

Study on Prediction Model of Tourist Amount of Scenic Spot Based on BP Neural Network Algorithm

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Abstract: In recent years, the expansion of tourism market has put forward new requirements to strengthen the management of scenic spots, in this paper, it takes Mount Tai Scenic Area as the researching object, establishing the prediction model of tourist amount by using BP neural network algorithm, so as to predict the amount of tourists of scenic spots. Through the experimental result, we can know that the algorithm of this model is fast and effective. Therefore, it can verify the possibility of using neural network algorithm to predict tourist amount in the scenic spots.

Introduction

With the extensive application of artificial intelligence algorithm, BP neural network algorithm as well as its similar learning algorithm can realize its advantages gradually compared with the original static algorithm. BP algorithm is a kind reverse supervised learning algorithm, its main idea is as follows: inputting learning samples, adjusting and training network weights and deviation repeatedly by using back-propagation algorithm, so as to make the output vector and expected vector be as close as possible, when the sum of error square of network's output layer is less than the specified error, the train is complete, then it can save the network weights and deviation. This algorithm has a good effect in the field of artificial intelligence prediction. In recent years, Mount Tai Scenic Spot has been regarded as the World Cultural and Natural Heritage by the UNESCO, world geological park, national 5A scenic spot in China, national scenic spot, national key cultural relics protection unit, China's intangible cultural heritage. The total number of tourists entering this scenic spot is increasing year by year. Due to the difference of the tourist season of the different places, as well as weather and cultural factors and so on, during the hot season, the number of climbing Mount Tai can reach to about 0.2 million people, the least number is only a few thousand people, because the visiting number is extremely unbalanced, it can result in the frequent management problems of scenic spot^[1-3].

The purpose of this study is to take Mount Tai Scenic Spot as sample, using BP neural network algorithm to establish the prediction model of Mount Tai Scenic Spot, so as to improve the ability of service department of Mount Tai Scenic Spot on the development of scenic spots as well as tourists' management.

Prediction Method of BP Network

BP neural network processing unit is the nonlinear input and output relationship, the connection weights of each layer can be adjusted by the learning regulation, the information of network can pass from the topology feed forward transfer of previous layer unit to all the nodes of the next corresponding layer^[4]. The state of the neurons in each layer can only affect the state of the neurons of the next layer. In addition to the nodes of the input layer, the net

input of the hidden layer and the output layer node is the weighted sum of the outputs of the previous layer nodes^[5].

BP algorithm is a kind of more mature and guided training method, which is a unidirectional propagation of multilayer feed forward network. Input signal can pass from the input node, followed by the hidden layer nodes, and then to the output node, the output of each layer node can only affect the input of the next layer nodes. The formula of calculating actual output is as follows, Formula 1

$$y_j = f\left(\sum W_{ji}x_i\right) \quad (1)$$

Among them, function $f()$ is generally Sigmoid function, which can be shown in Formula 2

$$f(x) = \frac{1}{1 + e^{-x}} \quad (2)$$

Adjusting the weights, according to the direction of the error backpropagation, from the output node, so as to return to the hidden layer to correct the weights according to Formula 3:

$$W_{ij}(k+1) = W_{ij}(k) + \alpha[W_{ij}(k) - W_{ij}(k-1)] \quad (3)$$

Training objective is to minimize the error function E , which can be shown in Formula (4)

$$E = \frac{1}{2} \sum \sum (y_{jp} - t_{jp})^2 = \sum E_p \quad (4)$$

(4) In the formula, E is the network output error, P represents the P^{th} sample, j is the number of output unit, t_{jp} is the expected output of unit, while y_{jp} is the actual output of unit.

If Formula (5) is introduced in Formula (3).

$$h(x) = \sqrt{e} \frac{A}{R} x e^{\frac{-x^2}{R^2}} \quad (5)$$

Then Formula (3) can be transferred, Formula (6).

$$W_{ij}(k+1) = W_{ij}(k) + \alpha[W_{ij}(k) - W_{ij}(k-1)] + h(x) \quad (6)$$

Among them, A and R can be regarded as the amplitude and the radius of the nonlinear self feedback. They can control the range of weights. When R is fixed, A can determine the range of the transferred dynamic power of the dynamical system of the weights between the space when the energy is partially extremely less, the greater A is, the wider the range of weight correction is. This formula is a chaotic mechanism. Introducing it to Formula (7):

$$x = \Delta w_{ij}(k) = w_{ij}(k) - w_{ij}(k-1) \quad (7)$$

Assuming $|x| = |w_{ij}(k) - w_{ij}(k-1)|$ can indicate the speed that dynamic system is close to the fixed point, if $|x|$ is very large then it can indicate that the system is far away from the fixed point, $h(x)$ should be quickly reduced, so that the correction of the weight can approach to the fixed point if the system quickly according to the direction of the gradient information. When $|x|$ is in the state of the middle value, the dynamic system of weights will enter a certain neighborhood of one certain fixed point, the self-feedback function of $h(x)$ feedback will produce new driving force and jump out of the fixed point, in the end, the weight can enter one certain neighborhood of the optimal fixed point under the global sense.

BP Network Simulation

It can adopt BP network of chaotic system that contains only one hidden layer to predict and analyze the trend of tourist amount of Mount Tai Scenic Spot, among them, the input layer can be including three neurons, the hidden layer can be including ten neurons, the output can be including one neuron, the weight value of network and threshold value can be randomly selected. Three variables of inputting can be selected for the following three months, while the output of the variables can be the corresponding tourist amount of Mount Tai Scenic

Spot of the middle month of the input variables. Among them, the input parameters can be treated as follows: each month will be divided by the next month, the basic data can be shown in Table 1. The simulation curve can be shown in Figure 1.

Table 1 The Amount of Tourists in Mount Tai Scenic Spot from January, 2010 to December, 2015 (unit: 0.01million people)

Serial number	Month	The amount of people	Serial number	Month	The amount of people	Serial number	Month	The amount of people
1	201001	98	25	201201	94	49	201401	87
2	201002	36	26	201202	43	50	201402	39
3	201003	46	27	201203	57	51	201403	65
4	201004	101	28	201204	104	52	201404	109
5	201005	194	29	201205	231	53	201405	265
6	201006	165	30	201206	168	54	201406	205
7	201007	146	31	201207	157	55	201407	195
8	201008	131	32	201208	187	56	201408	176
9	201009	99	33	201209	121	57	201409	187
10	201010	179	34	201210	203	58	201410	251
11	201011	87	35	201211	105	59	201411	96
12	201012	62	36	201212	75	60	201412	56
13	201101	102	37	201301	90	61	201501	88
14	201102	44	38	201302	42	62	201502	49
15	201103	52	39	201303	55	63	201503	87
16	201104	128	40	201304	134	64	201504	189
17	201105	221	41	201305	247	65	201505	295
18	201106	187	42	201306	199	66	201506	221
19	201107	166	43	201307	201	67	201507	196
20	201108	162	44	201308	197	68	201508	168
21	201109	103	45	201309	153	69	201509	99
22	201110	197	46	201310	256	70	201510	243
23	201111	86	47	201311	73	71	201511	115
24	201112	57	48	201312	55	72	201512	61

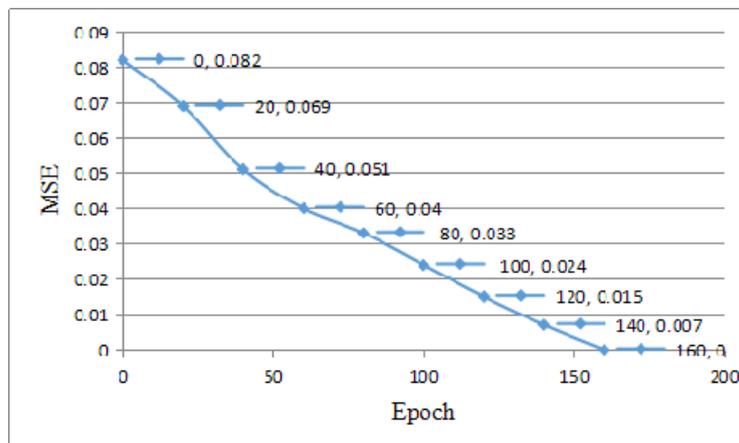


Fig. 1 Training Target Curve of BP Algorithm

Having prediction on tourist amount of Mount Tai Scenic Spot from January, 2016 to March, 2016 by adopting BP network, it can get the tourist amount of Mount Tai Scenic Spot which are as follows: 0.963 million people, 0.525 million people, 1.025 million people, while the actual tourist amount in January, February and March of 2016 are as follows: 0.97 million people, 0.51 million people, 1.00 million people, which can prove that the prediction accuracy of BP network.

Conclusion

BP neural network has the advantages of simple structure, strong learning ability and high prediction accuracy, which is especially suitable for complex nonlinear system. Based on chaotic system, BP neural network can have the study on the prediction of tourists amount, the experiment shows us that this kind of algorithm can achieve the desired requirement, people can believe that with the improvement of the continuous increase of computer processing speed as well as the expansion of the other related technology, neural network technology will get further development and perfection, the result of this prediction model shows that the prediction of BP neural network algorithm on the tourist amount is accurate and reliable, and its application in the prediction of tourism will continue to become mature.

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