TUTORIAL N°2

Artificial Intelligence in Electricity Distribution Systems

Background and aim of the tutorial

Since a few years, Artificial Intelligence (AI), a general concept which studies machines - or agents - being able to think and act in a rational way, is gaining more and more attention in various fields of the everyday life, and electricity distribution systems are no exception. This tutorial intends to give a comprehensive overview of the AI and Machine Learning fields, focusing on their application in electricity distribution systems.

Contents

More particularly, the tutorial will involve speakers both from the academic and industrial sectors. The structure will be the following:

1. *Advanced data analytics in electricity distribution networks* (Z. De Grève - UMONS - Belgium). So far, most applications of AI in Power Systems are based on the use of Machine Learning techniques for providing data analytics capabilities (e.g. for learning complex patterns hidden in the increasing amount of data collected in modern networks). This first part will describe how Machine Learning can enable advanced predictive and descriptive analytics, and will propose solutions to deal with imperfect real-life datasets (missing data, outliers, etc.). Open-source tools for performing Machine Learning-based data analytics will be presented.

2. *Reinforcement learning: a generic tool for solving sequential decision-making problems in electricity distribution networks* (D. Ernst - ULiège - Belgium). Reinforcement learning enables to learn what to do in the absence of labeled examples of what to do, when a mathematical model of the environment is not necessarily available. It is for instance employed in the AlphaGo program of Google DeepMind. This second part will introduce the audience to the world of Reinforcement Learning, and present applications pertaining to electricity distribution systems, as well as electricity markets.

3. *Real-time operation of the Paris electricity distribution grid with an hybridation of AI and physical models* (T. Bibette - DC Brain - France). This third part will give a most thorough return of experience on the build-up of the Paris electricity grid data-driven digital twin. We will go over the data treatment processes used to draw value from basic SCADA-type datas. We will then go over a presentation of the interfaces used on a daily basis by Enedis to better operate the network and suppress false positives from maintenance plans. The aim of this part will be to start a discussion over application fields and maturity levels for AI application in grid management.

Expected benefits

At the end of the tutorial, participants will have a structured knowledge of domains such as Artifiical Intelligence, Machine Learning, Deep Learning, Reinforcement Learning and Data Analaytics. Supported by the return of experience of an industrial actor, the will have a clear view on what can be the added value of such concepts in the world of electricity distribution networks (and electricity systems to a larger extent), and will be able to identify new potential applications in their respective areas of study.

Who should attend

Every person interested by the field of AI, and curious of its potentialities in electricity systems.

Support material

A copy of all the presentation material used in the tutorial will be supplied to delegates (electronic version).

About the presenter(s)

- Dr Zacharie De Grève (University of Mons, Electrical Power Engineering Unit): zacharie.degreve@umons.ac.be
- Prof. Damien Ernst (University of Liège, Montefiore Research Unit): dernst@ulliege.be
- T. Bibette (DC-Brain http://dcbrain.com/, director BeNeLux): thomas.bibette@dcbrain.com

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