TRACK AND FIELD PERFORMANCE OF BP NEURAL NETWORK PREDICTION MODEL APPLIED RESEARCH - LONG JUMP AS AN EXAMPLE

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ABSTRACT

According to the influence of many factors sports scores, the traditional sports prediction method is difficult to get satisfied with the present situation of the predicted results. Use the long jump athlete's special performance and quality of the relationship between training level, with the aid of the BP neural network strong nonlinear mapping ability, the paper put forward a long jump athlete's special performance of neural network prediction model. The model is made up of traditional forecasting methods, make full use of the information contained in the data, compare it with the traditional forecast methods, prediction accuracy has been greatly improved. In order to solve the field complicated it is difficult to use traditional mathematics method provides a new idea and method. Scientific training provides a theoretical basis for the athletes.

Keywords: *The BP Neural Network, Long Jump Athlete, Special Achievements, Prediction Accuracy*

1. INTRODUCTION

There are many factors affecting the results of sports competitions, the most important is the athlete's physique, but at the same time the athlete's body, technical characteristics, mental state, and external environment will affect the athlete's sports performance to some extent [1]-[2]. The traditional prediction method has to some extent to use individual athletes training index on specific performance prediction, thus guiding the athletes daily training, but these models are relatively harsh conditions and scope of use, As in the use of multiple linear regression model to forecast, special performance and relative factors between need to obey normality and homogeneity of variance and multiple linear relationship between strict conditions, and the grey system prediction model belongs to the linear modeling, in the short-term forecasting accuracy have a certain effect, and for the complicated nonlinear relation, simple grey forecasting is difficult to obtain an acceptable prediction error [3]. But, in fact, special performance and the quality training level may exist between the complicated nonlinear function relationship, it is difficult to meet the traditional forecasting model of the conditions, Therefore, using multiple linear regression and grey system and so on traditional model to forecast the performance of the special athletes may be there is a big error, leading to the prediction precision is

reduced, so as to show the characteristics of unreasonable [4]-[6].

Compared with traditional forecasting methods, the application of BP neural network without strict constraints, variables do not need to satisfy a linear, independence, normality, homogeneity of variance and other conditions, This network has self-organization, adaptive and strong fault tolerance etc., which can effectively for the nonlinear mapping between data, when the traditional forecasting model can't achieve or forecast the result is bad, use this model often can achieve very good prediction effect.

2. RESEARCH OBJECT AND METHODS

Select part of the domestic first-class level of long jump athletes (national athletes) as the research object.

Artificial neural network is composed of a large number of processing units connected to each other and the composition of the information processing system, which has the characteristics of nonlinear, adaptive. Neural network originated from the modern neuroscience research, its main purpose is to try to simulate the brain neural network processing and memory information approach to information processing. Artificial neural network is a parallel distributed system, adopting the traditional artificial intelligence and information processing technology completely

different principle, to overcome the traditional symbolic logic based on artificial intelligence in the treatment of intuition, unstructured information defects, and has good fault tolerance and anti-interference ability and with memory, lenovo, adaptive and good robustness and a series of advantages [7].

Artificial neural network can be divided into two kinds, according to the network topology, respectively feed forward type network and feedback type network. The feed forward type network mainly function mapping, used for pattern recognition and function approximation. Multilayer feed forward network can approximate any continuous function, meaning that prediction model can fit the special achievements multilayer feed forward network to establish Jumper, a functional relationship between the indicators of the quality of training has proven, the real reflect their intrinsic characteristics, in order to overcome the deficiencies of multiple regression model and gray model [5]. The function forms can be expressed as:

$$f(x) = 1/[1 + \exp(-x)]$$

The BP neural network, namely back propagation, is one of the most used applications. The basic idea is to use gradient search theory, and make the network output and the expected output difference value of the minimum mean square. Input variable Xithrough the intermediate node affect output node, After the complicated nonlinear transformation process, generate output variable Yk, When the response variables and the model output variable is greater than the difference between the error of the predetermined standard, The model is re-set the weight value of the respective layers, re-establish the model, until the error value is less than a previously set error training stopped. The BP neural network calculation flow chart as Figure 1 shows.
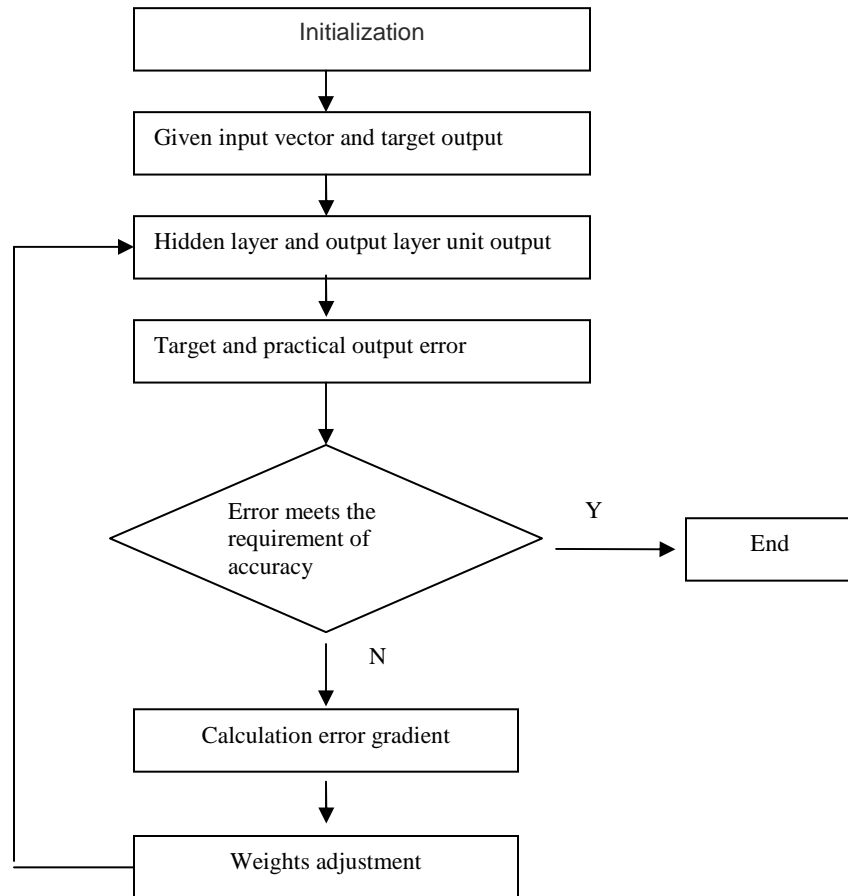

Figure 1:The BP Neural Network Calculation Flow Chart

3. PREDICTION OF SPECIAL PERFORMANCE OF BP NEURAL NETWORK MODEL

3.1 Model Independent Variable Screening

Because the training targets and specific achievement between the associative strength of different, special performance prediction for influence coefficients will be different. Need to filter out the indicators that impact of the high quality training. Use 2008-2009 year the State Sports General Administration included long jumper of historical data of long jumpers, analysize the training targets and specific performance correlation, calculate their correlation coefficient (R), the results in Table 1. Seen from Table 1, the athlete's standing triple jump, 30-meter dash, the instantaneous center of gravity away from the plate Teng Initially speed, the correlation coefficient between the final run-up speed of five meters and 100 meters run five qualities of training indicators and Specific Performance are larger Jumper select five quality training indicators as predictors.

Table 1: The Correlation Coefficient Of Quality Indicators And The Long Jump Training Special Performance

Quality training index	Degree of association
100 - meter run（S）	0.6748
30 - meter run（S）	0.6469
150 - meter run（S）	0.6972
standing triple jump（m）	0.9876
The last 5 meters run-up speed（m/s）	0.8362
The moment the body center plate horizontal speed（m/s）	0.5624
Swinging leg swinging speed (m/s)	0.5968
the instantaneous center of gravity away from the plate Teng Initially speed (m/s)	0.6286
Squats barbell（kg）	0.4136

3.2 The Established BP Neural Network Prediction Model

3.2.1 The determination of the network structure

The basis of the establishment of the neural network model is to determine the structure of the neural network. The Kolmogorov theorem states [8]-[9], Given any continuous function f:[0,1] I→ RJ,f can be accurately used with a three layer BP neural network. The network's input layer have I neurons, middle layer have 2 I + 1 neurons. This study selected five predictors that closely related to athletes special scores, and need to set five input neurons, according to the Kolmogorov theorem, choose a hidden layer, and set its neurons 11. Output layer for collection of special performance data.

3.2.2 Network learning

With the selected five quality training index and special performance as the training sample data (data see Table 2). The five quality training index data as a predictor for input, the corresponding special scores as output data. Because the BP neural network model is most sensitive to (0, 1), Thus the original data needs to be normalized, and normalized to the range of (0,1). Specific approach is as follows:

$$x_i^{'} = \frac{x_i - x_{min}}{x_{max} - x_{min}}$$

Xi is initial value, x'i is normalization of value, Xmin and Xmax respectively the minimum and maximum. Input data normalized BP neural network to learn the training samples, the network output error is reduced to an acceptable level, and thus the best mapping between the form the training quality indicators and special achievements in order to achieve the long jump with accurately predict the mobilization of special achievements. Neural network to solve complex non-linear problems, the learning process of calculation is quite complicated, in this study use SPSS19.0 statistical software to realize training BP neural network learning.

Table 2: The Neural Network Input Layer And Output Layer Data

| samples | Input sample | | | | | Output sample |
	standing triple jump（m）	The last five meters run-up speed（s/m）	100 - meter run（s）	30 - meter run（s）	the instantaneous center of gravity away from the plate Teng Initially speed（s/m）	Long jump scores（m）
1	9.98	11.36	10.3	4.0	9.68	7.89
2	10.13	10.92	9.8	3.8	9.70	7.73
3	9.68	10.00	9.7	3.9	9.59	8.46
4	9.95	10.22	8.9	3.8	9.67	8.01
5	10.10	9.98	9.0	4.1	9.51	8.10

3.2.3 The results of BP neural network model

Selection of long jump athletes in 2008 - 2009 quality training data are normalized, then into the trained neural network model, through the software analysis, obtained the special performance prediction. In 2008-2009 years of quality training index and special performance using multiple linear regression model expression, use least square method to fit, get mathematical model is:

$$y=0.35X_1+0.2X_2-0.18X_3-0.26X_4+0.29X_5+7.68$$

X_1、X_2、X_3、X_4、X_5 are behalf of the front selected quality training indicators, That is the long jump athlete's the standing triple jump performance, 30 meters running performance, the last five meters run-up speed, the 100 - meter run results and the center of gravity from plate moment who at first speed.

Using the multiple linear regression model, The calculated 2008 - 2009 athletes of special achievements predictive value. The calculation results see Table 3.

Table 3: Prediction Model Fitting Accuracy

| number | actual value（m） | BP neural network model | | multiple linear regression model | |
		predicted value（m）	error（m）	predicted value（m）	error（m）
1	7.89	7.92	-0.03	8.24	-0.35
2	7.73	7.69	0.04	7.61	0.12
3	8.64	8.62	0.02	8.57	0.07
4	8.01	8.10	0.09	8.11	-0.10
5	8.10	8.04	0.06	7.84	0.26

Table 3 of the error column can be seen, The BP neural network prediction model of prediction error is far lower than the linear regression model of the prediction error. Through the calculation methods of the error value and the BP neural network model of the average relative error is 0.048, and multiple linear regression model of the average relative error is 0.188. That the neural network model of prediction effect is better than that of multiple linear regression model, the BP neural network model is more suitable to evaluate the long jump athletes special performance prediction.

4. CONCLUSION

A research topic in the field, the uncertainty system of control problems has long been one of the central themes of control theory research, but the problem has not been effectively addressed. The learning ability of the neural network, it automatically learning system in the process on the uncertainty system of control characteristics, which automatically adapt to the system with the characteristics of time variation, in order to achieve optimal control system; obviously, this is a very exciting intentions and methods.

In this paper, prediction method based on the BP neural network's long jump athlete's special performance has the strong nonlinear mapping ability and generalization ability, overcome insufficient of the existing long jump athletes special performance prediction method, Namely subjectivity, optional, and prior to determine the prediction model of mathematical expression and the harsh conditions of use, has high prediction accuracy. For athletes reasonable arrangement of scientific training plan and provide a basis for selection of athletes, deserves further discussion and research.

Neural network technology as the smart technology leader in application prospects very beautiful, but the basic neural network technology has been applied to the end, is that the future development of the comprehensive application of multi-method research directions of theoretical and applied research. Mainly theoretical research in neuroscience basic research, to explore the higher level of intelligent network model using mathematical methods, in-depth study of algorithms and performance of the network, and the development of new network mathematical theory. Applied research is mainly reflected in network hardware and software to achieve various specific problems in the field of research, and so on.

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