Karlsruhe Institute of Technology

Institute for Automation and Applied Informatics

IAI

Master Thesis

Machine Learning: Feature Identification in Time Series that Determine Energy System Design

Fulfilling the Paris climate accords means reaching net-zero carbon dioxide emissions by mid-century. To find the most cost-effective pathways to achieve these targets, researchers build optimisation models of the energy system. Simplified models can determine the optimal capacities for wind, solar, battery and hydrogen storage based on representative time series for wind and solar generation. Decades worth of hourly data are typically used to guarantee that the system can meet electricity demand under all possible weather conditions, but the large datasets represent a computational challenge. In this project you will seek to understand what are the most important features in the time series for determining the optimal investments in renewable and storage infrastructure, in order to reduce computational complexity.

Objectives:

- Investigate features of the time series which influence the optimal capacities (e.g. statistical properties, seasonal change in output, length of low-output-periods, Fourier spectrum).
- Understand interactions with economic parameters (investment costs, etc.).
- Develop heuristics to replace the optimisation of capacities and operation.

Methods:

In this project you will analyse data by applying an array of methods of statistics, data reduction, and machine learning.

Personal Qualifications:

We are looking for motivated students interested in energy systems, data processing and numerical optimisation. Basic knowledge in these topics is desirable, as well as experience with object-oriented programming.

Energy System Modelling Group:

We are a young, international and friendly research group that is committed to preventing catastrophic global warming. We look forward to working with you!

Literature:

https://github.com/PyPSA/WHOBS

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