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Chief Editor : Qingsheng Xie
Subeditor : M H Wu
Guoning Qi
Pingyu Jiang

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Preface

Global economic integration makes the manufacture industry faced with more complex market environment. In recent years, as the market competition becomes increasingly more severe and the advanced technologies develop speedily, great changes have occurred to the traditional manufacture technology, business rules, transaction means and business and management modes, etc. The e-business, network manufacture, e-manufacture have been increasingly adopted in the manufacture industry; many new concepts and forms such as enterprise dynamic alliance, real-time enterprise, digital enterprise, etc. have sprung up continually; the advanced manufacture mode has been characterized by resources allocation globalization, network collaboration between enterprises, business operation informationization and manufacture process automation, etc. Currently, carrying on a profound research as to how the manufacture industry adapts to the manufacture technologies, business rules and management modes in today's complicated environment to strive for a sustainable development path for the manufacture industry is a very urgent and significant issue for the academic field.

In order to have a better command of the latest developing trend and research leading edge in fields such as e-business, advanced manufacture technology, etc., National Natural Science Foundation of China (NSFC), Guiyang municipal government, Chinese Mechanical Engineering Society (CMES), Guizhou University, Institution of Engineering and Technology (IET) will co-sponsor the 5th International Conference on e-Engineering & Digital Enterprise Technology in August, 2006 in Guiyang city. The representatives attending this conference will carry out extensive discussions on technical issues of current e-business, real-time enterprise, network manufacture and e-manufacture, etc. Some development strategies of region-oriented will be probed in combination with the realities of the manufacture industries of various countries. Some world-famous professors and experts are also invited to give reports on some hot issues of e-business and advanced manufacture in the conference. This conference will provide an excellent opportunity for the researchers in global manufacture study to exchange, discuss and report their latest findings.

This conference has obtained extensive supports from many sides. On this occasion, we'd

like to give our heart-felt thanks to National Natural Science Foundation of China (NSFC), Ministry of Education of the People's Republic of China, Chinese Mechanical Engineering Society (CMES), Guiyang Municipal Government, Guizhou University, Institution of Engineering and Technology (IET), etc. for their great supports. Thank our fellow researchers in the domestic or oversea academic field for the active responses. Thank greatly for the hard work and distinguished efforts made by the experts and work staff of the procedure committee and the organizing committee of this conference.

e-ENGDET2006 Organizing Committee

August, 2006

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FORECAST OF THE REGIONAL EC DEVELOPMENT THROUGH AN IMPROVED ANN MODEL

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ABSTRACT

The paper endeavors to make a forecast study of the regional E-Commerce development level with an improved Artificial Neural Networks (ANN) forecast model, it mainly consists of the following: (1) Setting up an improved ANN forecast model, that is, the Back Propagation Networking Learning Algorithm (BP Networking Algorithm) with an interference function. (2) Setting up a relatively complete and workable evaluation index system for passing judgment on the regional E-business development level; (3) On the basis of the models and evaluation index system established, an forecast study of the E-Commerce development level in a certain city in China was carried out. The result of the case study has indicated that the model has an ideal extension, the number of its hidden-layer neurons can easily be decided, and it is relatively easy to have a long-term forecast of the E-Commerce development without much initial data. With this model in hand, it is possible to cope with the problems of sparse, dispersed and hard-to-forecast statistical information in the development of the electronic commerce.
KEY WORDS Interference function; BP model; EC development; Forecast

1 INTRODUCTION

Nowadays, with the rapid development and wide application of information and communication technology represented by Internet and mobile technology, a new mode of business—E-business, is developing by leaps and bounds, subsequently leading to the emergence of a new type of economy, namely network-based economy. This type of economy, though global in nature, takes on noticeable regional features in its current development stage [1]. Judging from a global perspective, it is, geographically, indicative of "North American Phenomenon" so far [2].

It is of great importance to evaluate the development level of different regions in an objective and scientific way because of its regional development features.

To begin with, the development of network economy (which mainly represented by E-business) is clearly different from the conventional economy [3]. Though the developed regions with conventional economy are generally more active in E-business activities, it is not an absolute law either in international or domestic situation. For instance, according to the successive statistics released in 2001, 2002 and 2003 by the International Telecommunication Union (ITU), though the developed economies, such as the US, Japan, have high figures as a whole for measuring the regional E-business development level, Iceland, Ireland and Denmark have even higher figures. Domestically, similar trend is shown in China E-business Almanacs published over the past few years. Take Sichuan, Hebei and Fujian for instance, those provinces are relatively underdeveloped compared with Beijing, Shanghai and Canton in terms of economic development level, but many of their indexes on regional E-business development level are at the top, such as E-business transaction, E-business infrastructure, satisfaction of E-business users, policy environment of E-business, etc. Those examples indicate that some countries at different development levels, or the countries and regions that are less developed in the traditional sense, may achieve economic development skipping certain levels through vigorous development of E-business. It is a great opportunity for less developed countries and regions to, in the era of network economy, achieve leap-forward development by riding on the fast track of network economy. Anyway, national and regional competitiveness in the age of the Internet will require "being in the loop" more than ever before [4].

Next, an objective and scientific evaluation will help different countries and regions to better understand their weak areas in developing E-business, so as to promote its smooth development.

Finally, in this era featuring information and knowledge-oriented economy, the regional E-business development level is certainly a strong symbol showing that whether the region has a sustainable capability for

development or whether it will play an engine-like role in the global economic arena.

John C. Scott put forward a model called Internet Maturity in 2000, which highlighted the 4 stages of the development of the Electronic Commerce in businesses. It also explained thoroughly the way businesses stepped onto the highly developed stage of EC with such techniques as integrated skills and reengineering. This model was developed in somewhat the same way as the three stages of EC development presented by Yang Jianzheng in his Principles and Applications of the Electronic Commerce and the Tri-level Model of EC development and the Bi-level Model of EC development in 2003 China E-business Almanac. Unfortunately, these theories or models do not touch upon the study of the EC development in different regions.

It is considered difficult to implement the study of EC development in different regions because of the three handicaps: the construction or selection of models, the construction of measurement systems, and the collection of initial data for statistics. This paper is to deploy studies in these three spheres respectively.

2 CONSTRUCTION OF THE MODEL

The recently developed artificial neural network (ANN) Model is an active branch in artificial intelligence. ANN is a newly developed information processing system on the bases of the study of modern neurology, which simulates the biologic nerve system and seems to be able to process an array of information simultaneously. It can be used to process information by association, generalization, analogy, and reasoning. It has an advantage of self-learning, the capability of distilling features, summing up knowledge, and forecasting futures on the gained experiences. It is also full of adaptability, systematisation, and an ability of learning, associating, infrastructure problem solving, and noise eliminating [5]. Therefore, ANN has its bright future in the economic forecast.

The following four steps is need when dealing with forecast problems through ANN model:

(1) Constructing appropriate network structure according to specific problems, that is, deciding the number of neurons in input and output layers, the number of hidden layers and the number of neurons in hidden layers.

(2) Setting up learning sample set and anticipated output.

(3) Training the network till it becomes converged.

(4) Forecasting with the converged neural network.

2.1 Artificial Neural Network structure

The basic structure of neural network is as follows (Figure 1). This paper is to have a deep understanding on the time series prediction with the help of ANN, putting forward a brand-new forecast model, that is, the Back Propagation Networking Learning Algorithm (BP Networking Algorithm) with an interference function. The model is used to overcome the deficiencies of the traditional BP Algorithm, as it is more accurate for forecasting, less dependable on initial data, and easier to select the needed number of hidden layers and hidden-layer neurons.

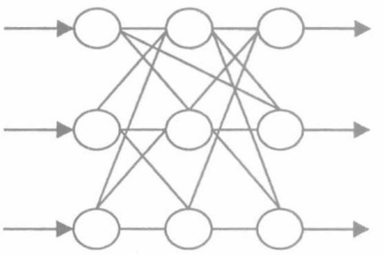

Fig.1 BP Neural network structure

(1) The number of neurons in input layer

In the traditional ANN forecast model, the statistical data (measure data) is regard as a time series $\{S(t), t=1\sim n\}$, n is the number of data. The forecast model can be described as:

$$S(t)=\phi[S(t-1), \cdots, S(t-p)] \qquad (1)$$

$\phi[\cdot]$ is a nonlinear function, p is the order number of model. According to time series S (t), n-p learning samples were chosen for training.

The tradition ANN model has the following deficiencies: ①it is hard to decide the number of hidden nodes;②the extensity of forecast curve is poor, so it is hard to carry out long term forecast. To overcome these defects, an improved ANN forecast model, that is, the Back Propagation Networking Learning Algorithm (BP Networking Algorithm) with an interference function is set up in this paper. The details are as follows:

Choosing a simple function, $z=aS^b$(b=1/2, 2or3, etc., a<1), use this function to interfere network in input layer. Here, two neurons in input layer are chosen, one is t, and the other is z.

(2) The number of neurons in output layer and the anticipated output

The anticipated output is chosen as the statistical data St, then the number of neurons in output layer is 1.

(3) The number of hidden layers and the number of neurons in hidden layers

The number of hidden layers and the number of neurons in each hidden layer has great effect on train learning effect and the forecast accuracy. The principal used in this paper is as follows: as regard to continuous function, the number of hidden layer is chosen as 1; as regard to piecewise continuous function, the number of hidden layer is chosen as 2. According to our research, we found that it is more reasonable if the number of neurons in hidden layer is taken as half the total number of neurons in input layer and output layer (but not less than one-fourth of learning samples). In this paper, 2 hidden layers are chosen, and the number of neurons in each layer is chosen as 6 and 8 respectively.

2.2 Network-learning Algorithm

BP (Error Back Propagation) is a multi-layer artificial neural network, comprising input, hidden and output layers. There is full inter-layer connection but no intra-layer connection of neurons.

The rationale of BP network:

Suppose the input mode vector A_k=(a1, a2, a3...an), k=1,2,3...m. Here, m is the number of learning modes; n is the number of neurons in the input layer. Correspondingly, the expected output vector Y_k=(y1, y2, y3...y_q), and q is the

number of the output neurons.

The calculation process of the input of the neuron in each hidden layer is follows:

$$s_j = \sum_{i=1}^{n} w_{ij} a_i - \theta_j \quad , j=1,2,\ldots,p \qquad (1)$$

In this formula, w_{ij} is the connection weight ranging from the input layers to hidden layers; θ_j is the threshold value of neuron in the hidden layer; p is the number of the neurons in the hidden layer.

To simulate the non-linear features of the biologic neurons, make s_j the independent variable of the sigmoid function, so as to calculate the output of each neuron in the hidden layer. The Sigmoid function is as follows:

$$f(x) = 1/(1+e^{-x/x_0}) \qquad (2)$$

Here $f(x)$ is transfer function, and the activation value of the neurons in the hidden layer is:

$$b_j = f(s_j) \qquad j=1,2,\ldots,p \qquad (3)$$

While information is flowing from the input layer to the output layer, if we provide the input information, we can get an output as follows:

$$L_t = \sum_{j=1}^{n} v_{jt} b_j - \gamma_t \qquad (4a)$$

$$c_t = f(L_t) \quad ,t=1,2,\ldots,q \qquad (4b)$$

It has been theoretically proved that there exists a three-layer network that can achieve the mapping action of any consecutive function with whatever accuracy required[6].

To carry out the mapping action, the network needs to be trained through the following steps:

1. Initialization of the weight value and threshold value. Choose at random an initialized weight value and threshold value from the interval (0,1);

2. Set input vector A and output vector Y;

3. Calculate the actual output vector C;

4. Revise the weight value, starting from the output layer, propagate the error signal backward, and try to minimize the error by revising different weight values;

5. Adopt $Y_k = (y_1^k, y_2^k, \ldots, y_n^k)$, the desirable output mode, and $\{Ct\}$, the actual network output, to calculate $\{d_j^k\}$, the error of different neurons in the hidden layer; its formula is as follows:

$$d_j^k = (y_t^k - c_t) \cdot c_t (1-c_t) \quad , t=1,2,\ldots,q \qquad (5)$$

6. Use $\{v_{jt}\}$, the connection weight, $\{d_t\}$, the error, and $\{b_j\}$, output of the hidden layer, to calculate the error of different neurons in hidden layers, namely $\{e_j^k\}$.

$$e_j^k = (\sum_{i=1}^{q} d_t \cdot v_{jt}) \cdot b_j (1-b_j) \quad j=1,2,\ldots,p \qquad (6)$$

7. To revise v_{jt}, the connection weight, and γ_t, the threshold value by using $\{d_j^k\}$, the error of different neurons in the output layer and $\{b_j\}$, the output of different neurons in the hidden layers:

$$v_{jt}(N+1) = v_{jt}(N) + \alpha \cdot d_t^k \cdot b_j \quad , j=1,2,\ldots,p;$$
$$t=1,2,\ldots,q \qquad (7)$$

$$\gamma_t(N+1) = \gamma_t(N) + \alpha \cdot d_t, (0<\alpha<1) \qquad (8)$$

8. To revise $\{w_{ij}\}$, the connection weight, and $\{\theta_j\}$, the threshold value, by using $\{e_j^k\}$, the error of different neurons in the hidden layers and A_k, the input of different neurons in the input layers.

$$w_{ij}(N+1) = w_{ij}(N) + \beta \cdot e_j^k \cdot d_i^k ,$$
$$i=1,2,\ldots,n;\ j=1,2,\ldots,p \qquad (9)$$

$$\theta_j(N+1) = \theta_j(N) + \beta \cdot e_j^k \quad j=1,2,\ldots,p \qquad (10)$$

9. Choose the next learning mode for the network, return to step 3, until all (m) modes are finished with the training.

10. Once again, choose at random a mode from m, return to step 3, if global error E is smaller than a preset small value, then the neural network is convergent. Or else, if learning time is bigger than a preset value, which means the network cannot converge any more. The formula is as follows:

$$E = \sum_{k=1}^{m} \sum_{t=1}^{q} (y_t^k - c_t)^2 / 2 \qquad (11)$$

BP algorithm is actually a kind of gradient algorithm, namely:

$$w(t+1) = w(t) + \eta(-\frac{\partial E}{\partial w})\Big|_{w=w(t)} \qquad (12)$$

3 CONSTRUCTION OF INDEX SYSTEM

The level of regional EC development can be used to reflect the integrated situation of the development of Electronic Commerce in that region. Therefore, it is necessary to select all the indexes from various spheres for the assessment.

With the consideration of the function of different sub-systems and the logical relationship between different levels of sub-systems, this paper will, in measuring the development level of the regional E-business Y, break the measurement system down into four first-grade sub-systems, which are: trading capability X_1, supporting trading capability X_2, development potential X_3 and governmental support X_4. Each first-grade sub-system is composed of several minor indexes. The particular index system is shown in the following table 1.

4 CASE STUDIES

4.1 Artificial Neural Network structure

This study is based on the practice in Huai'nan, Anhui Province. As a major city for coal and power generation, the medium-sized city has many big energy enterprises spread in several districts. Those businesses are generally advanced in information processing and hoist the EC development in the city. In order to promote the electronic commerce, the city started in 2004 a project called Digital Huai'nan. The project will be unfolded in all the 7 districts of the city, that is, tianjia'an, Panji, Maoji, Bagongshan,

Xiejiaji, Datong and Fengtai.

4.2 Artificial Neural Network structure

This paper is to forecast the development of the EC transactions in the districts in Huai'nan with BP Model. The analysis has its foundation of assessments, and the logic of the assessment of the EC development is as follows:

The index X_1 is achieved by calculation of the 4 items: X_{11}, X_{12}, X_{13} and X_{14}. X_2 is achieved by calculation of the 3 items: X_{21} (Supporting trading capability of infrastructure), X_{22} (Supporting trading capability of labor resource), and X_{23} (Supporting trading capability of management and safety). Of the 3 indexes X_{21}, X_{22}, and X_{23}, X_{21} is calculated through the following 5 items: X_{211}, X_{212}, X_{213}, X_{214}, and X_{215}. X_{22} is calculated through the 3 items: X_{221}, X_{222}, and X_{223}. X_{23} is calculated through the 4 items: X_{231}, X_{232}, X_{233}, and X_{234}. X_3 is calculated through the 5 items: X_{31}, X_{32}, X_{33}, X_{34} and X_{35}. X_4 is calculated through the following 3 items: X_{41}, X_{42}, and X_{43}. The index Y is calculated through X_1, X_2, X_3, and X_4.

Table 1 The index system

Y	X_1	The percentage of e-business turnover in GDP X_{11}	
		The percentage of e-business dealers X_{12}	
		The extent to which the dealing cost has been reduced X_{13}	
		The extent to which the dealing time has been reduced X_{14}	
	X_2	X_{21}	Degree of popularity of computer X_{211}
			Degree of popularity among net-user X_{212}
			The percentage of enterprises net-users X_{213}
			Credit card per head X_{214}
			The proportion of investment on e-business in total investment X_{215}
		X_{22}	The proportion of e-business personnel in the overall employed X_{221}
			The proportion of e-business personnel with bachelor degree or above in the overall employed X_{222}
			The proportion of e-business teaching program participators in the overall teaching program participators X_{223}
		X_{23}	Available or unavailable of e-business safety center X_{231}
			The proportion of installation of anti-virus software in computers X_{232}
			The proportion of updating anti-virus software in computers X_{233}
			The proportion of virus-related damages in the overall business turnover X_{234}
	X_3	The average ADR of net shares X_{31}	
		The average price-to-earnings ratio of net shares X_{32}	
		Degree of popularity among net-user X_{33}	
		The percentage of enterprises net-users X_{34}	
		The market accessibility of e-business X_{35}	
	X_4	The availability of special fund to support e-business X_{41}	
		The availability of special project arrangements to support e-business X_{42}	
		The availability of government measures to support e-business X_{43}	

We calculate the level of EC development as follows:

The 3-layer BP Model is used for the calculation. We set different numbers of the input and output neurons according to the different requirements for indexes. At the same time, some adjustment was also made to the number of the hidden-layer neurons. For example, X_1, the capability of EC transactions, adopts 4 input neurons (X_{11}, X_{12}, X_{13} and X_{14}) and one output neuron (X_1), while 8 neurons were chosen for the number of neurons in hidden-layer. All the other indexes were processed more or less the same way as X_1.

By this ways the overall capability Y of each district is calculated.

4.3 Artificial Neural Network structure

(1) The calculation for the forecast of EC development is as follows:

The calculation is accomplished with a 4-layer BP model. Because the problem come across is a non-linear time series problem, it is not proper to use an ordinary BP neural network. Therefore, we use a BP neural network with an interference function. Among which, there is 2 input neurons, 1 output neuron, 6 and 8 neurons in the two hidden-layers. Based on the initial data, we tried to forecast the 2005 EC development in various districts of Huai'nan. Listed below is only the result of the forecast of EC development in Tianjia'an District (Table2, figure2).

Table2 The forecast of EC development in Tianjia'an District

Year	Tianjia'an District
2005	0.634162
2004	0.578771
2003	0.52141
2002	0.464049
2001	0.316687
2000	0.279326
1999	0.134196

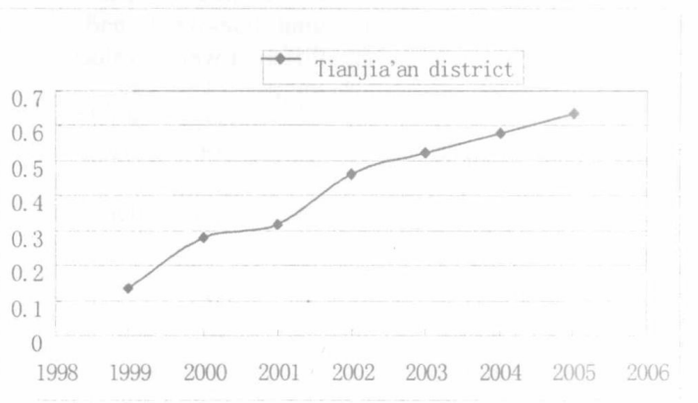

Fig 2 The forecast of EC development in Tianjia'an District

(2) Analysis of the forecast of the EC development

We have got several unique characteristics from the result of forecast. First, there have been evident developments of the EC transactions in all the districts, which is relevant to the domestic and international economic environment. Second, as far as the EC development in the past few years is concerned, Tiania'an,

Fengtai, and Xiejiaji Districts are the first three in transaction amounts and the growth rate. This reflects the global reality that in the launching stage of the EC development, the regions, which have solid economic foundations usually, take the lead. Third, we are once again assured from the assessment that the major driver of the EC development, that is, the government support, plays a very important role in this field. The draft of the EC development from 2002 to 2003 in various regions shows us that China Electronic Administration Year promoted greatly the EC development in these areas. Fourth, B2B transactions are the main force in the EC development in all the districts.

5 CONCLUSIONS

This paper has introduced a new scientific means to assess and forecast the EC development in a region. The ANN with an interference function adopted in our study has solved the problem of sparse, dispersed and hard-to-forecast statistical information in the development of the electronic commerce. We have constructed a model for assessment and forecast, and implement some calculation with initial data from a sample region. The ANN is a data-oriented method of analysis. We took the model of this kind because the regional EC development is new area for study, and we have not had much systematic arithmetic analysis. One the other hand, the problem we have is systematically sophisticated, non-linear, multi-indexed, and non-adequate, so we are not able to deal with it with the traditional arithmetic models. The ANN is also full of the abilities of self-learning, self-organizing, self-adapting, and problem solving, and is a proper choice for the study of new and sophisticated systems.

REFERENCES

[1] Guo Jianquan. Regional Analysis of Network Economy. Journal of East China Normal University, first edition in 2004(1): 56~61.

[2] Joanne E Oxley, Bernard Yeung. E-commerce Readiness: Institutional environment and international competitiveness. Journal of International Business Studies, 2001(4): 705~706.

[3] Zheng Jingping. Measuring the Level of E-business. 2003 China E-business Almanac. Beijing: Editing office of China E-business Almanac: 483~488.

[4] Edward E.Leamer，Michael Stroper. The Economic Geography of the Internet Age. Journal of International Business Studies, 2001(4):660~661.

[5] Jiao Licheng, Alogrithm of Neural Network, Publication of University of Xi'an Electronic and Technology, Xi'an, pp. 249-294, 1995.

[6] Jiao Licheng, System Theory of Neural Network. Publication of University of Xi'an Electronic and Technology, Xi'an, 1995.