

RESEARCH SEMINAR

Analyzing and Resiliently Operating Cyber-Physical Systems with Extended Deep Reinforcement Learning Architectures



Dr Eric MSP Veith

Postdoctoral Researcher
University of Oldenburg
Germany

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Venue : BC203

Abstract

In order to reach set goals for greenhouse gas emissions, the share of renewable energies in power grids rises around the world. Together with new market concepts and an ever-tighter integration of prosumers, the strive for efficient operation of power grids has introduced a multitude of information and communication technologies as well as AI-based algorithms. Moreover, the proliferation of IoT technologies has created a large group of devices, which may be neglectable individually, but become grid-affecting in sum. Complex cyber-physical systems inherently suffer from attack vectors because of the complexity. Recent years have also shown us that power grids have become valuable targets.

Learning agents, i.e., software systems based on Deep Reinforcement Learning, have already firmly established themselves in a multitude of applications for smart grids. They promise to provide resilient strategies for the operation of power grids, being able to adapt themselves and react to events that were not foreseen by their creators. In this talk, we will present the Adversarial Resilience Learning methodology and reference framework. It extends the state of the art in DRL for power grids by establishing an autocurriculum setup to improve training performance, by transparently incorporating offline and imitation learning into the agent's architecture, and using eXplainable Reinforcement Learning through equivalent decision trees to give behavioral guarantees.

About the Speaker

Dr Eric MSP Veith is computer scientist by heart. He obtained his diploma in 2010; his studies initially focused on computer and communication networks. During his PhD, he devised a Multi-Agent System for guaranteed optimal real power equilibria in distribution grids with a high amount of volatile, distributed, renewable energy resources.

In 2017, after his PhD, he joined the computer science institute OFFIS in Oldenburg, Germany. Here, he created Adversarial Resilience Learning (ARL), a methodology based on Deep Reinforcement Learning to analyze a cyber-physical energy system for weaknesses and let the agents reliably learn strategies for a resilient operation.

Since 2022, Eric leads his own junior research group at the University of Oldenburg, Germany, focusing on extended agent architecture based on ARL that allow for guarantees and explainability and supervising PhD candidates in this particular area of research.

Dr Eric MSP Veith is member of Germany's federal platform for artificial intelligence (PLS), of the Transatlantic Cyber Forum, the German standardization organization (DIN), is IARIA fellow and serves in the steering committee of IARIA's ENERGY, and serves in the TPC of the ACM e-Energy and the European Simulation and Modelling Conference.