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The short-term load prediction of power system is carried out by MATLAB

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Abstract

With the leap-forward development of China's economy, the power industry is growing stronger and stronger, which puts forward higher requirements for accuracy and timeliness of power load forecasting. Short-term load forecasting is an important part of power load forecasting, which plays a particularly important role in power system planning, operation and control. It can not only improve the security of system operation, but also enhance the economy of system operation. In this work, Matlab is used to establish a prediction model, combined with weather factors, the accuracy of the prediction is improved compared with the traditional methods

Keywords

The power system, Short term load forecasting,The weather factor.

1. Introduction

Short-term load forecasting is the basic part of power system operation analysis, which plays an important role in unit combination, economic dispatching and safety check.Improving the accuracy of load prediction is an important method to ensure the rationalization of power system optimization decision. Many complex factors affect power loads, such as agricultural production activities, industrial electricity consumption, residents' daily life, weather and climate, etc., which affect the fluctuation of power load in different dimensions. Research shows that the change of power load and there is a strong nonlinear relationship between meteorological factors and so use the traditional multiple linear regression models to predict power load will exist a lot of limitations, and feedforward backpropagation neural network to establish complex nonlinear model, in the power load forecasting well make up for the deficiency of the traditional multiple linear regression model.[1] In the modern electric system, there are many types of electrical appliances that constitute the power load. The load proportionality affected by meteorological conditions, such as air conditioning, continues to increase. The meteorological factors (temperature, humidity, rainfall, etc.) have a more prominent impact on the power system load. Consideration of meteorological factors has become one of the main measures to improve the accuracy of load prediction.

Bakirtzis, a foreign scholar, uses the short-term load forecasting model of artificial neural network to forecast the load of his electric control center, and the model can predict the daily load curve change.[1] In China, Kang Chongqing, Zhou Anshi and other scholars in State Key Laboratory of Electric Power System have analyzed the influence of weather factors in different stages of short-term power load prediction, and established a neural network short-term load prediction model related to weather factors, which can obtain short-term accurate forecasting results.[1]

Therefore, based on the BP neural network theory, this paper establishes a neural network model through Matlab. Firstly, the seven-day power load prediction is implemented according to the known

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load data of a certain region, and then the seven-day power load prediction is carried out by using weather factors. Finally, the results of the two predictions are compared.

2. Analysis of influence of meteorological factors on load

Various meteorological physical conditions (such as cold and warm, wind and rain, dry and wet, rain or shine, etc.) and their changes in a short period of time in a certain region can be collectively referred to as the weather of the region.[2] In recent years, China's meteorological science has been rapidly developed, using meteorological satellites, radar and other tools to telemetry the weather conditions and meteorological changes in the vast area, and with the help of advanced communication technology to transfer and save the detection data, through human-computer interactive processing system, comprehensive application of a variety of forecast technology, Thus to the specific area of the meteorological conditions to make a more accurate quantitative forecast.[2] Accurate weather forecast, not only for people's production, life to provide convenience, and in the power planning, power engineering design, power production scheduling and other work at the same time, provide an important reference.

Sudden weather changes can cause dramatic changes in load and electricity. Moreover, the impact of different meteorological factors on the electric load is different. The actual statistical analysis shows that, among all meteorological factors, temperature has the most significant effect.[2] For example, in the case of continuous high temperature in summer, the human body in order to eliminate the feeling of sultry, will open a large number of refrigeration air conditioning, and with the increase of the proportion of cooling load, the impact of temperature on the load is more obvious; If the weather turns cold suddenly or during a cold winter, the low temperatures can put a lot of heating loads into operation.[2] In addition, the influence of rainfall on power load can not be ignored. Rainfall will directly affect agricultural irrigation power consumption and reduce agricultural load. Moreover, the rainfall caused the temperature to drop, which had a certain impact on the air conditioning load. In addition, the influence of rainfall on small hydroelectric load has a certain lag effect and accumulation effect.[2]

3. Feedforward neural network

In the feed-forward neural net, the neurons of each layer can receive the signals of the neurons of the previous layer and produce signals for output to the next layer. Layer 0 is called the input layer, the last layer is called the output layer, and the other intermediate layers are called the hidden layer. There is no feedback in the whole network, and the signal propagates unidirectional from input layer to output layer, which can be represented by a directed acyclic graph.

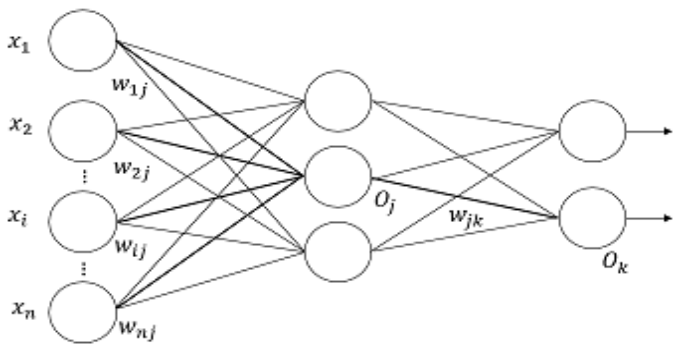

Figure 1 Multilayer feedforward neural networks

Figure 1 shows:

Number of neurons in the input layer (n) = number of elements in the input vector

Number of neurons in the output layer = number of elements in the output vector

Number of neurons in hidden layer =2n+1

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4. Source of Data

The data in this paper come from State Grid Corporation of China (SGCC). Through the application, the electricity load at each time point of a region from January 1, 2009 to January 10, 2015 can be extracted.

5. Build power load prediction model

5.1 Forecast based on power load

The Neural Net Fitting APP is opened in MATLAB, and the electric load data from 0:00 on January 1, 2009 to 23:00 on January 9, 2015 is taken as the input data, and the power load data from 0:00 on January 2, 2009 to 23:00 on January 10, 2015 is put: The power load data of 00 is used as the output data. Then the ratio of training set, verification set and test set is adjusted to 90%, 5% and 5% respectively. Next, according to the number of neurons in the input layer is 24, the number of neurons in the hidden layer is adjusted to 49, and the model construction is completed.

5.2 Forecasts are made based on weather factors

The Neural Net Fitting APP was opened in MATLAB, and the meteorological factor data (daily maximum temperature, daily minimum temperature, daily average temperature, daily relative humidity and daily rainfall) from January 1, 2012 and January 10, 2015 were used as input data. The 24-hour power load data from January 1, 2012 to January 10, 2015 is taken as the output data. Then the ratio of training set, verification set and test set is adjusted to 90%, 5% and 5% respectively. Next, according to the number of neurons in the input layer is 5, the number of neurons in the hidden layer is adjusted to 11, and the model construction is completed.

6. Test of model

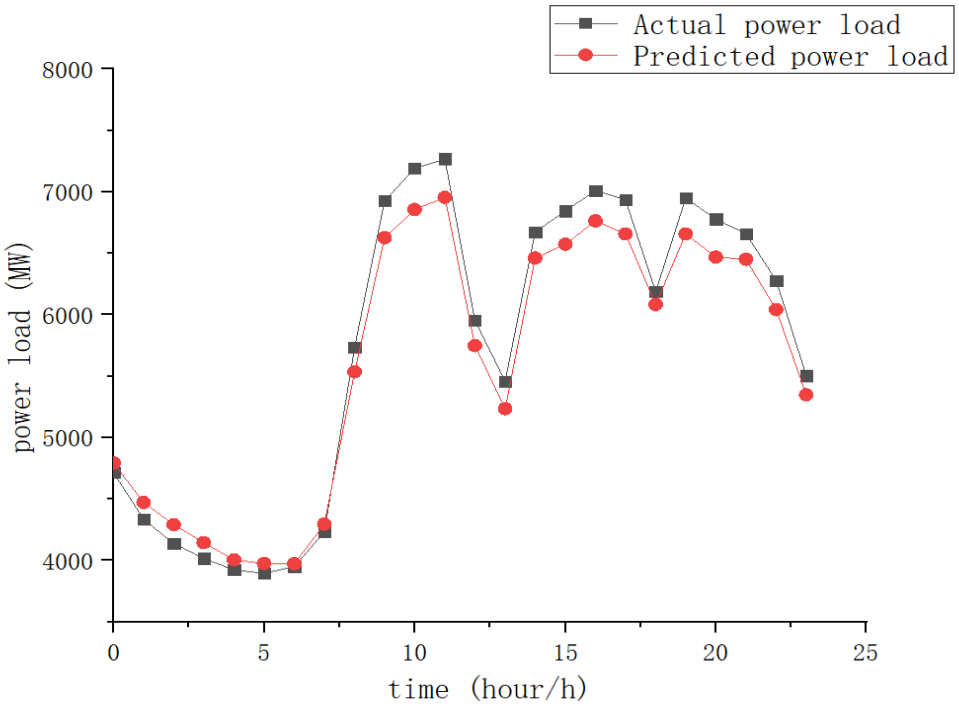

Figure 2 According to the power load prediction, the predicted value of the neural network approximates the actual value

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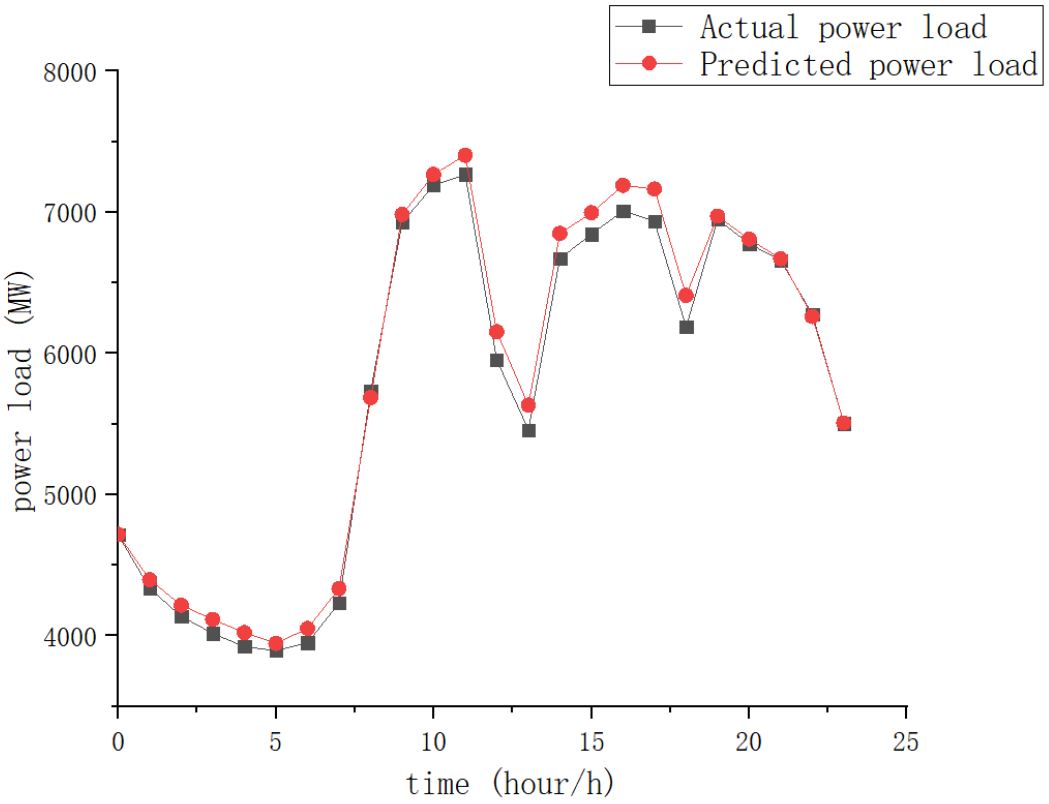

Figure 3 The line chart of the approximate effect between the predicted value and the actual value of the neural network based on the forecast of meteorological factors

To see if the model works, the real data collected on January 10, 2012 were compared with the predicted data to draw the power load approximation effect between the predictive value and the actual value in 24 hours, as shown in the figure.

By comparing Figure 2 and Figure 3, it can be seen that the difference between the actual value and the predictive value of the power load at each time point in the day in Figure 2 is small, which indicates that the established model is more accurate and can be used for the actual power load prediction. Meanwhile, it also indicates that the prediction based on meteorological factors can improve the accuracy of the electric load forecasting.

7. Power load analysis

It can be seen from the curve trend of power load that the number of power load varies greatly at each time point in a day.

The hours when electricity consumption is high are 11 to 12 noon, 16 to 18 PM and 20 PM. The main reason is that people and students will go home at noon and in the evening, and more people will work and study from afternoon to evening. Therefore, the state power department should increase the power supply during these peak periods to meet the demand of residents.[1] Electricity use drops at 7pm, as most people choose to eat dinner at that time and use fewer appliances.

The power load dropped sharply after 22:00. The main reason is that during the period from 22:00 to 7:00 in the morning, many power facilities are at rest and factories use less electricity. Therefore, the state power supply department should reduce the power supply during this period.[1]

In order not to cause excessive waste of electricity, but also to meet the demand for electricity, to achieve good economic and social benefits, the national power supply department should make a plan in advance according to the change of electricity consumption in a day.[1]

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8. Conclusion

Due to the particularity of the production and use of electric power, the accuracy of using the traditional mathematical pattern to forecast the power load is low. Therefore, this paper establishes the BP neural network model to predict the power load through the neural network toolbox of MATLAB. Firstly, this article preprocesses the collected data. Then, the BP neural network prediction model is established, and the power load of each time point on January 10, 2012 is used to test the model, and the accuracy of the two models is compared. Finally, it is verified that using weather factors to forecast the power load can improve the accuracy of the prediction.

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