Forecasting solar power output through LSTM-Based Models

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Talk Abstract

The escalating demand for renewable energy solutions especially solar power necessitates precise prediction models to optimize energy production and grid management. Photovoltaic (PV) power generation while sustainable is highly dependent on weather conditions [1]. Making accurate forecasting is a crucial aspect of energy planning and management. This study leverages an extensive dataset from the Verney weather station at Évora, Portugal. The dataset includes key meteorological variables such as solar radiation, temperature, and humidity, crucial for modeling PV output . Our objective was to develop a robust predictive model using Long Short-Term Memory (LSTM) networks to forecast PV power output based on the collected weather data. LSTMs are a form of recurrent neural networks which are particularly suited for time-series data due to their ability to retain information over extended periods and their effectiveness in capturing temporal dependencies within the data. This aspect is crucial for understanding and predicting solar power generation. The methodology involved preprocessing the dataset to handle anomalies and normalize the input features [2]. The LSTM model was trained on sequences of hourly weather data to predict daily PV output. We divided the dataset into training, validation, and testing segments to ensure a comprehensive evaluation of the model?s predictive power. Results from the LSTM model demonstrated a high degree of accuracy in PV power predictions with a root mean squared error (RMSE) significantly lower than traditional time-series forecasting models. The LSTM effectively captured the nonlinear relationships between weather variables and PV output. The obtained results ensure that advanced deep-learning techniques can substantially enhance solar power forecasting [3] [4]. The LSTM-based model represents a significant advancement in the predictive analytics of solar energy systems. By accurately

forecasting solar power output, utility operators can better manage the variability and intermittency of solar power. This leads to more stable and efficient energy systems. This research shows the potential of deep learning techniques in revolutionizing energy forecasting and contributes to the broader goal of enhancing the reliability and efficiency of renewable energy sources. Future work will focus on integrating more temporal data and exploring hybrid models that combine LSTM with other predictive techniques to further enhance forecasting accuracy [5].

Keywords: RNN, LSTM, PV, Energy.

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