

AI for Grid Resilience: Reinforcement Learning in the L2RPN Challenge

Topic for “Praxis der Forschung”
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Project Description

The **Learning to Run a Power Network (L2RPN Challenge)** is a global initiative to advance artificial intelligence solutions for real-time electricity grid control. As our energy systems transition toward carbon neutrality, the role of AI in managing resilient, adaptive, and secure grid operations becomes critical. Power grids must now handle complex constraints: renewable variability, aging infrastructure, and cyber/physical disruptions. Modern grid operators are expected to do more with less, while maintaining seamless service to millions.

This project aims to develop an AI agent using **deep reinforcement learning (DRL)** to not only optimize energy flows but also resist disruptions and adapt to unknown, stressful scenarios – ensuring robust, secure and sustainable grid operation.

Tech at the Frontier

State-of-the-art techniques in L2RPN include:

- **Proximal Policy Optimization (PPO)** with policy/value network
- **AlphaZero-style planning** via Monte Carlo Tree Search
- **Hybrid action architectures** (discrete topology + continuous redispatch)
- **Simulation-driven guided exploration** (e.g., Grid2Op, Lightsim2Grid)

You'll build and train robust agents, compare them to official baselines, and experiment with novel control strategies.

Platforms

- Grid2Op
- Lightsim2Grid
- Stable Baselines3
- L2RPN Benchmarks (2020-2023)
- PyTorch / TensorFlow

More Information

- <https://l2rpn.chalearn.org/>
- <https://github.com/Grid2op>
- Marot, Antoine, et al. "Learning to run a power network challenge: a retrospective analysis." *NeurIPS 2020 Competition and Demonstration Track*. PMLR, 2021.

