Predicting the energy output of wind turbine based on weather condition

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Abstract

Most of the countries around the world are facing huge environmental impact, and the most promising solution to mitigate these is the use of renewable energy, especially wind power. Though, the use of offshore wind energy is rapidly increasing to meet the elevating electricity demand. The researchers and policymakers have become aware of the importance of providing near accurate prediction of output power. Wind energy is tied to variabilities of weather patterns, especially wind speed, which are irregular in climates with erratic weather conditions. In this paper, we predicted the output power of the wind turbines using the random forest regressor algorithm. The SCADA data is collected for two years from a wind farm located in France. The model is trained using the data from 2017. The wind direction, wind speed and outdoor temperature are used as input parameters to predict output power. We test our model for two different capacity factors. The estimated mean absolute errors for the proposed model in this study were 3.6% and 7.3% for and 0.2 capacity factors, respectively. The proposed model in this study offers an efficient method to predict the output power of wind turbine with preferably low error.

Introduction

Renewable energy such as wind and solar energy plays an increasing role in the supply of energy world-wide. This trend will continue because the global energy demand is increasing and the use of nuclear power and traditional sources of energy such as coal and oil is either considered as non-safe or leads to a large amount of CO2 emission.

Wind energy is a key-player in the field of renewable energy. The capacity of wind energy production was increased drastically during the last years. In Europe for example, the capacity of wind energy production has doubled since 2005. However, the production of wind energy is hard to predict as it relies on the rather unstable weather conditions present at the wind farm. In particular, the wind speed is crucial for energy production based on wind and the wind speed may vary drastically during different periods of time. Energy suppliers are interested in accurate predictions, as they can avoid overproductions by coordinating the collaborative production of traditional power plants and weather dependent energy sources.

The main goal of this paper is to use public data to check feasibility of wind energy prediction by using a industrial-strength off-the-shelf non-linear modeling. In our study, we investigate and predict the energy production of the wind farm based on

publicly available data. The energy production data is made publicly available in real time to assist in maintaining the security of the power system.

Literature Survey

Existing Problem

Wind power generation differs from conventional thermal generation due to the stochastic nature of wind. Thus, wind power forecasting plays a key role in dealing with the challenges of balancing supply and demand in any electricity system, given the uncertainty associated with the wind farm power output. Accurate wind power forecasting reduces the need for additional balancing energy and reserve power to integrate wind power. For a wind farm that converts wind energy into electricity power, a real-time prediction system of the output power is significant. In this guided project, a prediction system is developed with a method of combining statistical models and physical models. In this system, the inlet condition of the wind farm is forecasted by the auto regressive model.

Proposed Solution

Our aim is to map weather data to energy production. We wish to show that even data that is publicly available for weather stations close to wind farms can be used to give good prediction of the energy output. Furthermost, we examine the impact

of different weather conditions on the energy output of the wind farms. We are building a Machine Learning technique to predict the energy output of wind turbine. We use the scoring end point to give user input values to the deployed model. The model prediction is then showcased to predict the energy output of the wind turbines.

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