

## Prediction of Average Power Produced by Wind Turbines Using MLP Neural Networks

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This paper explores wind turbine power output prediction using Multi-Layer Perceptron (MLP) neural networks. Accurate forecasting of wind energy production is critical for grid stability and optimizing energy systems. The study compares various prediction techniques, including physical, statistical, and hybrid methods. The methodology employs real-world data sourced and uses records from 2016-2017. Data preprocessing includes filtering, seasonal decomposition, time series analysis, and dividing the dataset into training, validation, and testing sets. The model's structure and hyperparameters were carefully tuned, employing 144 samples from the produced power as input, representing 24-hour cycles, to forecast the next hour. The study evaluated multiple MLP configurations, varying in hidden layer sizes and training strategies, to identify the optimal architecture for short-term wind power forecasting. The evaluation uses statistical metrics to assess prediction accuracy, including RMSE, NRMSE, and R2. Early stopping and randomized dataset splits were evaluated to enhance model performance and robustness. The main goal of this paper is to demonstrate the utility of MLP in forecasting for wind power generation systems. The models analysed obtained results between 94-95% for the coefficient of determination (R2). To improve performance, we should add environmental variables to the forecasting models or use deep-learning models.

**Keywords:** Artificial Neural Network · Wind Power Production · Multi-layer Perceptron · Forecasting · Python · Time Series Prediction