Universität Stuttgart
Institut für Flugmechanik und Flugregelung

RL-based Scheduling of Copter Docking

Master Thesis

Background

Autonomous drones deployed in teams show a huge potential in a variety of future applications (e.g., inspection tasks, precision agriculture, monitoring of wildlife and disaster sites). Unfortunately, their operating range is limited by factors such as battery capacity, disk space for data recording, etc. This problem can be addressed by autonomous landing procedures that enable a drone to connect to a docking port to replenish batteries and offload data. However, in scenarios with more vehicles than available docking ports, a scheduling algorithm needs to decide the vehicle order and the times at which docking occurs while maximizing the utility of the system. Against this background, reinforcement learning (RL) is a promising solution approach.

Problem Definition

In previous work, a modular framework for simulating different docking scenarios has been developed. The next step is casting the scheduling problem as a RL task. For this purpose, a suitable state and action space as well as a reward function need to be designed. Furthermore, a robust yet fast RL algorithm must be chosen. Different agents should be trained for different docking scenarios, their performance evaluated, and the results compared to non-learning-based methods that already exist in the field. Lastly, the effectivity of the algorithm can be demonstrated on real hardware.

Tasks

- Framing of the scheduling problem as a RL task
- Implementation of the selected approach in the existing framework
- Conduction of a comprehensive experiment campaign in simulation to validate the applicability of the approach for different scheduling scenarios
- Testing of the approach on real hardware in a flight experiment involving several drones.

Requirements

- Interest in RL techniques
- Experience with ROS / Gazebo desired
- Good programming skills in Python / C++
- Good academic performance

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