LITERATURE SURVEY

Date	16 September 2022
Team ID	PNT2022TMID30223
Project Name	Predicting energy output of wind turbine based on weather condition
Maximum Marks	4 Marks

1. Artificial Neural Network Model for Wind Mill.

An artificial neural network is a computational model that consists of several processing elements that receive inputs and deliver outputs based on their predefined activation functions. Windmill control can be used with different input data with air pressure and water irradiation variables. The methods are classified and analyzed into four groups according to the application: forecasting and predictions, design optimization, fault detection and diagnosis, and optimal control. The Artificial Neural Network model for Uncertain Variables, can be used to control Windmills with different input data Establishing variable preference weights based on output with the Probability technique. The less air pressure, the greater of wind speed. And the greater of sunlight, the greater of wind speed. The factor that determines the movement of the wind is the difference in pressure in nature. Airflow flows through the pressure over a large area to a small area. The flow of air that blows in nature is a result of the difference in wind temperature gain. So that the difference in temperature causes a difference in pressure, and produces wind flow. Wind potential that can be utilized for wind energy generation is wind potential with a minimum speed of 4.16 m/s. The minimum wind speed (generally 12-14 km/h) to begin turning and generate electricity. strong winds (50-60 km/h) to generate at full capacity. winds of less than 90 km/h, beyond that speed, the turbines must be stopped to avoid damage. The use of wind mill plays a role in producing wind power which can be used as a source of electrical energy. The movement of this wind mill is a matter of uncertainty, to determine whether or not the wind mill moves. So that the model used in this study is the Artificial Neural Network model for Uncertain Variables (VTP) which is a selection model using probability techniques, membership degrees, logical OR functions, linear programming and Euclidean distance to reduce the learning process.

2.Wind Power Prediction Based on Recurrent Neural Network with Long Short-Term Memory Units.

Producing electricity from renewable resources has been widely used in the past 10 Years above to decrease the worldwide difficulty with electrical energy and environmental pollution. For a wind farm that converts the wind power to electrical energy, a big challenge is to predict the wind power exactly despite the instabilities. The climatic conditions present at the site decide the power output of a wind farm. A precise forecast is required to overcome the difficulties initiated by the frequent weather conditions. If the output is forecasted accurately, energy providers can keep away from costly over production. In this paper, an end-to-end web application has been developed to predict and forecast the wind turbine's power generation based on the weather conditions. The prediction model has been developed using Bidirectional Long Short-term Memory which is a unique kind of RNN (Recurrent Network Network). Bidirectional long-short term memory (Bidirectional LSTM) is the process of making any neural network have the sequence information in both directions backwards (future to past) or forward(past to feature).It performs excellent in terms of capturing long-term dependencies along with the time steps and is hence ideal for wind power forecasting. Wind power is one of the most promising renewable energy sources, it is clean, safe and inexhaustible. However, predicting wind signal has always been challenging because the time series data is nonlinear, non-stationary, and disordered. In this paper, we provide a novel predicting framework including a recurrent neural network (RNN) structure model with long short-term memory (LS TM) units and an effective forecasting map adapted to different prediction horizons. We compare our new approach with concurrent methods and show that our new method is more effective in predicting wind power.

3. PREDICTING POWER OUTPUT BASED ON WEATHER CONDITION ON WIND TURBINES

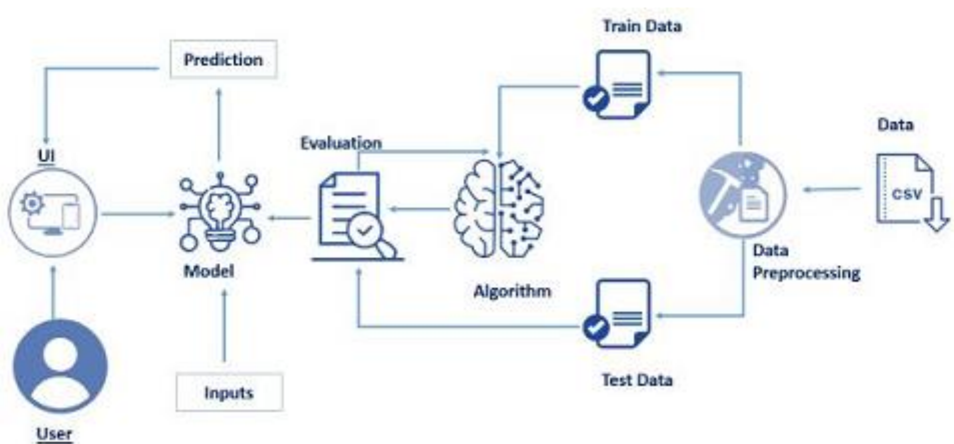
Wind plant has lower cost of energy compared to other renewable energy source for large scale application. Due to the different geographical patterns, weather, and properties of the wind turbines, a wind turbine may have various performances given different situations. If the total output of a wind power plant can be predicted with high accuracy, more useful information can be provided to the power companies to help in scheduling the power generation Wind speed is affected by a number of factors and situations, operating on varying scales (from micro to macro scales). These include the pressure gradient, Rossby waves and jet streams, wind speed is affected by a number of factors and situations, operating on varying scales (from micro to macro scales). These include the pressure gradient, Rossby waves and jet streams, A very simple and effective means to eliminate leading or lagging power factor errors, reduce voltage raise and fall, enhance equipment operating life and improve system power capacity. The range offers consolidated features in one package without the risk of Vibration, while stabilizing electrical networks by providing harmonic mitigation, power factor correction and load balancing. In a simple alternating current (AC) circuit consisting of a source and a linear load, both the current and voltage are sine curve. If the load is purely resistive, the two quantities reverse their electric field at the same time. At every instant the product of voltage and current is positive or zero, the result being that the direction of energy flow does not reverse. In this case, only active power is transferred Wind direction is reported by the direction from which it originates. For example, a northerly wind blows from the north to the south. Wind direction is usually reported in cardinal directions or in horizontal degrees. Wind direction is measured in degrees clockwise from due north. In general, wind directions are measured in units from 0° to 360°, but can alternatively be expressed from -180° to 180°.

4. Deep Learning-Based Prediction of Wind Power for Multi - turbines in a Wind Farm

The difficulty of conducting the temporal-size sequence prediction, such as "wind turbine power prediction," is to simultaneously extract the time dependence and spatial features hidden in the data. After data preprocessing, the LSTM-CNN joint prediction model is proposed, which exploits a two-stage modeling strategy. In the first stage, the temporal features are difficult by the LSTM sub-model. In the second stage, the spatial connections between more things from the spatial matrix is determined by the CNN sub-model. LSTM can effectively difficulty the data temporal dependence, has excellent performance in prediction on a same things of time scales, and can be trained by back- cause continue through time algorithm. The CNN has the ability in processing the input in the form of two-dimensional images, and can meet the need to simultaneously predict the power of multiple wind turbines the LSTM-CNN joint modelling is mainly divided into two stages, which are In the first stage, the LSTM captures the temporal correlation in the data that has been preprocessed. Specifically, the processed power data of n wind turbines goes into n LSTM modules and each LSTM model is set to β layer. Each LSTM outputs a value. After series and processing, the corresponding output values of each turbine are put into a two-dimensional matrix Wp according to the location of the wind turbines In the second stage, the CNN is used to extract the spatial correlation stored in the matrix Wp. Starting from the input layer of CNN, the spatial features in the matrix Wp are captured by the convolution kernel to obtain a new feature map. The CNN will gradually extract the spatial information of the spatial power matrix after multiple complex-pooling layer structures and output a one-dimensional vector in the final output layer as the actual output of the model. In this study, Rectified Linear Unit Re LU) is selected as the activation function of the convolutional layer. As an unsaturated nonlinear function that can accelerate the convergence rate during training, Re LU can significantly improve the performance of CNN.

PROBLEM STATEMENT

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.



SOLUTION

The prediction of wind power plays an important role in maintaining the stability of the entire power grid. In this project, a Machine learning approach is proposed for the power prediction of wind turbines based on wind flow. Utilization of wind energy sources provides advantages in terms of being environmentally friendly, and it can be energy source reliable. Accurate wind power forecasting reduces the need for additional balancing energy and reserve power to integrate wind power. In this guided project, a prediction system is developed with a method of combining statistical models and physical models. We are using 2 LSTM models, one for future Windspeed prediction and another for future wind direction prediction, these predictions would be fed to our Third regressor model which would give us the Future Power output. We build an application that recommend the Power Grid to suggest the best time to utilize the energy from wind farms.