LITERATURE SURVEY

Predicting the energy output of wind turbine based on weather conditions

TEAM LEADER: PASUPATHI DADEEJA

TEAM MEMBER1: NAGARAJ .G

TEAM MEMBER2: PALANI SELVAM.M

TEAM MEMBER3: PUSHPAVENI.V

PAPER 1:

TITLE: Using machine learning to predict wind turbine power output

PUBLICATION YEAR: 2013

AUTHOR NAME: A Clifton, L Kilcher, J K Lundquist and P Fleming

DESCRIPTION:

Wind turbine power output is known to be a strong function of wind speed, but is also affected by turbulence and shear. In this work, new aerostructural simulations of a generic 1.5 MW turbine are used to rank atmospheric influences on power output. Most significant is the hub height wind speed, followed by hub height turbulence intensity and then wind speed shear across the rotor disk. These simulation data are used to train regression trees that predict the turbine response for any combination of wind speed, turbulence intensity, and wind shear that might be expected at a turbine site. For a randomly selected atmospheric condition, the accuracy of the regression tree power predictions is three times higher than that from the traditional power curve methodology. The regression tree method can also be applied to turbine test data and used to predict turbine performance at a new site. No new data are required in comparison to the data that are usually collected for a wind resource assessment. Implementing the method requires turbine manufacturers to create a turbine regression tree model from test site data. Such an approach could significantly reduce bias in power predictions that arise because of the different turbulence and shear at the new site, compared to the test site.

PAPER 2:

TITLE: Wind power prediction based on EEMD-Tent-SSA-LS-SVM

AUTHOR NAME: Zheng Li and Hexu Sun

DESCRIPTION:

To solve the wind power prediction problem, the Improved Sparrow Search Algorithm-Least Squares Support Vector Machine (ISSA-LS-SVM) prediction model based on chaotic sequences is proposed to improve the convergence accuracy and shorten the prediction time of the prediction model. Firstly, the problem in the historical data is decomposed using an ensemble empirical modal algorithm. Then, wind speed series prediction is performed using the LS-SVM model. Finally, the wind turbine output power prediction is performed. The results show that compared with LS-SVM, SSA-LS-SVM and Tent-SSA-LS-SVM models, the EEMD-ISSA-LS-SVM prediction model has improved the convergence precision of wind power output predictive model, which is significant for the subsequent realization of optimal power dispatch.

PAPER 3:

TITLE:A short-term hybrid wind power prediction model based on singular spectrum analysis and temporal convolutional networks

PUBLICATION YEAR: 2020

AUTHOR NAME: Yang Zhao and Li Jia

DESCRIPTION:

Accurate and stable wind power prediction is the basis of wind energy planning, dispatching, and control in the generation and conversion of the wind power generation industry. A new nonlinear hybrid model, singular spectrum analysis (SSA)-temporal neural network (TCN) is proposed to improve the accuracy of wind power sequence prediction. This method introduces SSA, which decomposes the original wind power sequence into four parts: trend, primary detail components, secondary detail components, and noise. The experiment is conducted under the three conditions of no noise removal, only noise removal, and decomposing original sequences without noise into several components to verify that SSA does help improve the model performance. Moreover, this paper adopts a new TCN network instead of the current most advanced Long Short-Term Memory (LSTM) network. It has a longer actual memory range and is better able to cope with the gradient disappearance. In order to study the advancement of the TCN, the experimental part also includes the performance comparison between the TCN and the LSTM network, as well as the ablation experiment of the TCN. Finally, multi-step prediction is conducted to further demonstrate the fitting ability of the TCN, SSA-TCN, and LSTM network. The results show that (a) the SSA-TCN has the best predictive performance among the involved models;

PAPER 4:

TITLE: Deep Learning-Based Prediction of Wind Power for Multi-turbines in a Wind Farm

PUBLICATION YEAR: 2013

AUTHOR NAME: Xiaojiao Chen,Mi Dong,Yan Guo,Shiying He

DESCRIPTION:

The prediction of wind power plays an indispensable role in maintaining the stability of the entire power grid. In this paper, a deep learning approach is proposed for the power prediction of multiple wind turbines. Starting from the time series of wind power, it is present a two-stage modeling strategy, in which a deep neural network combines spatiotemporal correlation to simultaneously predict the power of multiple wind turbines. Specifically, the network is a joint model composed of Long Short-Term Memory Network (LSTM) and Convolutional Neural Network (CNN). Herein, the LSTM captures the temporal dependence of the historical power sequence, while the CNN extracts the spatial features among the data, thereby achieving the power prediction for multiple wind turbines. The proposed approach is validated by using the wind power data from an offshore wind farm in China, and the results in comparison with other approaches shows the high prediction preciseness achieved by the proposed approach.

PAPER 5:

TITLE: Wind Power Prediction with Machine Learning Ensembles

PUBLISHED YEAR: 2016

AUTHOR NAME: Justin Philipp Heinermann

DESCRIPTION:

Wind power into the electricity grid, precise and robust predictions are required. With increasing installed capacity and changing energy markets, there is a growing demand for short-term predictions.Machine learning methods can be used as a purely data-driven, spatio-temporal prediction model that yields better results than traditional physical models based on weather simulations. However, there are two big challenges when applying machine learning techniques to the domain of wind power predictions. First,when applying state-of-the-art algorithms to big training data sets, the required computation times may increase to an unacceptable level. Second, the prediction performance and reliability have to be improved to cope with the requirements of the energy markets. valve.