TECHNISCHE UNIVERSITÄT DARMSTADT

Thesis Topic (B.Sc. / M.Sc.)
Reinforcement Learning for Drone Swarms

Fachbereich 18
Elektrotechnik und Informationstechnik
Bioinspirierte Kommunikationssysteme

Department 18
Electrical Engineering and Information Technology
Bioinspired Communication Systems

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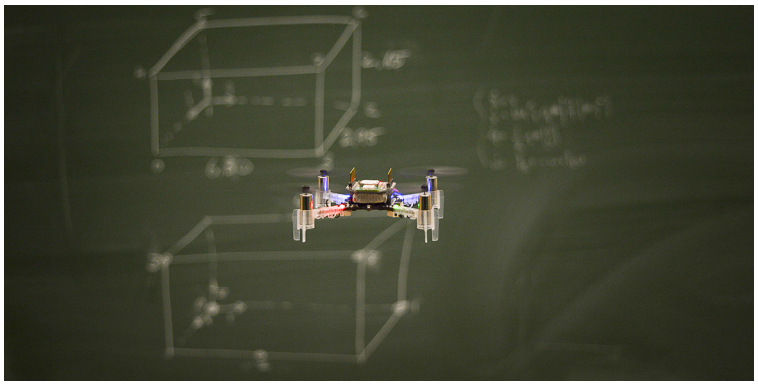
Recent breakthroughs in Reinforcement Learning (RL) combining classical RL approaches such as Q-Learning or Policy Gradient methods with the Deep Learning paradigm have achieved good performance in many simulated complex single-agent problem domains such as Atari games or Mujoco robotic benchmark tasks. Many problems such as sample inefficiency and transfer to real systems remain, while general solutions for multi-agent systems are still out of reach.



Drone swarms offer many possibilities for applications such as transportation, disaster relief operations, environmental exploration or ad-hoc communication networks. Although the capabilities of individual drones are limited, drone swarms on the other hand promise robust solutions via collaboration. In the limit, this approach requires scalable, robust coordination between the drones not realizable by a single centralized coordinator.

At BCS Lab's Dronelab, you will have the opportunity to work with Crazyflie 2.1 drones from Bitcraze. You will investigate how to apply Reinforcement Learning techniques to achieve complex behavior in simulations and optionally on real drones. Possible problems you may work on range from learning high-level or low-level policies on simulations, to transferring learned behavior onto real drones, to implementing learning pipelines between simulation and real system.

You are encouraged to realise your own ideas within the project and the projects can be adapted to your interests. Some of the following may or may not help during your thesis, depending on your specific topic combination:

- Experience in reinforcement learning / machine learning
- Experience in optimal control / control systems
- Experience with embedded systems
- Python

For further information, please contact Kai Cui.