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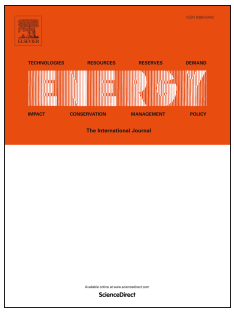

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Application of Imputation Techniques and Adaptive Neuro-Fuzzy Inference System to Predict Wind Turbine Power Production

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Abstract

Wind Turbine power output prediction can prevent unexpected failure and financial loss, through the detection of anomalies in turbine performance in advance so operators can proactively address potential problems. This study examines common Supervisory Control And Data Acquisition (SCADA) data over a period of 20 months for 21 pitch regulated 2.3 MW turbines. To identify the most influential parameters on power production among more than 150 signals in the SCADA data, correlation coefficient analysis has been applied. Further, an algorithm is proposed to impute values that are missing, out-of-range, or outliers. It is shown that appropriate combinations of decision tree and mean value for imputation can improve the data analysis and prediction performance. A dynamic ANFIS network is established to predict the future performance of wind turbines. These predictions are made on a scale of one hour intervals for a total of five hours into the future. The proposed combination of feature extraction, imputation algorithm, and the dynamic ANFIS network structure has performed well with favourable prediction error levels in comparison with existing models. Thus, the combination may be a valuable tool for turbine power production prediction.

Keywords: Performance Prediction, Wind Turbines, Imputation Algorithms,

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