

Intelligent Decision Support for Wind Park Operation: Machine-Learning Based Detection and Diagnosis of Anomalous Operating States

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Abstract : The operation and maintenance cost for wind parks make up a major fraction of the park's overall lifetime cost. To minimize the cost and risk involved, an optimal operation and maintenance strategy requires continuous monitoring and analysis. In order to facilitate this, we present a decision support system that automatically scans the stream of telemetry sensor data generated from the turbines. By learning decision boundaries and normal reference operating states using machine learning algorithms, the decision support system can detect anomalous operating behavior in individual wind turbines and diagnose the involved turbine sub-systems. Operating personal can be alerted if a normal operating state boundary is exceeded. The presented decision support system and method are applicable for any turbine type and manufacturer providing telemetry data of the turbine operating state. We demonstrate the successful detection and diagnosis of anomalous operating states in a case study at a German onshore wind park comprised of Vestas V112 turbines.

Keywords : anomaly detection, decision support, machine learning, monitoring, performance optimization, wind turbines

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