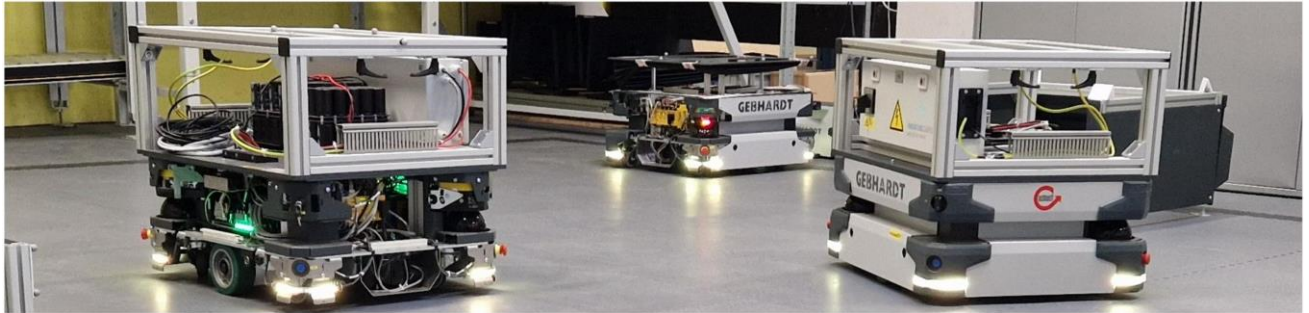


Masterthesis

Optimizing Lifelong Multi-Agent Pathfinding (LMAPF) Using Reinforcement and Imitation Learning



Field: Mobile robotics is one of the fastest-growing and most dynamic areas in intralogistics. As fleet sizes rapidly increase, the challenge shifts from single-robot navigation to large-scale, cooperative fleet coordination. Efficient and adaptive management of these fleets is essential to ensure high system throughput, reliability, and productivity. At the IFL, we are at the forefront of this development, actively contributing to the industry standard VDA 5050, which defines communication between mobile robots and fleet management systems.

Problem Statement: Traditional Lifelong Multi-Agent Pathfinding (LMAPF) algorithms rely on fixed heuristics and lack adaptability to dynamic, real-world environments. In practice, robot fleets must operate continuously under uncertainty, delays, and changing task demands—conditions where static methods quickly reach their limits. This thesis explores learning-based approaches such as Reinforcement Learning, Imitation Learning, or hybrid methods to enable scalable and adaptive coordination. The goal is to develop policies that learn cooperative behaviors, reduce congestion and deadlocks, and improve overall system throughput and robustness.

Required Skills:

- Experience with Python or a similar programming language.
- Familiarity with machine learning frameworks such as PyTorch or TensorFlow is an advantage.
- Knowledge of graph theory and pathfinding algorithms is a plus.
- Problem-solving mindset and an independent working style.

Benefits: Join a young, motivated team working on cutting-edge, industry-relevant research in mobile robotics. Your work will directly influence real-world projects. You'll receive close supervision with weekly feedback sessions, as well as access to workshops on scientific writing, software engineering, and more.

Research Group:

Mobile Agents and Robotic Systems

Thesis Type:

Practical, Conceptual, Simulation

Majors:

Mechanical Engineering, Mechatronics, Computer Sciences

Start Date:

immediately

Language:

German/ English

Application:

If you are interested, please email your CV, current transcript, and a brief motivation letter outlining relevant experience.

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