Internship proposal

Distribution system state estimation via machine learning techniques

Profile: Master student.
Duration: 5-6 months, starting February-March 2022.
Salary: around 600€ per month, according to the working days of the month.
Workplace: CentraleSupélec, 3 rue Joliot-Curie, 91190 Gif-sur-Yvette, France.

Description

Due to the increase in number of electric vehicles, renewable power generation and/or self-consumption sites, the Distribution System Operators (DSOs) are in a need for real-time estimation or short-term forecasting of the status of low voltage (LV) electrical networks.

To this purpose, the deployment of smart meters seems to allow for a better observability of the LV grid. However, technical and regulatory constraints limit their utilization, especially in real-time.

A possible solution would be to consider classical machine learning techniques for contributing to the estimation of the state of the LV grid. Indeed, they allow for the possibility to take advantage of the measurements history in order to achieve the learning step and then execute the model using a very small number of real-time measurements.

To this purpose, the objective of this internship is to develop and test a state estimator based on neural network.

The main steps to reach this goal are:

- Literature investigation.
- To develop a neural network based state estimator.
- To test the developed estimator in different scenarios.

This internship is part of the research work carried out at the L2S and GeePs laboratories, as part of a project in collaboration with EDF.

Desired profile

- Master student in the field of artificial intelligence or electrical engineering (energy or control systems).
- Programming (matlab or python) and math skills are required.
- Knowledge of main machine learning techniques (particularly neural networks) are desirable.
- Knowledge of electrical systems is a plus.

Contact : Please send your application (CV + motivation letter) to alessio.iovine@centralesupelec.fr and trungdung.le@centralesupelec.fr

References

[1] K. Dehghanpour, Z. Wang, J. Wang, Y. Yuan, et F. Bu, « A Survey on State Estimation Techniques and Challenges in Smart Distribution Systems », IEEE Transactions on Smart Grid, vol. 10, no 2, p. 2312 2322, mars 2019, doi: 10.1109/TSG.2018.2870600.

[2] Y. Liu, J. Li, et L. Wu, « State Estimation of Three-Phase Four-Conductor Distribution Systems With Real-Time Data From Selective Smart Meters », IEEE Transactions on Power Systems, vol. 34, no 4, p. 2632 2643, juill. 2019, doi: 10.1109/TPWRS.2019.2892726.

[3] G. Hong et Y.-S. Kim, « Supervised Learning Approach for State Estimation of Unmeasured Points of Distribution Network », IEEE Access, vol. 8, p. 113918 113931, 2020, doi: 10.1109/ACCESS.2020.3003049.

[4] P. N. Pereira Barbeiro; H. Teixeira; Jorge Pereira; R. Bessa, “An ELM-AE State Estimator for real-time monitoring in poorly characterized distribution networks”, Conférence IEEE PowerTech, Eindhoven, 2015

[5] V. Miranda, J. Krstulovic, H. Keko, C. Moreira, and J. Pereira, “Reconstructing Missing Data in State Estimation With Autoencoders”, IEEE Trans. Power Systems, vol. 27, no. 2, pp. 604-611, May 2012