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The Development of Machine-Learning Models to Forecast Energy Output of Wind Turbines WILSON HU, RICHARD KYUNG, RISE Research Group — Fossil fuels are currently being depleted at a rate faster than can be formed, creating the need for alternative energy sources. The main limitation in implementing renewable energy is currently its high cost and unpredictability. The main goal of this project was to explore underlying patterns in wind turbine power generation in order to identify potential improvements to forecasting. Five models were studied in this project: the linear regression model, random forest regressor, multilayer perceptron, XGBoost regressor, and support vector machine. The primary feature selections used to predict power output were wind speed, wind direction, ambient temperature, turbine features, and a combination of all four. Using k-fold cross-validation (k=10), it was found that the XGBoost regressor was the optimal model, with minimal errors. Then, time-series k-means, an unsupervised learning algorithm, was used to cluster data, and was found to significantly improve predictions compared to supervised learning. Manual seasonal clustering was also performed but failed to improve accuracy at all. A hybrid of the top two models, XGBoost and random forest, was created and tested. The hybrid was found to have fewer errors either separately.

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