



# BioTechnology

*An Indian Journal*

**FULL PAPER**

BTAIJ, 10(3), 2014 [537-542]

## Sports competition performance prediction model research and application based on BP neural network

Yushuo Qian\*, Guijia Xu

Changchun Normal University, Changchun 130032, Jilin, (CHINA)

### ABSTRACT

Neural network has been rapidly developed in recent years, and widely applied in more fields, neural network is a kind of network information system constructed by human brain inspiring, it has relative strong self-fault tolerance and self-training learning ability and others good advantages. The paper just based on the advantages, it constructs BP neural network model, and carries out detailed application and verifies the model, among them it selects men 100m running and swimming sports events, carries out research on top one performance by establishing and applying neural network, result proves that its real value and calculation value have relative big accuracy, so the model provides extremely wide prospects for sports performance prediction. © 2014 Trade Science Inc. - INDIA

### KEYWORDS

Neural networks model;  
BP algorithm;  
Sports competition;  
Performance prediction.

### INTRODUCTION

Decision and prediction is a current popular prediction way, from which decision is the result of prediction, and prediction is premise of decision, so a scientific decision is on the basis of scientific prediction. We know that current prediction has already mapped to each corner of life, in competitive sports, predict future sports competitive level is particularly important for athletes in best training level, so sports performance prediction gets more and more important, but in modern times prediction methods have many types such as :regression analysis, and grey dynamical model and so on.

For prediction aspect research, lots of people have made efforts and got results that provides beneficial conditions for scholars from all walks of life making research on it, and provides impetus for human scientific predicting. Such as: (1) Wang Zong-Ping<sup>[1]</sup> etc. made

prediction on men swimming by neural network in 2006 and got higher accuracy; (2) Zhong Wu<sup>[2]</sup> and others constructed shot special performance prediction in 2004, meanwhile got its accuracy obvious higher than multiple linear regression model; (3) Yan Yu-Qing<sup>[3]</sup> and others made prediction on triple jump performance by applying neural network in 1998, and got excellent fitting ideal effects; (4) Robert Hecht-Nielson had ever stated model configuration with  $2N + 1$  pieces of hidden layers nodes that has  $N$  pieces of input nodes after ANN function single hidden layer in 1987; (5) After that, he mentioned any closed intervals one continuous function can use BP neural network model to approach in 1989<sup>[4]</sup>; (6) Cyrbenko as early as 1988 had ever proposed structural point adopting S type function, he pointed out a hidden layer was used to solve artificial distribution problems, and two hidden layers output functions by inputting figures<sup>[5]</sup>.

## FULL PAPER

The paper on the basis of previous research results, with regard sports performance influence factors, it makes prediction on sports performance by applying BP neural network, and combines with two detailed practical examples, it states the method implementation and applies the two detailed applied results showing that establish neural network prediction model has important and prolong significances for sports aspect performance research.

### BP NEURAL NETWORK CONSTRUCTIONS

#### Sports performance predicting's prediction model neural network theory

Hierarchical neural network is one kind of neural network two connection ways, neurophysiology and connectionism structure basic handling units ratio tends to be called as nerve cell, as following Figure 1 show.

One nerve cell  $k$  is expressed by following formula:

$$u_k = \sum_{t=1}^m w_{tk} x_t \quad (1)$$

$$y_k = f(u_k + b_k) \quad (2)$$

In above formula, nerve cell unit threshold value is  $b_k$ , input signal linear combinations' output is  $u_k$ , output signal is  $y_k$ , protruded weight  $w_{tk}$ , input signal  $x_t$ , and meanwhile activated function is  $F()$ , corresponding function formula is as following:

$$f(v) = \frac{1}{1 + e^{-v}} \quad (3)$$

$$\omega = \omega - \mu \frac{\partial}{\partial \omega}, \mu > 0$$

Here:

$$\frac{\partial}{\partial \omega} = \sum \frac{\partial}{\partial \omega} \quad (10)$$

Among them, the process from input layer to hidden layer and then transfer to output layer is information forward direction propagation, but once end cannot get corresponding output result, it will automatically turn to reverse propagation, and the model weight values defining and adjustment are adopting reverse propagation learning algorithm. The algorithm can thoroughly reflect their inner features, therefore he overcomes grey model and multiple regression seriously shortcomings.

We know BP neural network nerve cell does not change; corresponding model is as Figure 2:

For BP nerve cell, its input end is :

$$\text{net} = x_1 w_1 + x_2 w_2 + \dots + x_n w_n \quad (11)$$

In above formula, connection weight value  $w_1, w_2, \dots, w_n$

Input value:  $x_1, x_2, \dots, x_n$

These nerve cells all activated function all use S type function, the function not only is continuous but

## FULL PAPER

---

### Weight value adjustment

Known:

$$\Delta_k \omega_{ji} = \eta \delta_k o_{ik}, \eta > 0 \quad (15)$$

The formula is weight value adjustment formula, from which  $\eta$  is step length,  $\Delta_k \omega_{ji}$  is  $\omega_{ji}$  adjusted value,  $j$  is output nerve cell.

### MODEL PRACTICAL APPLICATION

#### Practical application for 100m running model

We make prediction on 15<sup>th</sup> to 24<sup>th</sup> sessions Olympic Games men 100meters race performance by applying BP neural network algorithm, regard it as samples like TABLE 1.

Besides, there is also 25<sup>th</sup> to 28<sup>th</sup> sessions Olympic

samples to establish BP neural network prediction model. Its relative data is as TABLE 3 and TABLE 4 show.

According to above table test on model, its process is as following:

Variance ratio:

$$\sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n-1}} \quad (16)$$

$$\left( \frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n-1} \right)^{-1} \quad (17)$$

We judge the model accuracy by referencing TABLE 5.

**FULL PAPER**

---

- of Callisthenics in Colleges and Universities[J]. Journal of Liuzhou Teachers College, **20(4)**, 84-85, 130 (2005).
- [7] Li Xiu\_Hua, Liu Cheng, Yang Xiao\_Hong; The Reform of Callisthenic Examination Methods in University[J]. Journal of Guangzhou Physical Education Institute, **21(4)**, 107-109 (2001).
- [8] Wang Jie-Feng; Problems and Solutions: On Bilingual Teaching in Colleges and Universities[J]. Journal of Fuyang Teachers College (Social Science Edition), **1**, 146-148 (2010).
- [9] Wang Jinfang; On the Development Trend or Popular Callisthenics[J]. Journal of Hubei Sports Science, **1**, (1997).
- [10] Liu Lin; On Quality Education and the Improvement of Teaching Method of Areobics Dancing[J]. Journal of Guangzhou Physical Education Institute, **21(4)**, 110-112 (2001).