Master Thesis

Chair for Theoretical Information Technology | RWTH AACHEN UNIVERSITY

Reinforcement Learning based Service Restoration Algorithm for Large Smart Grids

Research Area
Machine learning and big data analytics

Keywords
FLISR, Reinforcement learning

Description
Fault location isolation and service restoration (FLISR) is an important functionality for reliable and sustainable power grid operation. FLISR is usually a part of the advanced distribution management system (ADMS) used by the distribution system operators (DSOs). Basically, FLISR can be performed and understood in two parts: detecting the fault location and isolating it, and reconfiguring the grid topology such that any isolated loads due to this fault are reconnected to the grid and provided with electricity. The service restoration (SR) part of FLISR is the main task of this thesis work.

Goal
This thesis aims to provide a solution for SR in power grids. The SR can be understood as a direct application on reinforcement learning (RL) technique. The concept behind RL is to find actions to be done in a certain scenario or situation such that a reward function is maximized. Unlike supervised learning algorithms, RL is not given any examples of actions to be performed under certain scenarios. This has to be discovered by interacting with the environment.

Through RL, the grid is to choose the best action by reconfiguring the appropriate switches (to open or close) such that a certain reward function is maximized. The reward function can be formulated given some topological and electrical constraints. The topological constraints ensure for example that any section of the grid is connected to one feeding point, whereas the electrical constrains ensure that the line current and voltage drop are within certain ranges. The formulated problem can be tested on several benchmark power systems.

Requirements
- Excellent knowledge in Python programming.

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