BPNN BASED WATERWAY TRANSPORT VOLUME PREDICTOR

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The right prediction of the waterway transport volume is essential to the layout of water resource facilities on river or canal. The common methods now used in the prediction of transport volume include linear regression, grey system, time series prediction, dynamic system and exponential smooth, etc. Some of them are based on cause and effect analysis. In long term prediction, they are not a good way to do this work. Firstly, no work has successfully determined which the factors are. Not to say it is a huge work to predict them in the long term. Secondly, it's not an easy work to get the accurate relationship between the causes and our target. Other methods are based on the collection of time series data of the past years. The determined prediction models need to be built with the analysis of the known time series values. Many regression methods are brought to do this work, such as logistic regression, self-correlation and exponential smoothing. But as used in our prediction area, the results are not good enough.

Analysis on the transport volume data of China from 1977 to 2004 shows that the waterway transport volume is long term dependent, which demonstrates its predictability with the data years before. There exist time series based prediction model to obtain the result accurately. There are many factors influencing the transport volume on the waterway, which build a complicated nonlinear system. This nonlinear characteristic is the main reason leading to the difficulty to predict the value accurately, especially for long term. This may be the reason that the result by those regression methods mentioned above are unsatisfied.

Artificial Neural Network is an information processing system. It can approximate any function even though the data are fuzzy, nonlinear and noisy. Considering its superior nonlinear and high accurate character and its wide use in the prediction with good results obtained in many fields, it is applied to the prediction of waterway transport volume in this paper including for a short period forecast and for long term forecast, namely that of the one year ahead, five year ahead and ten year ahead forecast. The data of China from 1977 to 2004 are used as the resources. For 1 and 5year ahead forecast, 6 specimens were used for testing the network's ability to generalize, and with 3 in 10 year ahead forecast. Table 1 shows the training and testing error of NN prediction. Generally, the error is smaller than 5%. And the testing results show that this can make an accurate prediction for future use. NN is a good way to do this work, and can give a relative accurate result in long term prediction.

Putting the NN prediction model and the common used ones together and comparing their prediction result, as showed in Fig. 2, the NN obtained the best fitted result with the real ones. Both absolute error and relative error from NN are the least. NN is a better model to do this work than the commonly used ones.

Tabel 1. the average BPNN training and testing error

prediction time	training			testing		
	Aver absolute	Max Relative	Aver relative	Average absolute	Max relative	Aver relative
1year ahead	180.4	3.7%	2.01%	294.8	3.7%	1.01%
5 year ahead	173.5	4.52%	1.95%	1195.8	4.55%	2.82%
10year ahead	302.76	4.60%	2.08%	1012.2	4.94%	2.9%

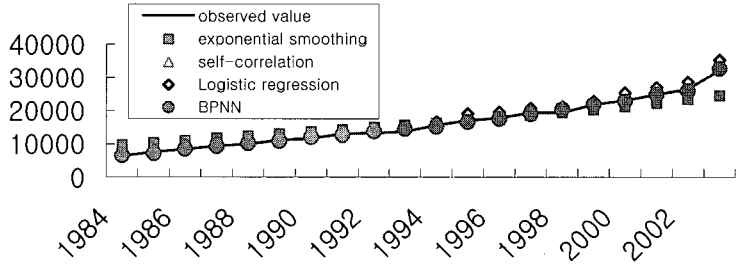

Fig. 2 Comparing the forecast results of prediction methods and the observed value

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