

Machine learning techniques applied to future Wind turbines

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Introduction

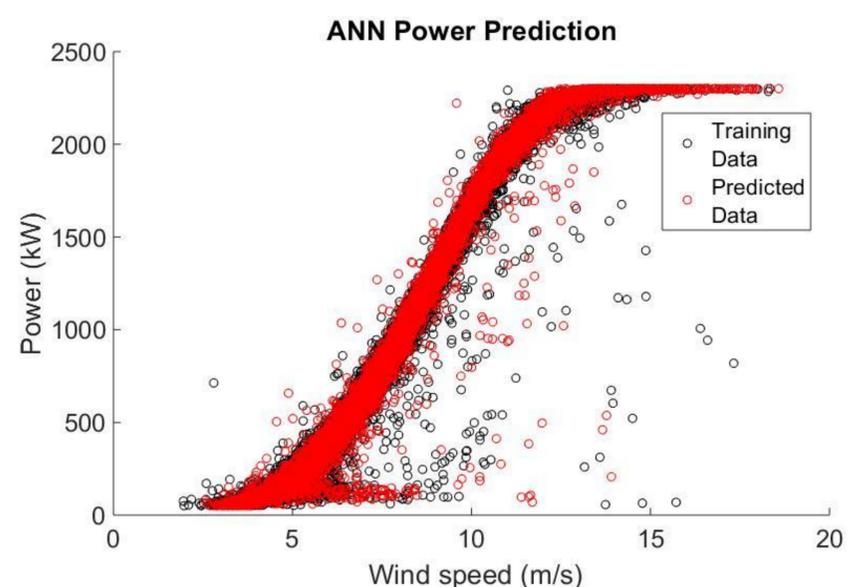
The magnitude of growth of offshore wind is suggested to reach a capacity of 800 GW by 2021 according to the world Wind Energy Association (WWEA). Indicating that there is a global increase on the manufacturing, maintenance and operations of Wind turbines. Global Wind Energy Counsel (GWEC) predicts there will be an increase in efficiency which will contribute significantly to the expansion. The application of new technologies can decrease the Cost of Energy (COE). A large proportion of the COE is operations and maintenance (O&M). The United Kingdom industry report states that O&M contributes to 20-25% of the life cost of an offshore windfarm, unexpected failures can increase this cost. O&M costs are expected to reach \$20.6 billion in 2023 by National Renewable Energy Laboratory (NREL). The need to reduce these cost is imperative to achieving the targets set above and adhering to the Paris Agreement.

Conditional monitoring techniques are used to monitor the performance of wind turbines to determine abnormal behaviour indicative of faults. Utilising conditional monitoring with effective approaches will determine failures earlier and catastrophic loss can be avoided. Wind farms equipped with SCARA system are recording valuable information about the turbines operations with minimal extra cost. Interpreting this information is the aim of this report.

Aims and objectives

- Understand current machine learning techniques applied to failure detection.
- Determine critical failure modes for operational up time.
- Interpreted SCADA Data
- Apply Machine learning techniques to determine failure modes
- Critically analyse what methods are most applicable to specific failure modes.

Methodology



There are many Machine learning techniques. Above I have explored an Artificial neural Network (ANN) ability to predict the power using wind speed for a horizontal axis wind turbine. This information can used in tandem with; pitch angle, blade rotational speed, temperature ect. To determine operational faults and apply the correct mitigation strategy to increase the life of the wind turbine.