Mid-long Term Load Forecasting Based on GM(1,N)-BP Neural Network Model

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Abstract

Mid-long term load forecasting is the important foundation of power system planning and operation. In the economic transitional stage, it is difficult to guarantee the prediction accuracy under the influence of the strong volatility of various loads. Accordingly, the gray prediction model of GM (1,N) is established by using the correlation degree of the multidimensional variables that affect the power load. Combined with BP neural network theory, residuals of loads are used for state division of BP neural network process and the load trend in the aimed planning year is predicted. Finally, the effectiveness and feasibility of the proposed method are verified by predicting load trend over the next five years in China's a certain regional power network as computational examples system.

GM (1,N) multidimensional grey prediction model G

On the basis of the GM (1,1) model, a variety of influencing factors are added to the prediction process to form the GM (1,N) algorithm. The sequence of predicted results for the total amount of power demand is expressed as E_{DM}.

The residual difference between the power demand sequence E and the E_{DM} is calculated, where has $\varepsilon=E-E_{DM}$. The sequence is predicted by using B-P reverse propagation neural network.

Residual correction based on BP neural network theory

The sample data I as the input of the BP neural network, after the network propagation of the output is O, the expected output of the network model is Y, according to O, Y, calculate the average variance of the network.Reverse correction of the weights and thresholds of each node of the neural network using gradient method.

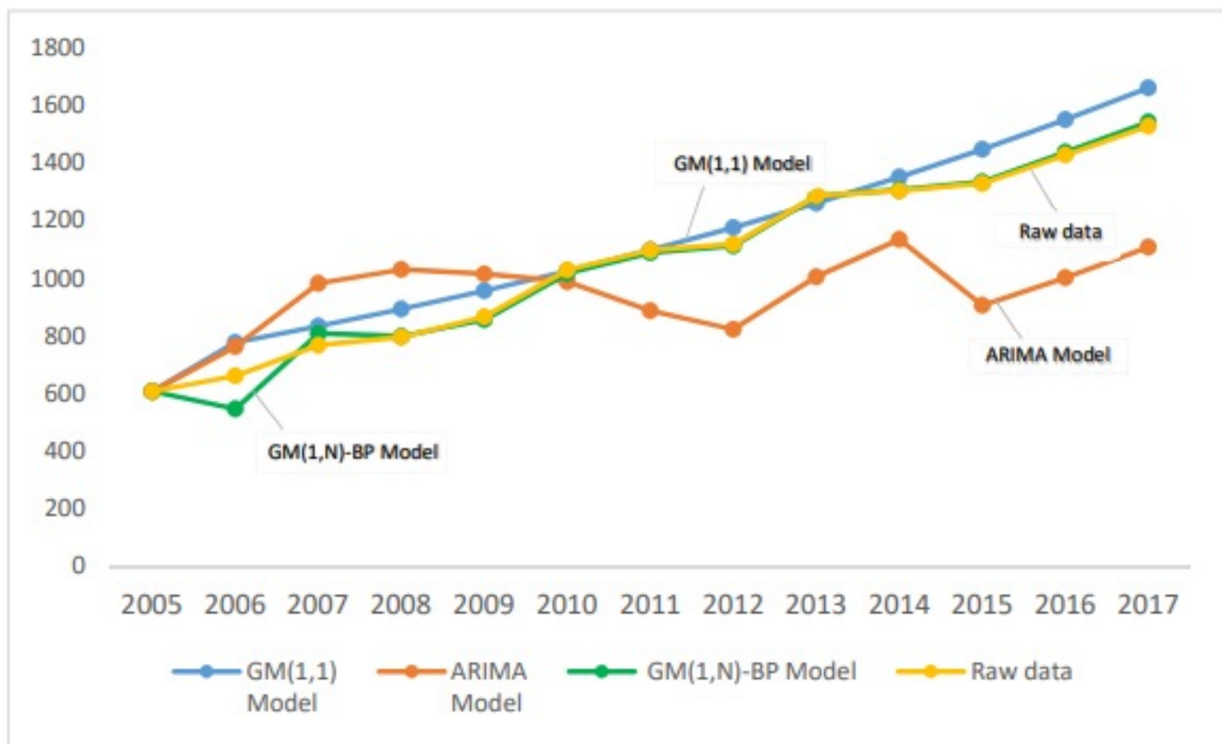
The weights and thresholds in the neural network are corrected by reversing layer by layer until the parameters such as the error or number of trainings of the model reach the set target. The B-P reverse propagation network prediction sequence for the sequence is expressed as ε_{AN}.

The difference sequence between the model residual sequence and the ε_{AN} is calculated, which has $\varepsilon_2=\varepsilon-\varepsilon_{AN}$. The B-P reverse propagation network prediction is made using the historical power demand residual ε_2 as the influence factor sequence, and the result of the prediction is expressed as ε_{2AN}. The final sequence of predictions, expressed as:

$$E_P = E_{DM} + \varepsilon_{AN} + \varepsilon_{2AN}$$

Results

The prediction results and accuracy of various methods are as follows:



Model	GM(1,1)	ARIMA	GM(1,N)-BP
Relative error	5%	6.5%	1.0%

It can be seen that GM (1, N) - BP provides a good grasp of residual error, prediction efficiency, and prediction accuracy.

Conclusion

GM (1, N) - multidimensional grey BP neural network prediction model considering influence of various factors to the growth of electricity demand, the result of the preliminary prediction of residual for secondary revision, so as to obtain higher prediction accuracy and smaller prediction residual error, and make up for the social economic background of the new normal single forecast model is difficult to grasp the trend of power load growth.