Prediction of Electric Load Big Data for Users through BP Neural Network

Yang Li 1, \*, Deping Zhang2

1Department of Photovoltaic Network, National Grid Ecommerce Ltd, Beijing, 100053, China

2School of Electronic Engineering, North China Electric Power University Beijing, 102206, China

\*liyang28@kkui.com

**Keywords:** BP Neural Network,Prediction, Electric Load

**Abstract:** Power load forecasting is very important for power dispatching. Accurate load forecasting is of great significance for saving energy, reducing generating cost and improving social and economic benefits. In order to accurately predict the power load, based on BP neural network theory, combined with the advantages of Clementine in dealing with big data and preventing overfitting, a neural network prediction model for big data is constructed.

1. Introduction

The accurate prediction of power load is of great significance for the electric power production and the safe operation of the power grid and the national economy [1]. Short term load forecasting is an important part of energy management system. The prediction error directly affects the analysis results of subsequent safety check of power grid, which is of great significance for dynamic state estimation, load scheduling and cost reduction [2-4]. Traditional prediction methods are based on linear regression, such as time series method, analysis method and pattern recognition method has defects of respectively [5].

1. The basic funamental of BP neural network

**2.1 The structure of BP neural network**

BP neural network is a multi-layer network with error reverse propagation, which is composed of input layer nodes, hidden layer nodes and output layer nodes. This process has been reduced to an acceptable level of error to the network output, or to a predetermined number of learning times. The network structure is shown in Figure 1.



Figure 1. Neural network structure

The general model of artificial neural network consists of four basic elements, which are:

(1)The BP neural network is linked by different node coefficients. When connecting weights and weights are positive, it indicates that the current link is an exciting state. Conversely, if the link coefficient is negative, the link state is a state of suppression.

(2) The input signal and the linear signal are the combination of the signals for each input signal.

(3) The function of the nonlinear activation function: making the neuron output signal within a certain range.

  (1)

  (2)

  (3)

**2.2 The determination of the number of network layers**

BP neural network is back propagating, mainly composed of three parts: input layer, middle layer and output layer. The number of nodes in the input and output layers is relatively easy to determine, but the determination of the number of nodes in the hidden layer is a very important and complex problem.

1. Results

**3.1 The establishment of simulation model**

The large data prediction model for the user's electricity consumption is implemented in the Clementine software.

**3.2 Analysis of experimental results**

By selecting the load prediction results of 403 and 411 lines. We can see that the actual values of the lines basically match the predicted values, but there are also some errors, especially in the peak period of electricity consumption, as shown in Table 1.

Table 1. Comparison of power load forecasting of 403 line

|  |  |  |
| --- | --- | --- |
| **Comparison** | **Power** | **Forecasting** |
| A | 12937 | 92387 |
| B | 928735 | 29837 |
| C | 894523 | 23894 |

From the comparison between prediction data and actual data, the BP neural network has better prediction performance and relatively small error, which can meet the demand completely, and has fast prediction speed and convenient operation.

1. Conclusion

The trend of mass data in power system provides a basis for load characteristic analysis and prediction model establishment, but the classical load forecasting method can not afford such a huge time and computing resource consumption. The problem of over fitting in large sample set will affect the prediction accuracy. In this paper, a power load forecasting model is built by using the BP neural network model, making full use of the powerful data processing function of Clementine and preventing the over fitting function. The experimental results show that the BP neural network model has good predictability and robustness, and has a certain practical application value.

Acknowledgements

The authors gratefully acknowledge the financial support from State Grid Corporation of China- Deepening research and application of PV Cloud (SG0000000000).

References

1. Cheng Qiyun, Sun Caixin, Zhang Xiaoxing, et al. Short-Term load forecasting model and method for power system based on complementation of neural network and fuzzy logic[J]. Transactions of China Electrotechnical Society, 2004, 19(10):53-58.
2. Fangfang. Research on power load forecasting based on Improved BP neural network [D]. Harbin Institute of Technology, 2011.
3. Amjady N. Short-term hourly load forecasting using time series modeling with peak load estimation capability [J]. IEEE Transactions on Power Systems, 2001, 16(4): 798-805.
4. Ma Kunlong. Short term distributed load forecasting method based on big data [D]. Changsha: Hunan University, 2014.
5. Shi Biao, Li Yuxia, Yu Hua, et al. Short-term load forecasting based on modified particle swarm optimizer and fuzzy neural network model[J]. Systems Engineering-Theory and Practice, 2010, 30(1): 158-160.