Wind Turbines Predictive Maintenance through Machine Learning

Context :

The energy sector is undergoing a profound transition to meet **climate objectives** while ensuring global access. On the energy production side, **renewable energy** sources such as wind and solar are gaining in popularity. Out of all the renewable energy alternatives, **wind energy** is the most developed technology worldwide [1].

The wind energy industry has recently set its sight on the benefits of **predictive maintenance**. Predictive maintenance aims to foresee when a certain equipment might fail and to identify when is the right time to perform a maintenance intervention. Predicting component failures in wind turbines can help to cut disruptions to energy production to an absolute minimum, as well as shorten downtime and reduce maintenance costs. This is important, especially since maintenance costs are estimated to represent 20 to 25% of the levelized cost per kWh for wind turbines [2]. Therefore, it appears that operation and maintenance costs have an impact on the profitability of the wind farm and on the competitiveness of wind turbines compared to other green energy alternatives. However, this also means that there is great room for improvement using new technologies.

Objective :

The main objective of this internship project is to develop a **global solution for predictive maintenance** on **wind turbines**, by implementing a comprehensive **machine learning framework** on a **real world data set**. The internship will focus on the development of innovative and reliable predictive maintenance strategies to detect early stage failures and, consequently, minimize the turbines downtime and reduce maintenance's costs.

In order to do this, you will be given access to 2 years of failure data (SCADA) from a real wind farm as well as data from the meteorological mast, to create, train and test your models. The data sheet covered breakage reports of five major components for five turbines. The objective is to provide the most accurate machine learning algorithm that would predict a breakdown up to 60 days before the incident and thus make the greatest savings for the operator.

Student profile :

In light of the internship objectives and application, we shortlisted two major desired skills to fulfill this internship: (1) Python programming skills, and (2) machine learning and optimization knowledge.

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Organization : 6 months internship financially supported for students in 5th year in Polytech Angers doing in parallel the SDS Master degree.

References :

[1] W.W. E. Association. [Online]. Available: https://wwindea.org/blog/2019/02/25/wind-power-capacity-worldwide-reaches-600-gw-539-gw-addedin-2018/.

[2] I. El-Thalji and J. Liyanage, "On the operation and maintenance practices of wind power asset: A status review and observations", Journal of Quality in Maintenance Engineering, vol. 18, pp. 232–266, Aug. 2012. DOI: 10.1108/13552511211265785.