Available online www.jocpr.com

Journal of Chemical and Pharmaceutical Research, 2014, 6(3):764-773

Research Article

ISSN : 0975-7384
CODEN(USA) : JCPRC5

H city colleges sports development environment evaluation based on the novel BP neural network algorithm

Zhao Xianpin

Wenzhou Vocational College of Science and Technology, China

ABSTRACT

In China, college sports resources are relatively abundant in all social elements, plays a major role in promoting the development of social sports, H city, as one of the three education base, the development of college physical education environment has reference significance for National Universities. However, due to the mathematical algorithm in the environmental assessment are often too complex, collecting of environmental data has high difficulty, the previous research mostly about policy macro discussion. This article is based on the full collection of data and former research, using BP neural network analysis method to data mining. And，we use computer to reduce the complexity of the algorithm, make the algorithm to evaluate becomes feasible. It can get H city colleges sports development environment evaluation results, hoping to be able to promote the further development of the sports industry in our country.

Key words: University Sports Development Environment, BP Neural Network, Data mining

---

INTRODUCTION

The successful hosting of the Olympic Games in Beijing marks the event. Our strategic goal of socialist modernization power sports is to speed up to realize. People`s sport participation is also steadily rising. But for the historical and realistic reasons, sports resources in terms of distribution in China present certain imbalance. In comparison, colleges have more sports resources. According to the fifth national sports field survey data show: our existing 850080 sports venues, including the higher education system has 28741, and 1.11% of the population of college students have 3.4% of the total nationwide sports venues [1]. With the increasingly strong demand for sports, the function of college sports resources has already surpassed the ordinary teaching category, become a major power to promote the progress of social sports in China.

From another point of view, there is a very close relationship between school sports and community sports, school sports are the basis of social sports, and social sports are continuations of the school sports [2]. With the development of economy and the improvement of people's living standard, the rapid development of communal sports brings new requirements for school sports, college sports has entered a period of rapid development. For the lack of social capital, its development momentum is not strong, excessive dependence on government investment. Industry awareness is not strong. These problems have severely affected the sports resources in colleges and universities elaborate. So the rational use of the sports resources in colleges and universities, to improve the progress of college physical education environment, to promote the harmonious development of China's sports and economy, has become an important research topic.

As early as in the twentieth Century, psychologist Levin studied the field of psychological dynamics theory reveals the inherent relationship between human's behavior and environment for the first time. This opened the curtain of physical environment research.

German Regensburg University philosophy professor Heinz Luster, the director of Arts and Sports College, visited Tianjin University of Sport in 1990 June. He brought a special report of sports environment problems (mainly refers to the natural environment). Heinz Luster thought sports not only brought fitness to physical, leisure and entertainment but also brought many negative effects to the nature, therefore, he pointed out that environmental problems of sports are big problems in twenty - century world [3].

Germany Hanna Clay, USA en Dell Sigelasiboge and South African BushraTuozhake et al. also make a special exposition on the physical environment (natural environment) [4]. In 1994, the United Nations Environment Programme and the International Olympic Committee signed a cooperation agreement between the physical and ecological aspects, make the environmental protection be one of the spirits of the Olympic, and pointed out "sports and the environment are inseparable"[5]. 2002 June appointed a special representative to dedicated sports environmental affairs, whose mission is to assist UNEP and sports keep in touch; [6]

In 2003 the environmental programme and the Global sports association and sports experts held a symposium on the global sports and Environment Forum in Tokyo, established global sports and Environment Forum in Japan's global sports alliance. The United Nations Environment Programme associations with the International Olympic Committee and other sports federations, formulated the "twenty-first Century sports and the environment agenda" [7].

The scholars of our country are also studied this problem.

Guangzhou Sports University professor Lin Wentao published the "physical environment" in 1998 by the dean's office of Guangzhou Sports University; [8]. Guangzhou Sports University WengXiquan edited the "Introduction of sports` environment" [9].

In 2003, Hunan Province, Loudi higher normal school XiongMaoxiang wrote a book of "physical environment". [10]

Since the twenty-first Century, more and more scholars in our country pay attention to sports environmental problems.

Some scholars believe that, the main problems of Chinese college sports industry at present are the property right is not clear, the lack of effective management, lack of talents manager and so on. To solve these problems, has to through the introduction of market mechanisms, explore new ideas, and make sports facilities functional diversification ways [11-14].

These are also scholars thought: the specific way to optimize the environment. Mainly have the following several kinds of ideas.
(1) For system support
(2) To optimize the construction of campus sports culture
(3) To optimize individual of environmental education [15].

In addition, Zhang Jishun proposed the construction of the school physical environment has to start from the services for the development of students, the sports facilities have to be scientifically designed [16].

Liu Guanyuan, Chen Shouyun put forward to strengthen environmental management, and to maintain ecological balance point in their respective research [17,18]. Wu Aibing analyses the educational expectation and development results inequality of female college students in physical education, which is the root of the female college students to form a weak position to participate in sports [19]. He Yaping has conducted the research to the relationship, which needs to deal with, in the harmonious development of our country sports. [20]. However, there is not much existing study on the sports environment, especially on the environment for the development of College sports:

Author thesis retrieve the title and abstract contains "sports development environment" , and published since 2003 in Chinese science paper online, on January 4, 2014, and the eligible papers only more than 600 pieces, and 555 of them are journal papers.

Throughout these studies, researches on sports development environment of foreign scholars mostly takes western national conditions as a starting point, since China is a developing country, these studies have predicted and guiding significance to China. And because the mathematical algorithms are too complex, collecting environmental data has a higher degree of difficulty, the domestic researches often give some guidance of policy, the subjective

consciousness dominated the process of study, rarely used rigorous, objective mathematical methods, make the research results with too much personal color.

To sum up, based on the previous research results, using the computer to reduce the computational complexity of the calculation of BP neural network algorithm and normalized the data, the mathematical evaluation of the environment has become available.

The article is structured as follows:
The first section, the foreign and domestic research on sports development environment are introduced,
In section second, the neural network theory and Application
In section third, the BP neural network theory and Application
The fourth section, use BP neural network algorithm to carry on the appraisal of the H City university sports development environment, and then put forward some suggestions for improvement.

2. NEURAL NETWORKS

Artificial neural network is a means to simulate human thinking. It is a nonlinear dynamic system. Information stored in distributed and concurrent processing is its characteristic. Although the structure of the single neuron is very simple, it`s function is limited, but a large number of neurons network system can realize the extremely rich and colorful behavior.

The research content of the neural network is quite extensive. The main research work is focused on the following aspects:
(1) On the biological prototype. From the physiology, psychology, brain science, anatomy, pathology, biological science research of nerve cells, neural network, and neural system structure and function mechanism of the biological prototype.
(2) Set up a theory model. According to the study of biological prototype, establish the theoretical model of neurons, neural network, including the concept model, knowledge model, chemical and physical model, and mathematical model.
(3) The application of artificial neural network system. Application system based on the network model and algorithm, composed of the actual using artificial neural networks, for example, does some signal processing and pattern recognition function, constructed robot system, etc.

Artificial neural network must first learn to specified criteria to study, then to work. Take the artificial neural network recognition for handwritten "A", "B" two letter as an example, when "A" input network, the output should be "1", and when the input is "B", the output is "0".

Network learning rule is: through the network learning, if the network to ensure that the wrong decision should make the network to reduce the possibility of committing the same errors next time. First of all, weights to each (0, 1) random value of the network connection, mode A corresponding image input to the network, get the output of the network. In this case, the network output for each "1" and "0" the probability of 50%, which is totally random. If the output is "1" (correct), enhance the connection weights, to enable the network to meet again "A" mode input, still can do the right judgments.

If the output is "0" (i.e. the error), the network connection weights value decreases, Its purpose is to make the network to reduce the possibility of committed the same errors when meet with "A" mode input again, through this adjusting operation, when the network turns into a handwritten letter "A","B", The correct rate of network judging will greatly enhance. This shows that the learning of the network of the two models has been successful, when the network again meets anyone mode, can make the rapid, accurate judgment and recognition. Generally speaking, the more number of neurons contained in the network, more model it can be memory and recognition. But the neurons increased, the complexity of the algorithm is higher, the calculation process is often beyond the capability of the artificial calculation, must be realized by computer. [21-23]

3. BP ALGORITHM

3.1Basic BP algorithm

A typical BP neural network is a kind of three or more than three layers of structure without feedback, no interconnection structure layer feed forward network, a typical three layers BP neural network structure is showed in figure 1.The first and last layers are called the input layer and the output layer. Each medium layer is called the hidden layer. Between each medium layer of neurons in the BP neural network are all connections, and no neuron connection between in eachlayer.

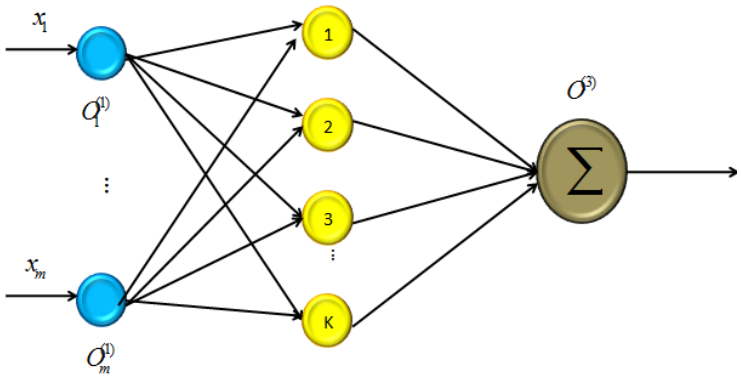

Figure 1. Three layer feeds forward BP neural network topology map

Training method of BP neural network is giving a sample to the input layer, and according to the forward propagation rules:

$$x_i^k = f(u_i^k)$$

u_i^k represents the input sum of k layer i neurons, the output of the neuron is x_i^k, and neuronal excitation functions are sigmoid functions:

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

Keep a layer to the output layer transfer, finally can get the output x_i^m. x_i^m is the m layer i node in the output layer, in this case the output layer only 1 node. The x_i^m and the expected output Y_i simultaneously input to calculate error E:

$$E = \frac{1}{2}\sum_i (x_i^m - Y_i)^2$$

Then according to the following formula to obtain the gradient of the error function, back to the hidden layer and output layer and then to the input layer utilize the gradient, reverse adjust connection weights.

$$\Delta w_{ij} = -\alpha \frac{\partial E}{\partial w_{ij}}$$

D. E. Rumelhart proposed a method in the literature. The method is to add a momentum in the revised rules, this will take into account the contribution on the gradient iteration, and the weight iteration formula is as follows: $\Delta w_{ij}(n) = -\alpha \frac{\partial E}{\partial w_{ij}} + \beta w_{ij}(n-1)$ where n is the number of iterations, the β is called the momentum coefficient, $0 < \beta < 1$ [24].

3.2 Improved BP algorithm

In the traditional BP algorithm, the smaller learning factor α, the smaller change of network prominent weight from one iteration to the next iteration, more smooth of error surface, but this way will make the training speed of the neural network very slow. On the other hand, if increase the value of α to accelerate the learning speed, could easily result in the changing weights of neural networks not stable.That is easy to produce oscillations. In order to decrease oscillation, improve the training speed of the network, some scholars put forward a novel algorithm of BP neural network. The algorithm performance is: take the target and each iteration output value difference added to adjust the connection weights of the formula $\Delta w_{ij}(n) = -\alpha \frac{\partial E}{\partial w_{ij}} + \beta \Delta w_{ij}(n-1) + \eta(x_i^m - Y_i)$ according to the proportion:

In formula η is the ratio, called the smooth coefficient. In the introduction of flat item, neural network always tries to make the adjustments of the connection weights in the same direction. Even if the two connection weights adjustment in different directions, also can decrease the oscillation trend, improve the training speed, accelerate network convergence. The flat item additions, means that take into account the difference of actual output values and

standard output values,in order to approach the standard output value as soon as possible, shorten gap η times between the two directions. Compared with the traditional BP algorithm only has the learning rate and momentum factor, the novel algorithm can approach faster to the standard output value,at the same time, due to the direction space descent, neural network can overcome the shortcomings of oscillation in the process of training. The figure 2 describes the algorithm work flow of simple adaptive learning.

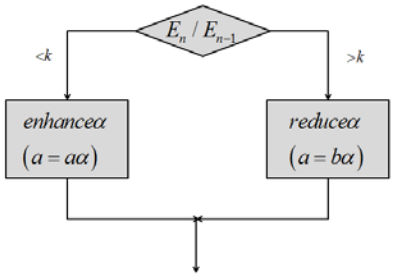

Figure 2. Flow chart of Adaptive learning rate algorithm

According to the above, the learning rate of algorithm adjusted as described below: first check the ratio of iteration error function of two adjacent values, if the error function decreased, the learning rate value α of the network algorithm is small, if the error function value does not decrease, the learning rate value α of the network algorithm is big, have to properly reduce the learning rate value of α, until the neural network convergence.

Provisions such a method to adjust the learning rate: If the ratio error of the new generation and the last old error are more than a fixed value (in this paper is defined as k, can be set to k=1.05), the learning rate needs to cut (in this paper, the learning rate actual value of a factor is multiplied by b, can be set to b=0.6); If the ratio error of the new generation and the last old error are less than a fixed value of k, the learning rate need for increased (in this paper, the actual learning rate value of a factor is multiplied by a, can be set to a=1.06).

The adjustment rules are available to be described as below:

$IF(E[w_{ij}(n+1)\} < kE[w_{ij}(n)])$

$\alpha(n+1) = a\alpha(n);$

$ELSE\ \ IF(E[w_{ij(n+1)}] > kE[w_{ij}(n)])$

$\alpha(n+1) = b\alpha(n);$

$ELSE$

$\alpha(n+1) = \alpha(n);$

According to the actual requirements and the previous experience, values of the variables were $a = 1.06, b = 0.6, k = 1.05$.

3.3 novel BP algorithm steps

Learning steps of the improved new algorithm of BP neural network as showedin figure 3:

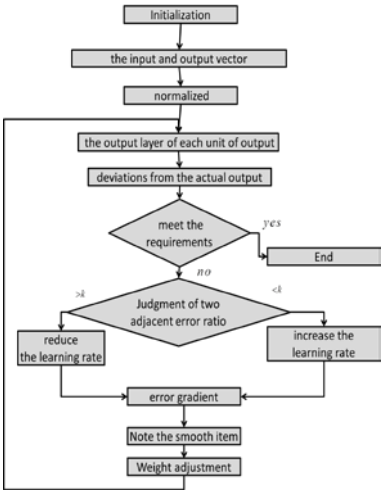

Figure 3. A novel BP neural network algorithm flow chart

Learning steps of the above the flow chart of the algorithm is described as follows:

(1) First initialized neural network. According to the number of influence factors in the general development of college physical education environment, to set the number of input layer node, while the output layer node number is generally set to 1, and the hidden node number layer set to $2m+1$

(2) determine the sample input and output sample expectations, selects a small connection weight matrix of ω and learning algorithms of factor α, momentum factor β and slowly factor η to the neural network algorithm randomly, And set the neural network allows the learning process error ε, then start training neural network.

(3) The normalized preprocessing of input sample data.
The general form of linear transformation algorithm

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

$x_{\max}, x_{\min}$ are maximum and minimum values of each input attribute; $x_i, x_i^{`}$ represent value of before and after normalization.

(4) Respectively calculate the hidden layer and output layer for each output unit. From the input layer to the hidden layer, then output layer the transfer function is the sigmoid function.

(5) Record the error between the target value and the actual output value. Then get to the next steps.

(6) Compare (5) value and the setting error precision in step (2).
If the error value is less than the error precision, the training objectives have been reached, go to step (7). Otherwise proceed to step (8).

(7) Stop training;

(8) Compare the error value of two adjacent iterations, If the ratio is less than k, adjusted according to the formula (10); If the ratio is greater than k, according to the formula (11) to adjusted to get the new learn factor value, then go to step (9).

(9) From this step get into the error back propagation stage, according to the error function to get the error gradient value, and then take the new learning factor value, in the backward propagation process of connection weights, then go to step (10).

(10) The standard output minus the theory value with the actual output value of the iteration, the results will be multiplied by the gentle factor, go to step (11) .

(11) Add the value of step (9) and (10), plus the momentum, with the results obtained to reverse adjust the output layer to the hidden layer, hidden layer to the input layer to adjust the connection weights, go to step (4).

According to the above discussion can be found, the computational complexity is very high, and it is difficult to achieve by using the artificial calculation way, must be implemented in a computer[25].

4. H CITY COLLEGES SPORTS DEVELOPMENT ENVIRONMENT EVALUATION BASED ON THE NOVEL BP NEURAL NETWORK ALGORITHM

Through the understanding of the college physical environment and the development findings, the college sports environment discussion of Scholar Deng Yuening is one of the most widely accepted papers. According to his statement, School physical education environment is the physical environment within a school.Other parts are called the social sports environment. In this definition, the school sports environment including material elements, elements of the system and the elements of information. Because of this study is the development of colleges' physical education environment of H city, one of the three foremost education bases in China. Therefore, in the H city range, the social sports environment has relatively little difference, so this paper selected the school range environmental factors, as high school sports development environment evaluation elements. The evaluation factors are as table 1:

Table 1. Evaluation factors

Hardware elements	Equipment value	C_1
	Sports venues	C_2
	Sports teaching costs than the total cost	C_3
Software elements	Physical education class than the total	C_4
	In the extracurricular sports	C_5
	The sports system	C_6
	Physical exercise consciousness	C_7
	Atmosphere	C_8
	Sports public opinion	C_9

The BP neural network algorithm needs to select a sample set as training data.

Therefore, this paper selected 20 university data as training data, its level of development has a consensus in the international. Determine the evaluation grade:
$T = \{T_1, T_2, T_3, T_4, T_5\} = \{excellant, good, medium, poor, wrost\}$.

Table 2. The training data table

	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9	Evaluation grade
td a	70	73	80	86	91	97	88	68	96	T_2
td b	67	87	67	85	53	98	85	70	96	T_2
td c	87	90	86	79	76	97	89	61	92	T_1
td d	65	77	77	80	43	83	57	46	86	T_4
td e	74	85	73	80	77	84	89	89	83	T_2
td f	85	88	84	87	68	99	77	87	71	T_2
td g	84	74	65	84	55	97	90	37	65	T_3
td h	69	76	72	78	72	75	74	64	72	T_3
td i	82	72	69	76	58	95	83	64	95	T_2
td j	90	88	90	84	85	98	41	57	92	T_2
td k	70	83	97	85	75	97	72	88	56	T_2
td l	73	82	73	85	90	97	83	90	99	T_1
td m	88	85	78	73	80	78	38	56	71	T_3
td n	85	61	79	41	59	72	39	37	65	T_5
td o	86	66	83	84	64	98	75	84	70	T_2
td p	77	76	87	85	79	97	61	80	76	T_2
td q	69	91	91	46	84	89	68	71	97	T_2
td r	81	65	64	78	64	95	64	76	64	T_4
td s	82	83	88	75	75	41	92	57	84	T_3
td t	67	85	77	85	93	58	77	88	76	T_2

In this paper select the sigmoid tangent function to be the transfer function for hidden layer neurons, considering the output range of the Y value, the output layer transfer function select purelin. Due to prohibitive computational complexity, the SD software is used to calculate the function.

Based on the evaluation index of $X = \{x_1, x_2, x_3 \cdots x_9\}$ as input, take the evaluation level of $T = \{T_1, T_2, T_3, T_4, T_5\}$ as output, the sports development situation of the 20 universities as training samples, establishes the mapping relationship between the evaluation indicators and evaluation of physical education development environment.

Through the collection of data, the longitudinal comparison, expert evaluation method 20 university sports development data had been made normalization using percentage by computer.

The training data as described in the table 2.

The error curve as showed in figure 4:

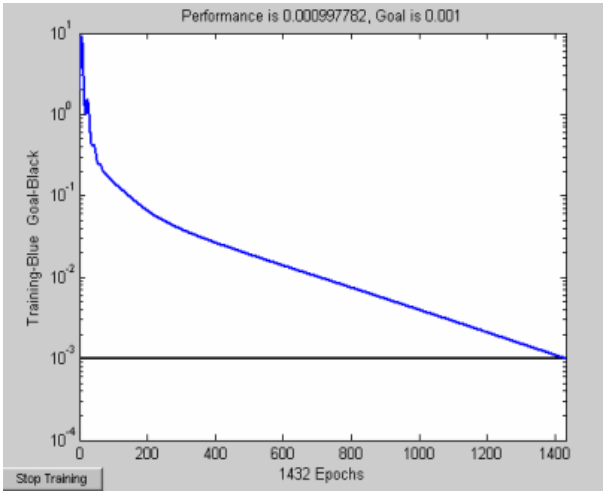

Figure 4. Error curve

Choose 17 University of H city as the evaluation object, collect the 17 universities` sports development data, and percentile normalization, as described in the following table 3:

Table 3. H City universities` sports development data

	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9
school 1	40	53	40	56	71	87	58	67	76
school 2	81	62	66	53	62	83	71	70	61
school 3	87	90	86	79	53	55	43	59	60
school 4	78	71	74	56	56	81	46	49	42
school 5	80	68	68	63	65	59	87	69	63
school 6	81	80	75	88	96	99	87	87	71
school 7	97	68	76	52	61	74	66	86	65
school 8	85	84	94	66	53	68	89	73	54
school 9	68	61	68	53	57	60	73	44	31
school 10	93	81	70	69	78	77	64	56	92
school 11	67	86	97	45	66	67	59	88	56
school 12	81	80	78	64	95	89	83	90	99
school 13	88	85	75	75	41	78	38	56	71
school 14	85	61	79	41	59	82	83	88	65
school 15	65	64	78	84	64	67	85	77	70
school 16	83	88	75	85	79	85	83	68	76
school 17	69	91	91	46	84	67	85	77	97

Input the trained model can get:

Table 4 is the evaluation grade

Table 4.Evaluation grade

	Evaluation grade		Evaluation grade
school 1	T_5	school 9	T_5
school 2	T_4	school 10	T_2
school 3	T_4	school 11	T_3
school 4	T_4	school 12	T_1
school 5	T_4	school 13	T_4
school 6	T_1	school 14	T_3
school 7	T_3	school 15	T_3
school 8	T_3	school 16	T_2
		school 17	T_2

CONCLUSION

This paper based on the previous research, and using computer software to reduce the complexity of neural network algorithm and training improved BP neural network algorithm with the collected data of 20 universities` sports development level that has been recognized by international, get the evaluation model. Then use it to evaluate H City 17 universities` environment for the development of sports.

However, this study also has shortcomings:
(1) In this paper, only H city 17 universities were evaluated in the study, the sample is limited in the city of H, lacking the study of social environment of university sports development;
(2) This paper chooses 20 universities for the training data; the number of training samples may not enough;

These problems will be progressively corrected in future studies.

REFERENCES

[1] Opinions on Further Strengthening the construction of high level sports teams in Colleges and universities[R] The State Sports General Administration of the Ministry of Education, **2005**;
[2] Wang Kangle. To create new discipline of sports [J] *Sports science*, **1998** (6);
[3] Liu Mairu. A research on the construction of new subject of sports environment [D] Huazhong Normal University, **2005**
[4] Lu Yuanzhen. Sports Sociology [M] Beijing Sport University press, **2000**
[5] XiongMaoxiang. Sports environmental introduction [M] Beijing Sport University press, **2003**
[6] Sina, sports dispatch [N] Beijing, **2007**
[7] The United Nations Environment Programme long-term strategy on sport and the environment [C] Council of the United Nations Environment Programme at its twenty-second session, **2003**
[8] "Sports and environmental agenda twenty-first Century" [C] Environment Programme and the global sports association "the global sports and environment forum", **2003**;
[9] Lin Wentao, Subject of sports environment [M] Guangzhou Sports University affairs office, **1998**;
[10] Guangzhou Sports University [I] Http://www.gipe.edu.cn/
[11] Zhang Xin, Discussion on the development of sports industry and its development strategy [J] *Journal of Shaanxi University of Science and Technology*, **2010**;
[12] Zhang Jun, *Journal of physical education*, **2000**, (5): 96 – 99;
[13] Wang Bo, *Journal of physical education*, **2006**, (11): 73 - 76
[14] ZhongBingshu, *China school physical education*, **2006**, (2): 45 - 48
[15] Zhang Liangyu, Liu Bing. Study of Analysis and Research on green environment current situation of school body [J] *sports science*, **2006**
[16] Zhang Jishun, Yao Lei. *Journal of physical education*, **2002**, (4): 76 -77;
[17] Liu Guanyuan. *Sichuan Sports Science*, **2004**, (6): 13 -14
[18] A Shouyun, Liu Donghui. *Journal of Beijing Sport University*, **2008**, (4): 506 -508
[19] He Yaping. *sports science*, **2009** (10)
[20] Wu Aibing. Ecological environment of physical education in Colleges and universities from the perspective of

social gender [J] *Journal of Anhui Normal University*, **2013** (5)
[21] Zhang Defeng. Study on dynamic fuzzy neural network algorithm based on pruning technique classification learning [J] *Research on Application of computer* -**2011** (28);
[22] Li Peng. Research on neural network algorithm based on Bayesian theory [J] *Ome information* in **2011** (28)
[23] Ouyang, Liang Jin. Application of improved BP neural network algorithm in stock price forecast [J] *computer and digital engineering*, **2011** (39);
[24]Rumelhart D.E., Hinton G.E., and Williams R.J. Parball Distributed Processing-Explorations in the Microstructure of Cognition[J]MIT press, **1986**, 30(5): 318-362.
[25] Li Youkun. Analysis and application of improved BP neural network [D] Anhui University of Science And Technology, **2012**