Master thesis/PhD program for the research group "Unmanned Flight Systems (Drones)"

Multi-Agent Reinforcement Learning Control with Connectivity Maintenance

Consider a swarm of autonomous agents, where each agent can only communicate with spatially close neighbors. The swarm has an objective that can be achieved if and only if the connectivity in the swarm is maintained, i.e., there exists a communication path between each pair of agents. Currently, there are no control algorithms that can take into account the connectivity constraints, non-linear dynamics, and state and input constraints.

The objective of this project is to study distributed RL-based algorithms for controlling a swarm of autonomous agents and preserving the connectivity of the communication network. The envisioned solution will be based on an intelligent reinforcement learning controller that will also integrate a connectivity constraint on the spectral information of the graph's Laplacian matrix, see [1] for more information about connectivity maintenance. The controller will be tested first in simulation and then on hardware.

Ihre Aufgaben

- A literature research on the current state of the art about multi-agent control and connectivity maintenance
- Implementation of the state-of-the-art algorithms
- Development of a novel method for trajectory tracking RL that incorporates a connectivity constraint
- Simulation of the developed algorithm

[1] B. Salamat, G. Elsbacher, L. Belzner, "**Model-Free Distributed Reinforcement Learning State Estimation of a Dynamical System Using Integral Value Functions**," IEEE Open Journal of Control Systems, February 2023.

Ihr Profil

Strong background in control theory, RL, and experience in Python are required.

Kontakt

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