Saradindu Sengupta, MSMI-1613

Reg No- 91616012

Title:

Solar Energy Output Forecasting from SolarGIS Data for Connected Grid Station

Abstract:

Using random forest regression method, daily mean solar output generation can yield promising result rather than conventional NWP model for forecasting. Using that in practice also the goal was to create a user-friendly application , with easy access, to provide accurate forecasting regarding saving and conservation.
The random forest model out-performs its other rivals and also conventional models , thus providing a better suited model to run with for forecasting.

Introduction:

Daily mean solar irradiance is the most critical parameter in sizing the installation of solar power generation units. The average solar irradiation on a specific location can help predict the amount of electricity that will be generated through solar panels and an accurate forecast can help in calculating the size of the system, return on investment (ROI) and system load measurements. To predict the mean solar irradiation various regression algorithms have been used in conjunction with various parameters related to solar irradiance. In this study, a comparative analysis of forecasting through random forest against the standard regression algorithms and neural

network is presented. Furthermore, it is shown that incorporation of azimuth and zenith parameters in the model significantly improves the performance.

Scope of The Study:

There are 3 main scope of this study,

1. Building a machine learning model that predicts the annual energy production of a prospective solar installation.
2. Building a model that predicts installation cost.
3. Implementing these models on a user-friendly web app that shows users how much they should expect to save on their energy bill each year by switching to solar.

Specificity :

In this study, the domain of interest has been put deliberately for only roof-top based PV solar system and for satellite data is been kept as a fail-safe mechanism provided data unavailability for any solar station. Also the range of parameters are limited to only tilted irradiance, global irradiance,diffused irradiance and total solar output without considering humidity or temperature.

Tools/method Used:

Tools used in this study includes, opensource Python Machine learning library as Tensorflow, Keras and Scikit-learn for data modeling and AWS and Gunicorn HTTP server for hosting the data at back-end and hosting the designed web app.

Neo4J community edition is also used as the back-end database on AWS.

For web interface Python based Django web-framework has been used.

For data modeling, random forest has been used along with elastic net and neural net for comparison.

Validation:

The model was validated using in-process business data as well as NREL's own simulation monitor deployed for OpenPV project.

Usefullness:

The usefulness lies how the user interpret the data. The model does not overtly specifies if it is viable to switch to Solar or not but provides data to let the user see it for themselves.

With every financila quarter passing and Solar power's price droping to 60% for last 10 years yet still the soft cost of maintenance and engineering, marketing has gone up 67% for the same period of time. This product intends to minimize that by just showing the return on investment(ROI) to the user so that the end user can make a calculated decision.