

Comparative Analysis of Deep Learning Model for Solar Irradiance Forecasting

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Solar irradiance forecasting is crucial for optimizing the utilization of photovoltaic plants and facilitating various tasks like unit commitment, transmission management, and maintenance scheduling. When implementing a new solar plant at a specific location past solar irradiance data is a critical factor for deciding which location is best or not. However, past irradiance data is not normally available and plant developers depend on data collected for 1 or 2 years. To overcome this limitation, this study presents a Long-Short-term memory (LSTM) model architecture for solar irradiance prediction using early weather data. For comparison purposes, a LSTM model using past irradiance data as an input was also developed. The research uses data from a solar station in Sri Lanka from 2013 to 2015. As well as two LSTM architectures combined with Attention mechanism are constructed to analyze time series data to improve prediction performance by enabling the models to focus on relevant features and capture complex temporal dependencies. The number of weather data like temperature, humidity, precipitation, sun height, surface pressure, and wind speed were included to improve the accuracy of model. Performance evaluation of the model is based on R square and mean squared error (MSE) metrics. The results show that a solar irradiance forecasting model that uses weather data as input provides comparable results as the past irradiance data model. The research emphasizes the importance of past weather data for accurate solar irradiance forecasting when past irradiance data is not available at specific locations. The research emphasizes and provides valuable insights into accurate solar irradiance forecasting when implementing new solar plant and optimizing solar power generation.

Keywords: Deep Learning, Long-solar-term memory, Attention mechanism, Solar irradiance, Mean squared error