M. Tech (Power System)

PREDICTIVE ANALYSIS OF SHORT-TERM WIND POWER FORECASTING USING VARIOUS NEURAL NETWORKS MODEL

A DISSERTATION

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE AWARD OF THE DEGREE
OF

MASTER OF TECHNOLOGY
IN
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Submitted by:

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CANDIDATE'S DECLARATION

I, Tushar Srivastava, Roll No. 2K17/PSY/19 student of M.Tech. (Power System), hereby declare that the project Dissertation titled "Predictive Analysis of Short term Wind Power Forecasting using various Neural Networks " which is submitted by me to the Department of Electrical Engineering Department, Delhi Technological University, Delhi in partial fulfillment of the requirement for the award of the degree of Master of Technology, is original and not copied from any source without proper citation. This work has not previously formed the basis for the award of any Degree, Diploma Associate ship, Fellowship or other similar title or recognition.

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I, Tushar Srivastava, Roll No. 2k17/PSY/19 student of M. Tech. (Power System), hereby declare that the dissertation/project titled "Predictive Analysis of Short term Wind Power Forecasting using various neural networks" under the supervision of Prof. M.M.Tripathi of Electrical Engineering Department Delhi Technological University in partial fulfillment of the requirement for the award of the degree of Master of Technology has not been submitted elsewhere for the award of any Degree.

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ABSTRACT

This study proposes a intelligent method for short-term wind power forecasting and uncertainty analysis. In practice, the power output of a wind turbine is a direct function of wind speed. Owing to the intermittent and irregular nature of wind, the wind power generation is not easily dispatched and the prediction of wind power is highly uncertain. To allow a procedure for more accurate forecasting, few wind power prediction models like: NARX (Non-Linear Exogenous Inputs), NLIO (non-Linear Input& Output), RNN (Recurrent Neural Network), LSTM (Long Short Term Memory), GBM(Gradient Boosting Machine), ANN/MLP (Artificial Neural Network/ Multi Layer Perceptron), Linear Regression, GA based SVM (Genetic Algorithm based Support Vector Machine) are established and discussed in case studies form. The historical wind speed and wind power generation data for year 2015 of wind power plant located in Kolkata, available on Ninja portal has been used for short term, day-ahead wind power forecasting. The models are mainly evaluated on basis of following parameters , they are : MAE (Mean Absolute Error) ; MAPE (Mean Absolute Percentage Error) ; MSE (Mean Square Error) ; RMSE (Root Mean Square Error), Variance. So, on basis of comparison of predictive models over the above parameters, we have concluded in each case studies, that which model performs best under the given circumstances for that case study. Overall, from whole analysis we can conclude that LSTM performs the best while RNN is quite close to it. In Daily average methodology, RNN performs the best having close competitor as GA based SVM.

CONTENTS

Appendices

List of Publications of the candidate's work

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

1. ADL - Adaptive Transfer Learning
2. ANN - Artificial Neural Networks
3. BPNN - Back Propagation Neural Networks
4. CNN - Convolutional Neural Networks
5. DNN - Deep Neural Networks
6. GA - Genetic Algorithm
7. GBM - Gradient Boosting Machine
8. GBR - Gradient Boosting Regression
9. LSTM - Long Short Term Memory
10. NARX - Non-linear Auto- Regressive Network with exogenous inputs
11. NLIO - Non-linear Input Output
12. PSO - Particle Swarm Optimization
13. RNN - Recurrent Neural Networks
14. TL - Transfer Learning