


Institute for Automation and Applied Informatics (IAI)

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Master‘s Thesis

Dataset Creation for Machine Learning Accelerated Optimal Power Flow on Congested Grids using High Performance Computing

The electricity grid is becoming increasingly congested, mainly due to the increased integration of renewable energy sources (RES). More advanced congestion management is therefore required, including Power Flow (PF) and Optimal Power Flow (OPF) calculations. Currently, OPF is often calculated using the DC approximation, however more and more the accurate AC solutions are required that are highly non-convex and difficult to solve. Therefore, one area of interest is Machine Learning (ML) algorithms that can accelerate finding AC solutions for various applications, such as forecasting and risk analysis. However, the scarcity of data sets suitable for training ML algorithms is a problem. In particular, there is currently no such dataset that includes congestion scenarios.

Duration of congestion measures on the most affected lines in Germany in 2019
(from the Bundesnetzagentur's monitoring report)

This Master's Thesis aims to create a dataset that can serve for the training of ML algorithms. It is based on the idea of the existing dataset OPFData, while adding congestions. The thesis uses the Julia framework (JuMP, PowerModels) as well as parallel computing (e.g. HAICORE/HoreKa). For the optional ML part a good option is Python.

Tasks

- Create congestion scenarios of one/several grids
- Establish a dataset with variations in load (RES)/generation/line ratings
- Optional: Apply a Graph Neural Network to the dataset & compare performance to OPF

Requirements

- Studies in Computer Science / Electrical Engineering or related fields
- Basic knowledge of electric grids
- Experiences in Julia programming are welcome
- For the optional ML part: Experiences in applying ML algorithms

Interested? Then please send us an e-mail with your resume and transcript of records.
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