

Smart Asset Maintenance and Management for Electric Power Distribution Grids

Ph.D Student: Hamid Mirshekali (hmir@mmmi.sdu.dk)

Center: Center for Energy Informatics, Mærsk Mc-Kinney Møller Institute, University of Southern Denmark

Principle Supervisor: Associate Professor, Hamid Reza Shaker (hrsh@mmmi.sdu.dk)

Co-Supervisor: Associate Professor, Athila Quaresma Santos (aqs@mmmi.sdu.dk)



University of
Southern Denmark

Background

Ensuring ongoing security and proper operation of the power system is crucial for meeting demands. Maintaining an adequate level of reliability throughout the entire power system, from generation to distribution, is a major concern for network managers. Effective asset management and maintenance can greatly impact system reliability by reducing costly failures and preventing shutdowns caused by aging, overconsumption, etc. The majority of today's maintenance techniques are reactive which are ineffective. On the other hand, a large percentage of asset management strategies focus on field inspection and asset age, which are not always available or effective. By enabling prescriptive maintenance and predictive asset management, this project will improve the reliability of power systems, overall maintenance costs, and decrease planning time for maintenance, all of which will accelerate the transition to renewable energy sources. The relevance and importance of reliability and predictive characteristics over electrical distribution networks have been highlighted by the steadily rising energy demand. The significance of electrical distribution grids is growing due to their role in providing consistent electricity to consumers. As demand and distributed power generation increase, the need for a smart system to enhance network reliability becomes crucial. Simply investing in network upgrades is no longer sufficient to handle the complexity of future distribution systems. It is evident that modernizing the distribution grid requires the implementation of advanced Distribution Management Systems. To improve reliability and optimize network investment costs, a smart asset maintenance and management platform is necessary. This can be achieved by leveraging the benefits of digitalization in distribution grids to improve asset management and maintenance.

Objectives

- Study of the applicability of different machine learning algorithms for smart asset maintenance and management purpose
- Developing a framework for handling and reconstructing of raw data in order to use in the machine learning model
- Studying on the possibility of virtual sample generation usefulness in the asset management and maintenance
- Developing new ways to validate and test the developed software-based toolset for predictive asset management and prescriptive maintenance

Methodology

The purpose of the project is to develop a platform for prescriptive maintenance and predictive asset management through conducting various case studies. To achieve this, it requires a systematic and data-driven approach, involving data preparation and model training using programming languages such as Python and software environments such as MATLAB. The process of completing the project will involve the following steps: defining clear and concise objectives and scope, conducting a comprehensive review of relevant literature, acquiring necessary data, conducting thorough data analysis, using the analyzed data to meet project goals, and evaluating the results to ensure the project's success.