PO.005

Catching the context: cross-fleet benchmarking enabled by context-sensitive fingerprinting of SCADA data

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Abstract

Wind turbine data, whether it is CMS or SCADA data, is typically analysed using advanced data mining and machine learning algorithms that exploit the time series. **Time-sensitive features** extracted from hourly, daily, weekly or monthly periods **do not reflect explicitly the actual context** in which the turbine is operating however. As a consequence, the resulting models are **turbine-specific** and are **difficult to generalise to the whole fleet** or portfolio. We present an **alternative approach** that is based on **characterising the operational context** in which the turbines are operating.

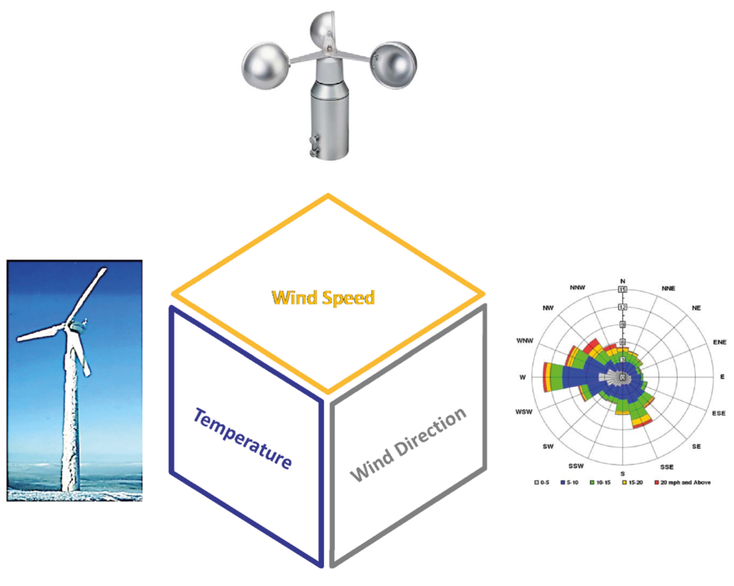
Cross-fleet benchmarking methodology

Our cross-fleet benchmarking methodology consists of the following steps:

1. Represent various operational contexts via hypercubes, derived from relevant exogeneous factors
2. Characterise an individual asset's performance/behaviour per cube, based on relevant output parameters
3. Benchmark assets across the fleet based on that characterisation
4. Derive a context-aware performance baseline
5. Exploit that baseline to identify underperformance

1. Hybercubes to represent operational contexts

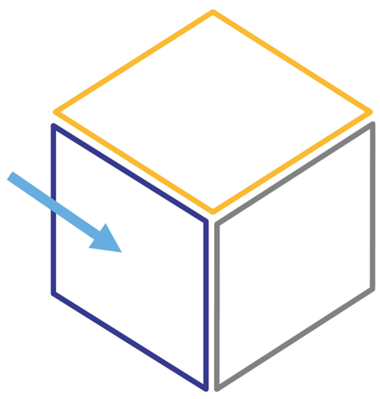
Hypercubes correspond to **different operating conditions** and are represented by a combination of different **exogenous factors**



2. Characterizing asset performance

An asset's performance is characterized by aggregating relevant output parameters per hypercube (e.g. mean production, event frequency, ...), resulting in a **context-aware performance characterization**

mean production per (temp, wind speed, wind dir) cube



3. Benchmark assets across the fleet

The context-aware performance allows to **compare assets** across the fleet

Outlying cube with high wind speed but lower production across the whole fleet

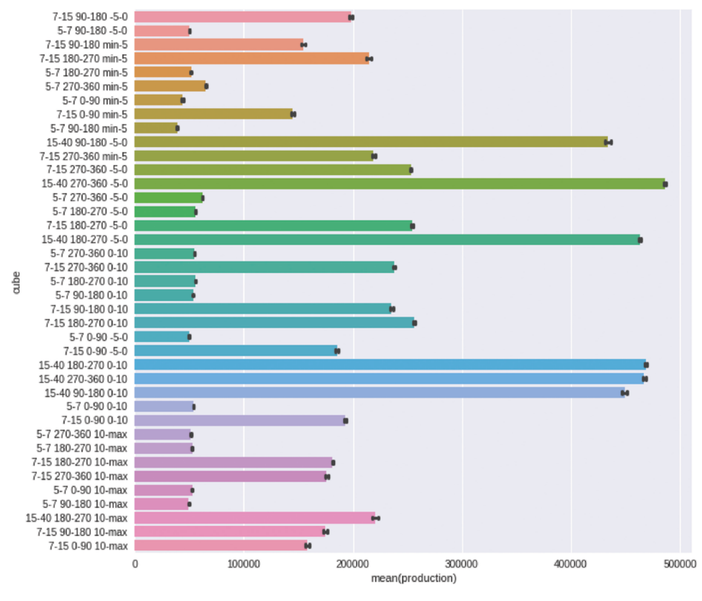
(Mostly) consistent performance behaviour for each turbine, mainly influenced by wind speed

Consistent performance behaviour for each cube

4. Derive a context-aware performance baseline

The hypercubes and associated performance characterization allow us to derive a context-aware performance baseline **across the fleet**

The mean production per cube is considered as the performance baseline



5. Identify underperformance w.r.t. the baseine

The context-aware performance baseline allows to detect underperformance that is **not immediately obvious** from the standard power curve

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