UNIVERSITÄT DUISBURG ESSEN

Offen im Denken

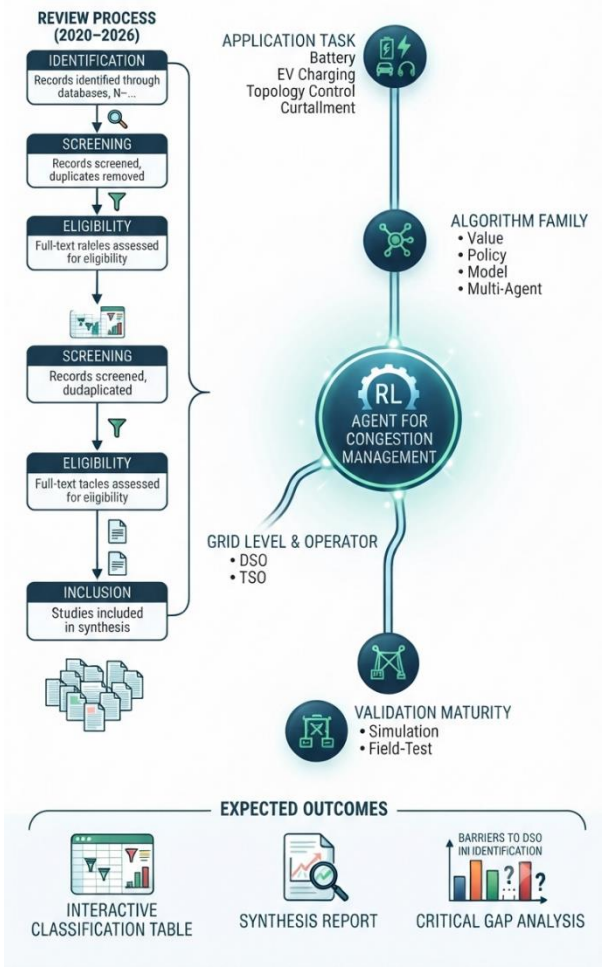
Fachgebiet für Elektrische Energiesysteme (EES)

Reinforcement Learning in Energy Management with a Focus on Congestion Management

The rapid growth of distributed energy resources, electric vehicle charging, and heat-pump adoption has fundamentally transformed distribution grid operations. Grid operators now face unprecedented levels of volatility, making effective congestion management—addressing voltage and thermal limit violations—a central operational challenge. Reinforcement learning has become a key approach to solving these congestion issues, as it allows for smarter, automated control decisions that can adapt to the unpredictable nature of today's power grids.

While various control strategies exist, the sheer volume of emerging research, particularly in advanced computational techniques, has created a fragmented landscape that is difficult to navigate. There is a critical need to synthesize these disparate approaches to understand not only their theoretical potential but also the practical hurdles preventing their widespread adoption in real-world distribution networks.

The objective of this thesis is to conduct a comprehensive, systematic literature review that maps the current state of research at the intersection of automated energy management and congestion mitigation. This work aims to establish a structured taxonomy of existing methods, analyze their performance across different grid levels, and critically evaluate the gap between simulation-based results and operational reality to identify the key barriers to implementation.



Betreuer und Ansprechpartner

- **M.Sc. Ahsen ULUTAŞ**
  ahsen.ulutas@stud.uni-due.de, BA062

Bearbeiter

- **N.N.**