International Journal of Scientific Research and Management (IJSRM)
||Volume||5||Issue||07||Pages||6497-6500||2017||
Website: www.ijsrm.in ISSN (e): 2321-3418
Index Copernicus value (2015): 57.47 DOI: 10.18535/ijsrm/v5i7.87

Probabilistic Wind Power Forecasting Using Fuzzy Logic

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Abstract

Wind power forecasting is the need of the era. As wind power generation lays a platform for usage of renewable resources. Employing efficient wind turbines enhances the forecasting of generation in short term. However, power generation differs from conventional thermal due to its unstable nature. Henceforth, accurate wind power forecasting plays in managing the variance in supply and demand of the high energy consumption sectors. This paper deals with classifiers to minimize the errors during wind power forecasting due to some data loss. The proposed paper combines fuzzy logic and neural network to get the better result than the existing methods.

1. Introduction

Data Mining is the process of bringing out "the hidden values and information" from data warehouse. Its mining process can be applied to various domain were decision to be taken from previous outcomes. This mined Data set can be utilized for the efficient planning in managing the resources in long run.

The uneven heating of the earth atmosphere, the subsequent change in the earth surface and earth's rotation are the causes of wind. Due to these reasons wind is directly propionate to the solar energy. These factors when utilized by the wind turbines in effective manner can generate electricity.

The materialistic form of wind is in the go green form, where it does not affect the atmosphere by emitting any hazards' gases. The process of wind power generation is carried by converting the kinetic energy (wind force) into mechanical power.

Wind turbines, like aircraft propeller blades, turn in the moving air and power an **electric generator** that supplies an electric current. Simply stated, a wind turbine is the opposite of a fan. Instead of using electricity to make wind, like a fan, wind turbines use wind to make electricity. The wind turns the blades, which spin a shaft, which connects to a generator and makes electricity.

The development of wind energy use has led to a noticeable contribution to the energy supply in India. The amount of wind power being incorporated into power systems worldwide has been increasing dramatically over the past decade. Wind power has no fuel costs and zero emissions, which means that its increased presence in power

generation portfolios provides great benefits to society.

3. Proposed Method

Fuzzy classification is the process of grouping elements into a fuzzy set whose membership function is defined by the truth value of a fuzzy propositional function.(1) The proposed system is developed for the values which have uncertainty. The values we input for this process is a forecasted power values where the direction is also added as additional factor and forecasted. The errors are reduced due to use of classifier in this data set. Usage of this forecasted data will automatically will not produce error rate when compared to real dataset. Here two fuzzy values are found using NNFuzzy and then probably is applied on the fuzzy dataset in our proposed system rule function is also applied to produce rule for likely and unlikely data to be to avoid uncertainties in data. Therefore our proposed system improve accuracy, reduce time and also error rate is reduced.

The proposed method give better result when compared to ARMA and fuzzy and svm.it gives better accuracy than the existing and reduces time of execution.

Step 1: First fuzzy values are found out for the wind forecasted data.

Step 2: Then neural network is applied to fuzzy sets found.

Step 3: Finds the membership function to fuzzy.

Step 4: Predicted value is based on NNfuzzy.

Step 5: On this predicted values probability is applied and find out probability values.

Step 6: Next rule function is applied and finds the values.

Step 7: At last likely and unlikely values are found and applied.

Here, the power forecasted data is used as input values to get fuzzy values. Neural network on fuzzy values and find outr the membership function to predict NNfuzzy values.in this predicted values probability is applied to find out the predicted values and rule function is applied on this values to know the likely and unlikely values for uncertain values in probabilistic wind power prediction.

4. Result and Discussions

Our Proposed method uses fuzzy logic based on probabilistic detection. We set year wise threshold values and how many months have wind speed and power generated is high. We use if-then rules for probability detection. Here in addition rule is also generated using Fuzzy Interface System (FIS) in Fuzzy Logic.

Proposed system searches for the FIS structure and number of rules that have the highest fitness value. Multiple performance measures are incorporated into the fitness function to address the problem of imbalanced data. Fitness function includes both training and validation to avoid data over-fitting. Classification performance of the proposed method is evaluated using different data sets and results are compared to those of a number

DOI: 10.18535/ijsrm/v5i7.87

of models generated by fuzzy means clustering with various cluster numbers.

Matlab 2013 tool is used for training and testing and a better result is produced. Results show that the proposed method has better accuracy and a well compromised sensitivity and specificity. Some of the screenshots are given below.

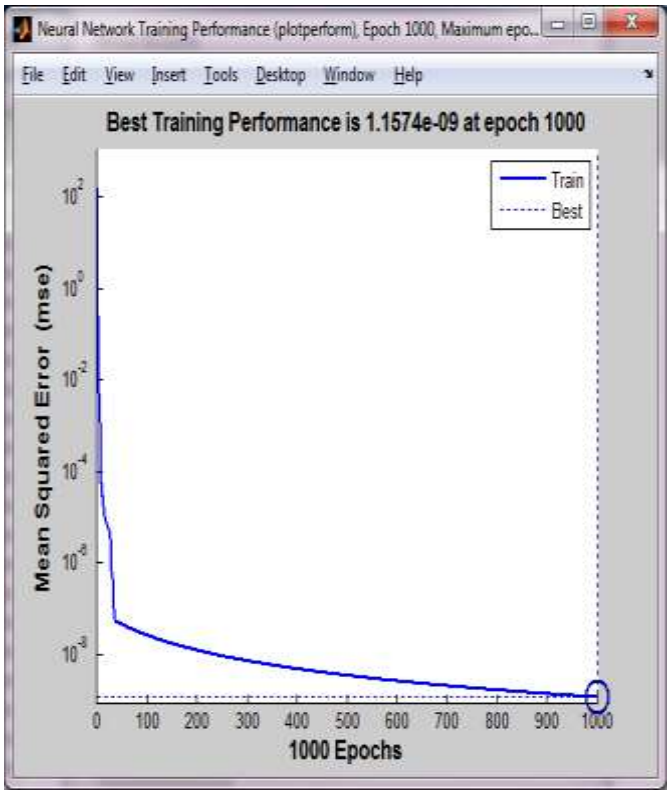

Figure:1 Neural network Performance

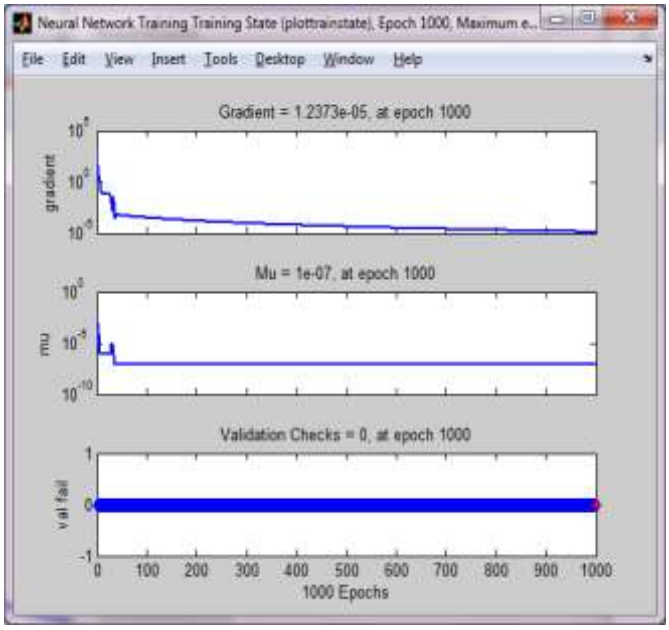

Figure:2 Neural Network Training state

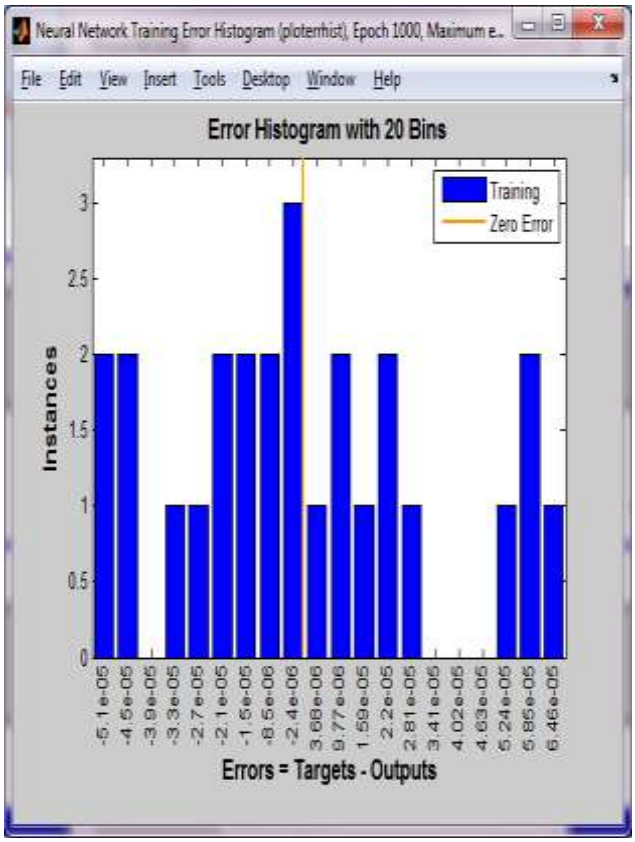

Figure3: Error Histogram

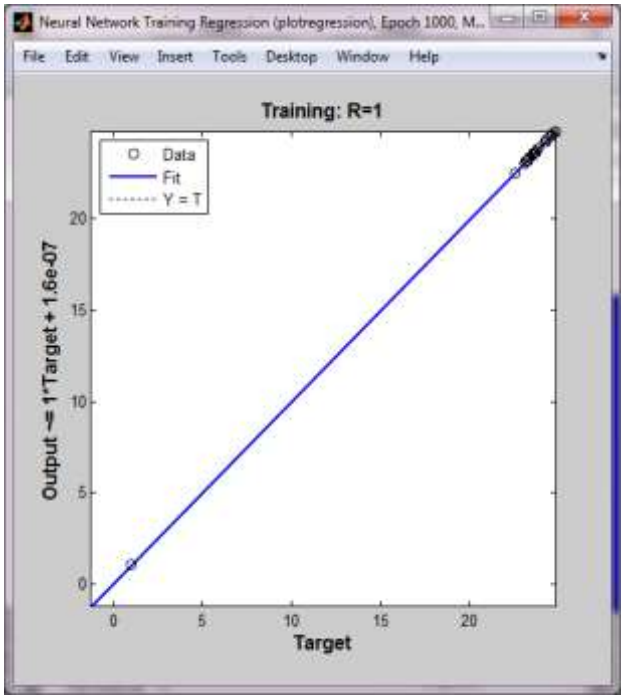

Figure:4 Training Regression

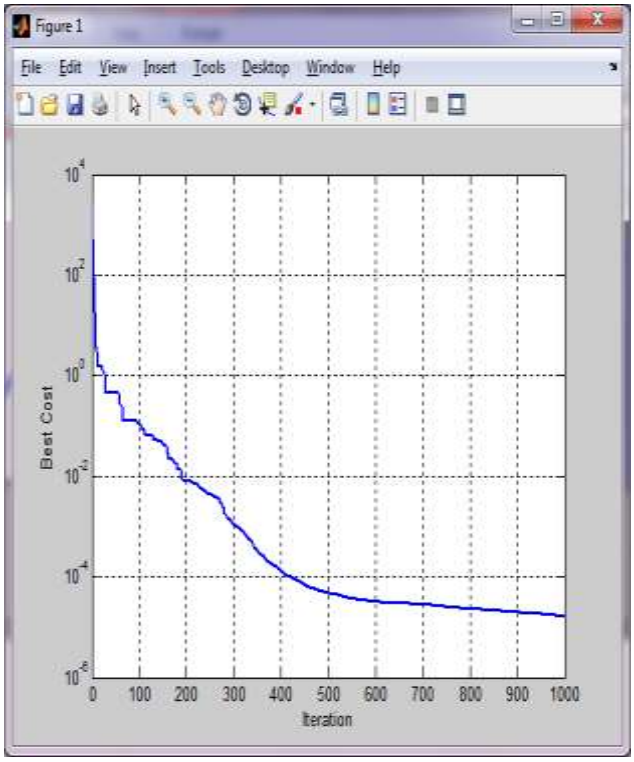

Figure: 5 Number of Iteration

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