Power Forecast of Solar Panels Using Machine Learning Techniques: A Survey

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Abstract- *The non-renewable sources of energy are limited and will get exhausted eventually. Looking at the current need of electric power and its fulfilment, the non-conventional way of generating this energy has become essential. Climate change and energy crisis have motivated us to make use of renewable non-conventional source of energy. This paper discusses the theoretical assumptions and design aspects of developing a Model which will predict the solar power generation beforehand. The paper aims at promoting the use of renewable source of energy by developing a model which will accurately predict the solar power generation. The suggested model uses various Machine Learning Algorithms to predict the power generation which will be beneficial to both Industries and Residents*

Keywords- Solar Power, Machine Learning, Prediction Model

I. INTRODUCTION

Climate change and energy crisis have led us to use renewable energy use and Solar Energy is one of the most appropriate option for use. It is renewable as well as non-conventional source of energy and available in abundance. Power generated using Solar PV Panels depends on many external factors namely weather and meteorological factors. Factors such as Wind, Cloud and Rain also affect the rate of Power Generated. A proposed model uses the methodology which will have high level of accuracy in predicting solar power.[1] To do so we will compare various Machine Learning Algorithms and find the most accurate to be used to get desired result.

The Dataset will be divided into Training and Test Data after pre-processing and scaling and various Machine Learning Algorithms will be applied to find out the most accurate of them. The most suitable one will be applied in the model to predict the power.

The dataset[4] used in this work is historical weather data from Amherst, MA, and is maintained by the University of Massachusetts, Amherst – Computer Science Weather Station.

II. MOTIVATION

Roof-top mounted solar photovoltaic (PV) systems are becoming an increasingly popular means of incorporating clean energy into the consumption profile of its users. It is one of the most efficient renewable sources of energy which can be used over non-renewable sources of energy such as Fossil Fuels. There are certain influencing factors such as environment friendly which promote the use of Solar Energy and it is also safer than traditional electricity current.

The motivation behind taking up this project was to implement a model which would help people manage the energy resources in an efficient and economical way. This model can help the user to pre-plan and use the power according to the prediction made by different machine learning and statistical techniques and avoid any sorts of loss due to sudden weather changes which are not in their control. Application of this model incurs low cost for installation (economical), safer and comparatively more available than other energy resources. Electric utilities often allow the inter-connection of such systems to the grid, compensating system owners for electricity production. As the systems grow in number and their contribution to the overall load profile becomes increasingly significant, it becomes imperative for utilities to accurately account for them while planning and forecasting generation.

III. LITERATURE REVIEW

A similar study has already been done previously. The comparative study is given below. The Advantages and Limitations of the Papers are discussed which will be overcome in our proposed model.

PAPER NO.	PAPER NAME	ADVANTAGES	LIMITATIONS
1	N. Sharma, P. Sharma, D. Irwin, and P. Shenoy, "Predicting solar generation from weather forecasts using machine learning."	• 27% more accurate than existing models. • 51% better than simple approaches that only use the past to predict the future.	• It does not incorporate information from multiple weather metrics and their impact on solar intensity.
2	Gensler-Janosch, A., et al. "Deep Learning for solar power forecasting - An approach using AutoEncoder and LSTM Neural Networks."	• Performance achieved can also be transferred to other regenerative energy sources, e.g. forecasting of wind power output. • Feature Extraction Capability.	• It needs to take into account if an overestimation or an underestimation is preferred.
3	Mayukh Samanta, Bharath Srikanth, Jayesh Yerrapragada, "Short Term Power Forecasting Of Solar PV Systems Using Machine Learning Techniques."	• High Accuracy using Hybrid Model.	• Predicts a Non Zero Solar irradiance during period of day when there is completely no sunlight.

Table 1: Comparative Study of Previous Research

IV. PROPOSED SYSTEM

The obtained Dataset is in unprocessed format. So it will be pre-processed to fill the empty data and make it standardized. After pre-processing is done the Data will undergo scaling to bring data on a common scale. After this the data will be split into Training and Test Data. The Training Data will be used to Train the Model and after the Training is done Test Data will be passed to the model and Analysis will done to find out the accuracy of the model. While doing the Analysis various error factors will be considered to get accurate results. The algorithm with minimum error and maximum accuracy will be our model for prediction.

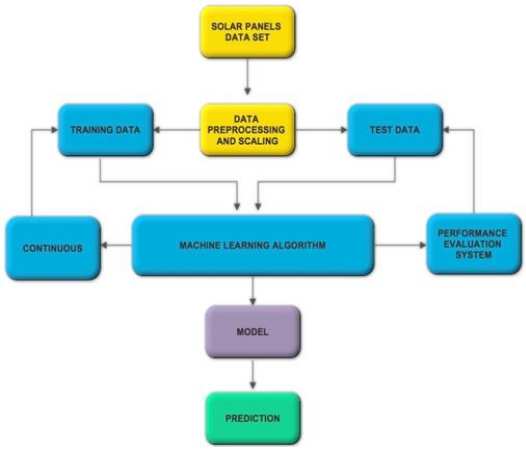

Figure 1 System Architecture

In our work we will be using various machine learning algorithms: weighted linear regression, PCA-based weighted linear regression, boosted regression trees, and neural networks.[2]

V. FUTURE USE AND SCOPE

The main objective is to benchmark different forecasting techniques of solar PV panel energy output.

Figure 2 Machine Learning Algorithms

Towards this end, machine learning and statistical techniques can be used to dynamically learn the relationship between different weather conditions and the energy output of PV systems. This is being done to optimize the energy structure and improve the performance of a PV system.[3]

Accurate prediction of PV power output is required to make better generation plans, support the spatial and temporal compensation, and achieve coordinated power control, so that the need for energy storage capacity and operating costs can be reduced. Our aim is to investigate the future engineering methodologies, which can be used to increase the overall prediction accuracy.[1] We will be using various techniques to train models on solar irradiance data and different meteorological parameters to forecast solar irradiance, and therefore power, for different forecasting horizons in the short-term future

VI. CONCLUSION

This model will help user predict the Solar Power Generation. It will guide the user through unfamiliar situation which can occur so that he could save power prior itself. It will also help in promoting use of renewable source of energy.

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