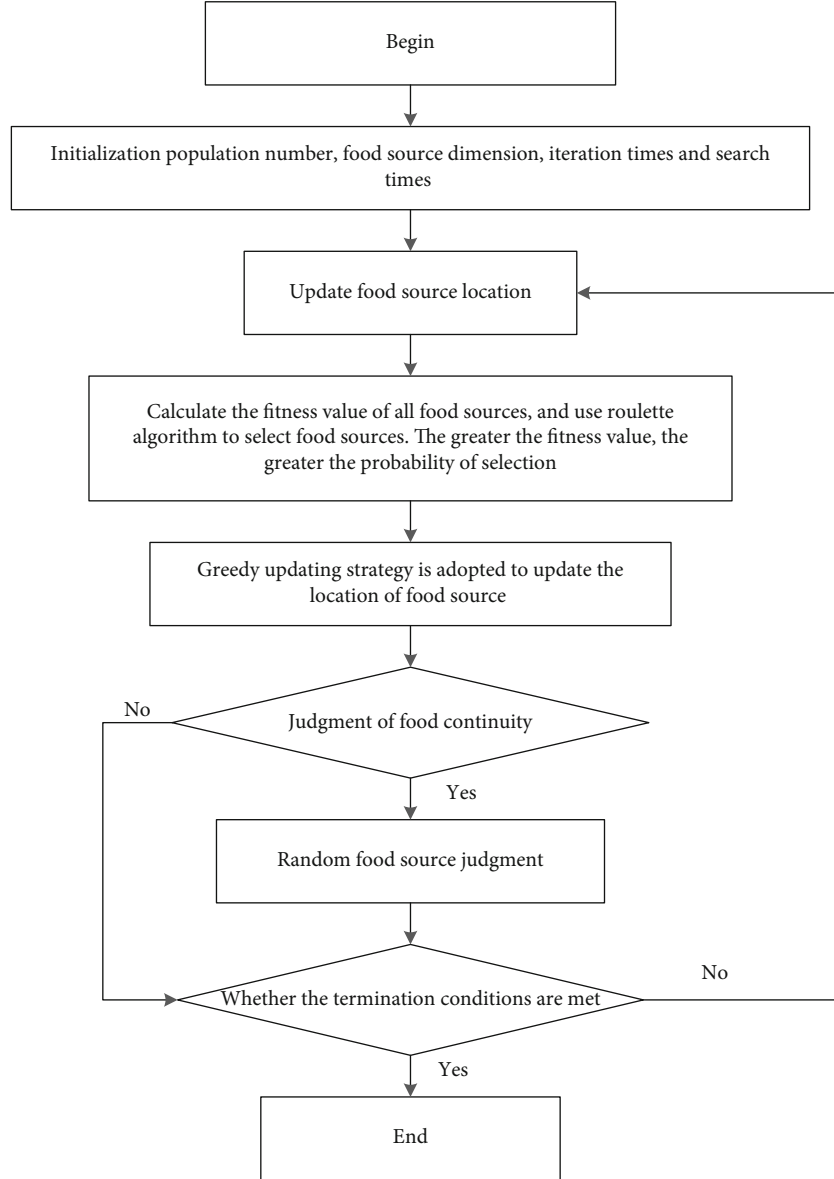
$$f'(x) = f(x)(1 - f(x)). \tag{13}$$

FIGURE 2: Flow chart of artificial bee colony algorithm.

There are also

$$s_j^{(k)} = \sum_{i=1}^{n} a_i^{(k)} w_{ij} - \theta_j, \qquad (14)$$

$$b_j^{(k)} = f\left(s_j^{(k)}\right), \qquad (15)$$

$$l_i^{(k)} = \sum_{j=1}^{p} b_j^{(k)} v_{jt} - \gamma_t, \qquad (16)$$

$$c_i^{(k)} = f\left(l_t^{(k)}\right). \qquad (17)$$

The interval value of the actual output $c_i^{(k)}$ of the network is $(0, 1)$, and the interval value of the output y_t is $[m, m]$.

Ideal output [23] is

$$\tilde{y}_t^{(k)} = (B - A)\frac{y_t^{(k)} - m_t}{M_t - m_t} + A. \qquad (18)$$

The actual output corresponds to the actual value:

$$\tilde{c}_t^{(k)} = m_t + \frac{\left(c_t^{(k)} - A\right)\left(M_t - m_t\right)}{B - A}. \qquad (19)$$

Calculate the sum of squares of errors of k learning models.

$$E_k = \frac{1}{2} \sum_{i=1}^{q} \left(1 - \frac{m_t + \left((c_t^{(k)} - A)(M_t - m_t)/(B - A) \right)}{y_t^{(k)}} \right)^2 . \tag{20}$$

In the network, there will be obvious deviation in the output value interval in the actual situation, so the ideal output is standardized and the standard interval is set as $[B, A]$. At the same time, the number of nodes in the hidden layer needs to be output to all levels of the output layer to ensure that the number of nodes in each interval is equal.

2.3.1. Mathematical Derivation of BP Network. In order to reduce the positive gradient of the sum of squares of relative errors, it is necessary to calculate the partial derivative of the actual output.

Partial derivative [24] is as follows:

$$\frac{\partial E^k}{\partial c_t^{(k)}} = \left(1 - \frac{m_t + \left((c_t^{(k)} - A)(M_t - m_t)/(B - A) \right)}{y_t^{(k)}} \right) \cdot \left(-\frac{M_t - m_t}{(B - A)y_t^{(k)}} \right). \tag{21}$$

The mean square error influence degree under k learning models can be obtained, namely,

$$\frac{\partial E^k}{\partial v_{jt}} = \frac{\partial E^k}{\partial c_t^{(k)}} \frac{\partial c_t^{(k)}}{\partial v_{jt}} . \tag{22}$$

Connect weights in a positive gradient [25], that is,

$$\frac{\partial E^k}{\partial v_{jt}} = -d_t^{(k)} b_j^{(k)} . \tag{23}$$

According to the principle of gradient descent, the negative ratio of the adjustment amount can be calculated, and the adjustment amount is

$$\Delta v_{jt} = -\alpha \frac{\partial E^k}{\partial v_{jt}} = \alpha d_t^{(k)} b_j^{(k)} , \tag{24}$$

where a is the learning rate, $a \, E \, (0, 1)$.

The adjustment amount pushed to the threshold is

$$\Delta \gamma_t = -\alpha \frac{\partial E^k}{\partial \gamma_t} = -\alpha d_t^{(k)} , \tag{25}$$

$$\Delta \theta_j = -\beta e_j^{(k)} , \tag{26}$$

where β is the learning rate, $\beta \, (0, 1)$.

3. Establishment of Neural Network Model of Gymnastics Sports Characteristics

3.1. Model Structure of BP Neural Network. The antierror algorithm based on one-way propagation of multilayer network is the most mature network optimization algorithm. In many fields, it has the conduction function that is difficult to analyze and realizes the fast output algorithm that reduces the difficulty layer by layer, weakens the definition in the sense of fixed parameters, and greatly simplifies the modeling process. Its basic structure includes the input layer, hidden layer, the output layer of the nodes connected with each other, and the same level of conduction mode of nonconnection, in order to build a network model. Its structure diagram is shown in Figure 3.

In order to study and analyze the characteristics of gymnastics, the input layer can be expressed as the gymnastics movements of athletes or related enthusiasts. The hidden layer can be expressed as the arrangement of some difficult actions. The output layer is the perfect performance of gymnastics. Through such a process, the BP neural network model of gymnastics characteristics can be established.

3.2. Training Process of Network Construction. After determining the structure of the network model, it is necessary to carry out training analysis on the network sample data (analysis of athletes' physical characteristics and action completion degree). The specific training process is as follows:

(1) The incentive function is constructed by the connection weights and thresholds between hierarchies

(2) Randomly select the action training set of remote mobilization and reprint it to the network

(3) Split and output the detailed actions of hidden layer in the form of network calculation

(4) The response of network output layer is analyzed

(5) Neuron error is analyzed under given conditions

(6) Calculate the neuron general error of hidden layer

(7) The correction of connection weight and threshold is adopted to reduce the experimental error

(8) Carry out the second optimization and improvement to get the calculation threshold

(9) Randomly select another athlete's characteristic analysis, and repeat the above before doing it, so as to make full use of the training set

(10) Carry out all the above operations, so that every athlete can go to the analysis coach to carry out education and guidance through the analysis results

Through the above-mentioned testing process, the correct concept of training and guidance is objectively considered, so that the sports improvement can effectively adapt to the arrival of special circumstances. Using the BP neural network algorithm to stimulate the action of the data set of learning more quality fitting effect greatly enriched the gymnastics in the health activities of the degree of interest.
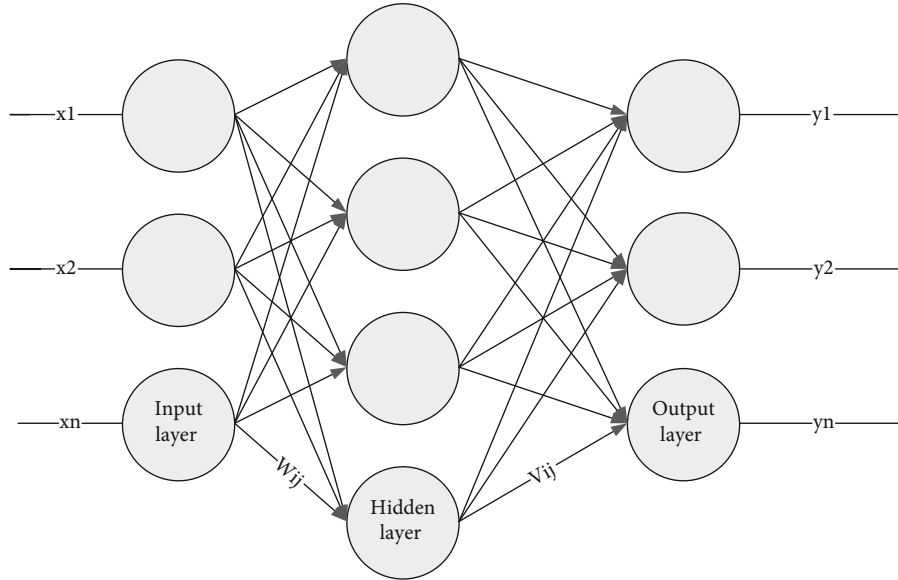
FIGURE 3: Structure diagram of BP neural network.

3.3. Application of Artificial Neural Network Model in Gymnastics. Gymnastics requires extremely high physical quality of the human body, which cannot be easily realized by ordinary people. It needs to be practiced day after day, also the basic mastery and proficiency of movements. However, it is easy to get hurt in the learning process, and it is common to be unfamiliar with equipment, which leads to injuries. In the process of assessment, we mainly collect and describe the related activities of injury risk. After getting a certain amount of index analysis, we can carry out the pretreatment stage, which is also the most important step to prevent the preparation before injury. Through the early warm-up preparation work will greatly reduce the possibility of injury in the artificial neural model in the factor analysis of the output results effectively further improved. The expected error parameters of the transfer function between network levels are solved. When the error value is greater than the expected value, the training can be stopped for rest to relieve fatigue and reduce the risk rate.

Of course, in individual and double training, the injury rate will obviously increase, and double cooperation will greatly increase the possibility of injury because the degree of tacit cooperation is not enough and the mistakes in operation are all risk factors. In this case, it is necessary to investigate according to the trust of both parties, and it is necessary to carry out risk assessment activities of both parties, so as to make the scientific prediction results more accurate and ensure the common security of both parties.

3.4. Analysis of Gymnastics Characteristics Based on Intelligent Optimization. The above-mentioned firefly intelligent optimization algorithm is used to analyze the sports effect of competitive gymnastics, and the detailed decomposition of actions is obtained after the perfect segmentation.

However, compared with the traditional firefly algorithm, it has some local shortcomings, such as slow response speed and difficulty to solve complex problems. In addition, in order to further improve individual quality and obviously improve their own ability, it needs to be explored in a reasonable dimension. Therefore, the finite dimension update method is used to reduce the search speed and improve the search accuracy, which more balances the search speed and accuracy of the algorithm. The improvement of the algorithm is as follows:

(1) The local shortage method is driven by the optimal individual, and the coverage process is realized from the optimal point outward, without letting go of any dead angle. Relatively speaking, a team must have excellent talents to drive people with poor strength to move forward together and make a choice between one-dimensional and all-dimensional

(2) Fireflies are subject to the most individual-led updating strategy, and the dimensions will be randomly selected between one-dimensional and weighted dimensions. By constantly updating the last individual, the honey collection quality of the population can be improved

3.4.1. Leading and Renewal Strategy of Elite Group. Simply put, a team cannot overcome the unity of the team, that is, the introduction of elite groups to enhance the overall strength. The objective function is constructed, and the value of the objective function is determined by comparing and analyzing any individual of the elite group. The experimental results show that the brightness of the optimal individual will be obviously better than that of the basic individual, so elite individuals can lead the monomer to collect honey. The specific formula is as follows:

$$X_b^{\lim} = X_{22b}^{\lim} + \text{rand}\,(-1, 1) \times \left(X_{22b}^{\lim} - X_b^{\lim} \right). \quad (27)$$

(1) It means that the optimal individual is randomly selected from 22 arbitrary individuals to lead the learning training, while lim means updating in limited dimensions.

(2) Retrieve high-quality information for standby, and meet the standard high-quality conditions

(3) The roulette algorithm can be used to collect stage information

(4) When the experimental samples are sufficient, the high-quality search in the area can be performed

3.4.2. Finite Dimensional Renewal Strategy. In order to increase the learning interest of high-quality individuals and avoid interference from other groups, a finite-dimensional updating strategy is adopted to realize the local optimal algorithm. The optimal individual strategy is

$$X^{\lim} = X_b^{\lim} + \text{rand}\,(-1, 1) \times \left(X_b^{\lim} - X^{\lim} \right), \quad (28)$$

where $X^{\lim}$ represents the current update individual, then X_b is the optimal individual, and lim represents the finite-dimensional update mode.

Calculate the current number of iterations as

$$\text{rand}\,(0, 1) < 1 - \left(\frac{0.5 * k}{\text{maxgen}} \right). \quad (29)$$

max is the maximum number of iterations and is also the updated strategy. After the update, an ordinary individual can be randomly selected to follow. The researchers simulated the mathematical method of intelligent optimization mainly through the behavior characteristics of fireflies and artificial bees and further obtained scientific research results. After each task of the group gives instructions, the intelligent optimization algorithm is obtained by iterative process optimization. So far, it can enhance the seeking ability, avoid falling into local defects, and achieve overall equilibrium. In the initial iteration, the right side of the unequal sign is close to 1, which makes the greater the probability, the greater the probability of randomly selecting the best. After entering the final iteration, the right side of the iteration is close to 1/2, and the selection probability becomes 50%, which is beneficial to improve the precision of searching elements in the final iteration.

4. Research on Aesthetic Characteristics and Application of Gymnastics

4.1. An Analysis of the Essence of the Beauty of Sports Gymnastics. Taking the beauty of competitive gymnastics as the research point, we can show the rich and colorful forms of beauty and achieve evaluation through people's perceptual cognition. In gymnastics performance with the rhythm of music, through the beauty of body, difficulty and music beauty of gymnastics form. When stretching the body movements, it is necessary to optimize and improve the movements to perform perfectly. The display of beauty through body movements, rhythmic jumping, and rotation are extremely elegant postures. The combination and induction of the systematic structural elements of competitive gymnastics are to give full play to the unique characteristics of sports events. The summary diagram is shown in Figure 4.

The aesthetic process of competitive gymnastics is the expression result presented by a jury and audience with the perceptual system of feeling, perception, and hearing. The random number distribution of artificial bee colony is shown in Figure 5.

By comparing the left and right segmentation images, we can know that the gradual recursive trend of the left gradient is uneven in the gradient results of random numbers. Among the random numbers with a total number of 5000, (0-0.1) has the largest proportion and then shows a decreasing distribution trend step by step. The right random numbers show the trend of stable arrangement, and this algorithm makes up for the locality and balances the overall search results.

4.2. Algorithm Test and Comparison in Experimental Dimension. In order to verify the performance of the algorithm, 10 dimension values under the standard test are selected for test comparison and judgment. In order to avoid randomness, the population number is fixed to 40, and the iteration times are set to 10, and the convergence curves under dimensions are obtained, respectively. The result of the operation is shown in Figure 6.

Through the calculation results of dimension value, we know that the dimension value of BP neural network is the highest, which is the performance of relativity and stability, but there are still some cases of non-convergence. Compared with the bee colony algorithm, the convergence is not enough, showing two-level differentiation results, which is not enough to calculate high-precision performance. Through the convergence results of different dimensions, it is recognized that updating the calculation strategy will help balance the global and local search capabilities.

4.3. The Expression Form of Gymnastics Beauty. Score the whole process through the form of human expression and posture, and score the specific form of its display according to each part. Each stage and performance skills have their own uniqueness, and each athlete also has his own style, but he needs to report the performance according to the competition rules. The scores of the judges are shown in Figure 7.

In the process of competition, the judges mainly take the posture beauty displayed by the body as the main scoring method, followed by the stretching beauty of the movement as the secondary evaluation method, and the rest of the beauty shows a certain score ratio. There is no relatively big difference in the scoring of each judge, and the highest
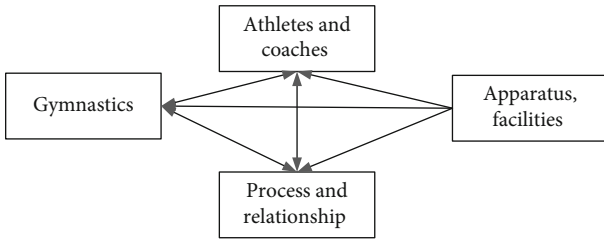
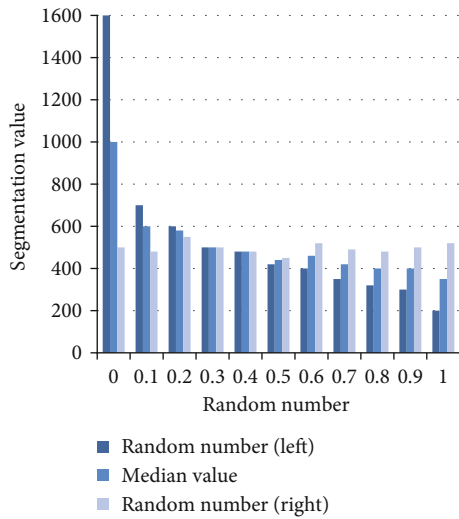FIGURE 4: Competitive gymnastics sports system.

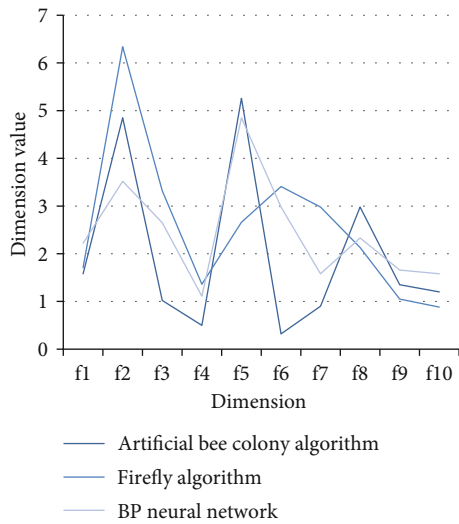FIGURE 5: Comparison chart of random number division.

FIGURE 6: Dimension value calculation result of F1-F10.
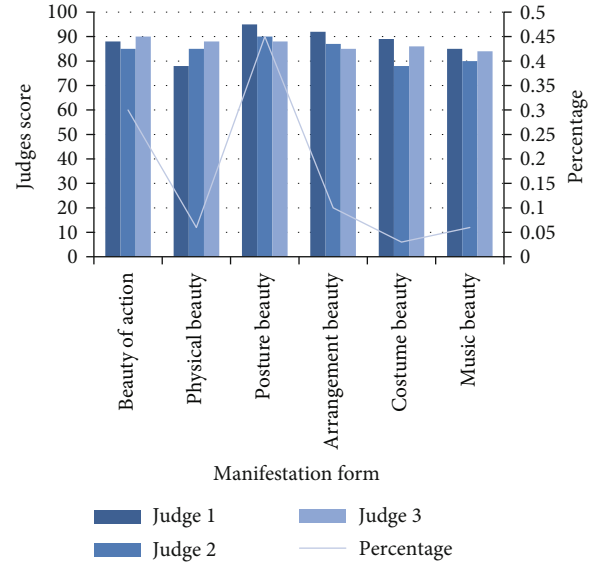

FIGURE 7: Statistical chart of judges' scoring on the expression form of gymnastics beauty.
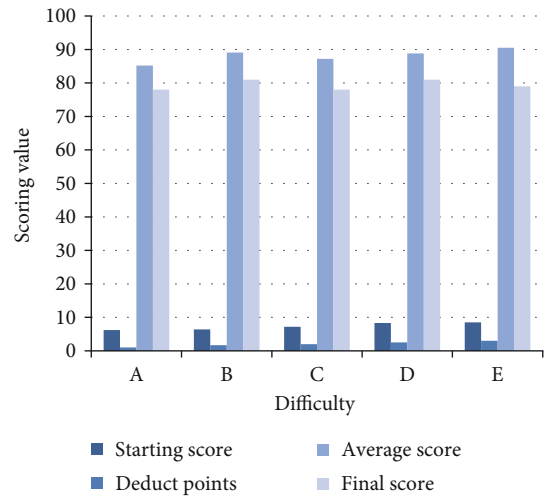

FIGURE 8: Difficulty score.

Under different difficulty levels, the scoring situation is relatively different. In the face of difficult movements, the judge's score will be relatively high, but the deduction will be relatively serious. In this way, we can complete the corresponding actions according to our own strength and achieve our ideal results. It is also a good thing for some players to break through themselves, which may surpass their usual performance and deserve encouragement.

4.4. Iterative Analysis of Gymnastics MSE under Artificial Network. Collect the frequency of movement error in the process of sports competition to do further action improvement analysis, and get the analysis result of iteration times of network structure. It is also a decision-making means to prepare for the next competition for the experimental analysis of each competition, which greatly improves the performance. The error graph is shown in Figure 9.

score is 95 points, which shows that it needs to be improved in the usual training process.

It needs to be selected according to the difficulty, because the scores of high scores and low scores are obviously different, and the completion of players will be quite different. Therefore, according to the action, the final selection is shown in Figure 8.
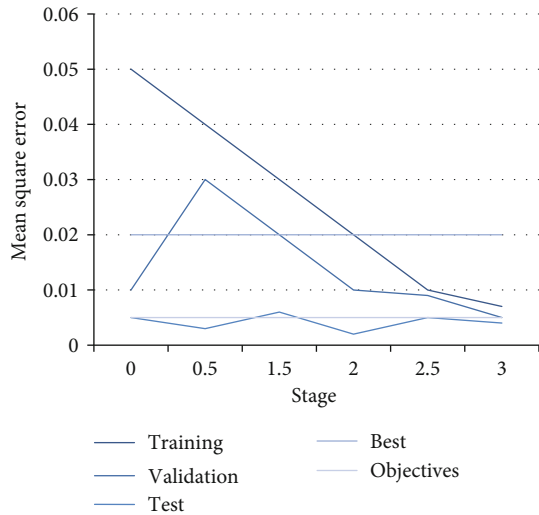
FIGURE 9: MSE iterative curve of artificial neural network.

From the network model in the training process of iteration times significantly reduced, it shows that in the case of reduced mean square error, good convergence is needed to achieve error accuracy. In order to achieve the ideal target error, it is necessary to carry out the premise work of verification and training and achieve the training purpose of each step.

4.5. Comparative Analysis of Convergence of Gymnastics in Various Algorithms.

This paper is exploring the most perfect display form of gymnastics characteristics, focusing on the classical algorithm to optimize algorithm practice, so that gymnastics more perfectly displayed in the eyes of the world. The necessary analysis of the convergence speed of each algorithm causes the perfect posture to show a more balanced temperament. The convergence curve is shown in Figure 10.

It can be clearly seen from the figure that the convergence effect of artificial peak method is the best, and the algorithm has the global search ability. The biological method that individuals depend on populations will give full play to the effective performance of individual capabilities. The three algorithms will effectively improve the effect of scientific training and make a good contribution to gymnastics.

4.6. Correlation Analysis of Spatial Characteristics of Gymnastics Events.

Athletes may complete some difficult spatial movement tracks such as rotation, translation, and jumping of the body mechanically when completing the complete set of gymnastics movements. Spatial movement within a certain period of time creates a beautiful artistic shape which is the perfect display of gymnastics art by the athlete or highly skilled person. The performance space of gymnastics is based on body movements, assisted by equipment, and then evaluated according to the types of movements, the distance of space movement, and the flexibility of the body.
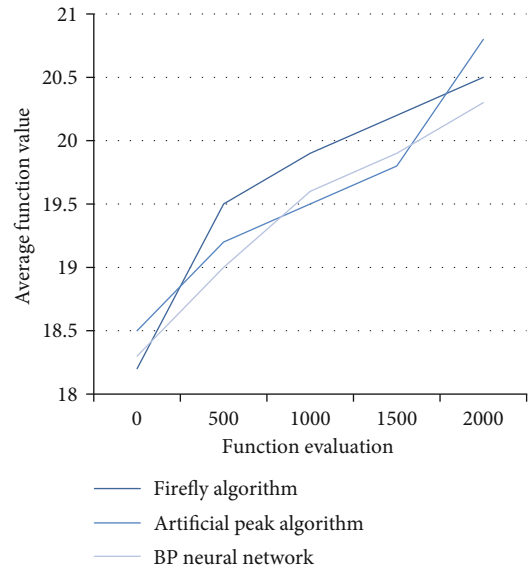

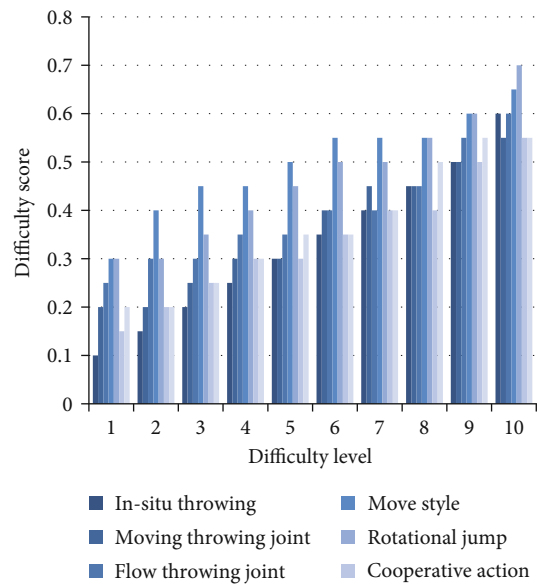FIGURE 10: Comparison of convergence curves of three algorithms.

FIGURE 11: Difficulty and score of action.

The space gymnastics operation performance with team cooperation can show the difficult performance form more comprehensively. Through the form of difficult movement space of the team, this paper explores the form of grasping the body space when the complete set of movements is completed. It studies the spatial characteristics according to the grade coefficient, and the results are shown in Figure 11.

Through the score in the difficulty level, we can judge which spatial performance features are difficult. It belongs to rotary jumping when it is difficult, because sometimes it is necessary to complete difficult movements completely by personal physical quality without the help of equipment. Swelling, twisting, swinging, and landing perfectly in the air to keep balance, which is why there is a high difficulty score of 0.7 on the score level.
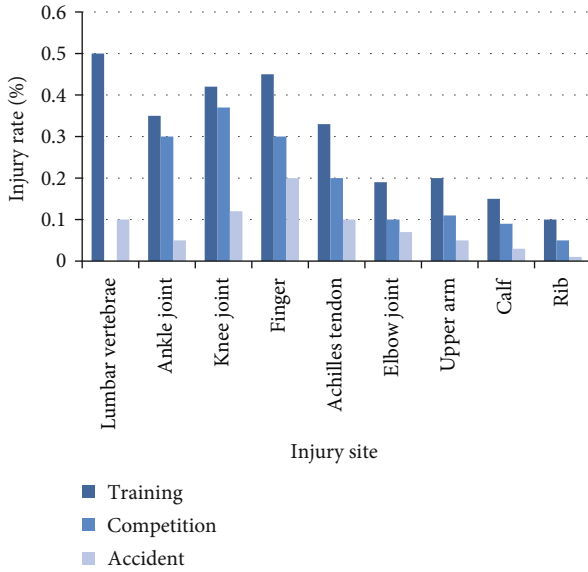
Figure 12: Distribution of main sports injury parts in competitive gymnastics.

4.6.1. Distribution Characteristics of Injury Parts in Gymnastics. After the above-mentioned experimental analysis of gymnastics difficulty, it was considered that in the process of training and performance, it is inevitable that there will be injuries in different positions. Some athletes may train for a specific part to improve their ability to resist injuries. However, the injury between boys and girls can also appear in different parts, and the distribution map of the parts is shown in Figure 12.

Through the histogram, we can know that the possibility of injury during training is greater, which may be caused by long-term fatigue and improper training. However, the main injured parts are generally distributed on joints and important torso, such as waist, ankle joint, and knee joint, so these parts are important protective parts. No matter in training, competition, and peacetime, the injury rates of lumbar spine are 50%, 45%, and 10%, respectively, which is a high-risk injury of sports injury, so protective measures should be strengthened.

5. Conclusion

Gymnastics, with its own unique charm, is displayed in front of people, and is also concerned by everyone in sports. After the advent of the scientific era, the performance form has been greatly changed. From simple movements to difficult realization, it is the improvement of physical quality, but it is also the technical display of scientific analysis. From objective evaluation to today's standardization, it is the experimental result on the road of human exploration, which makes the beauty of human posture fully displayed. This paper subjectively analyzes the detailed description of gymnastic movement characteristics with the mathematical calculation method under the structure of artificial bee colony, firefly, and neural network and explains the skills and methods in the competition process. The experimental

contents are summarized as follows: (1) The traditional firefly algorithm has the defect of poor convergence. Based on the investigation of experimental problems, a globally optimized finite-dimensional algorithm is obtained, which greatly improves the search speed and update strategy. (2) The artificial bee colony relies on individual excellent bees to lead the common bee colony to collect honey, which balances the local defects of the whole and greatly improves the quality of collecting honey. (3) Under the neural network, the regular learning mode of greatly simplifying the process and improving the concentration cannot only improve the learning efficiency, but also reduce unnecessary injuries. (4) The diversification of gymnastics brings people rich and colorful feelings, so paying attention to it will also be a way for people to keep fit.

The following are the conclusion and prospect: (1) In the hierarchical structure of neural network, the theoretical knowledge research is not mature enough, and the system needs to be more perfect to embody the experimental results effectively. (2) The influence degree of parameters on the firefly algorithm is regionalized, so it is necessary to find excellent parameters to define the optimization algorithm and modify it. (3) In the elite colony, there will also be some colonies mixed with them, so it is necessary to test and discriminate to determine the excellence of the colony. (4) The constant change of movements is through people making difficult movements according to their physical conditions, so the complex ideas of human nerves can be explained by not only experimental data.

Data Availability

The experimental data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declared that they have no conflicts of interest regarding this work.

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