# KIT
Karlsruhe Institute of Technology

## Autonome Lernende Roboter (ALR)
### Prof. Gerhard Neumann

## Project Type ———

- ☑ Master Thesis
- ☐ Bachelor Thesis
- ☐ Research Project

## Supervisors ———

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## Difficulty ———

Algorithmic

Math

Application

# Bayesian Aggregation for Deep Reinforcement Learning in Swarms

## Description

In this work, we want to apply Bayesian aggregation [3] as a new compact representation of neighborhood constellations in deep reinforcement learning for swarms. In previous work [2], simple mean aggregation was used which gave equal weight to all pieces of information in a neighborhood. With this new approach, we believe we can automatically give more weight to more important information while neglecting less useful information. This should result in better and faster policy learning in swarms.

## Tasks

In this thesis, you should
- Get familiar with Deep RL methods (PPO, SAC)
- Implement baseline method
- Implement Bayesian Aggregation for swarm state processing
- Evaluate on simple point mass swarm task and more complex swarm robotics environments
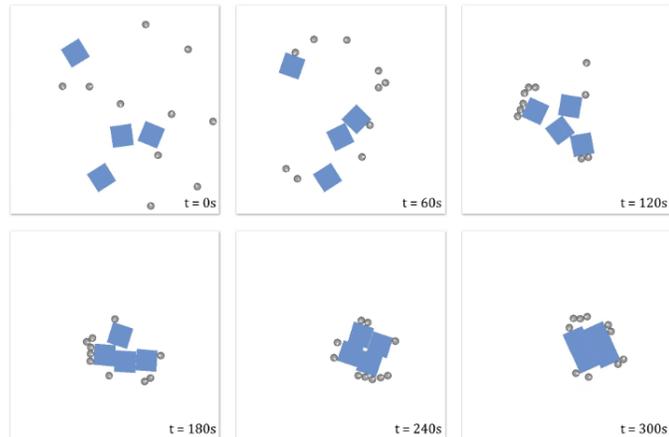


**Figure 1:** A swarm of robots collaborates to collect four separate objects and assembles them (picture taken from [1])

## References

[1] Gregor HW Gebhardt. Using mean embeddings for state estimation and reinforcement learning. 2019.

[2] Maximilian Hüttenrauch, Adrian Šošić, and Gerhard Neumann. Deep reinforcement learning for swarm systems. *Journal of Machine Learning Research*, 20(54):1–31, 2019.

[3] Michael Volpp, Fabian Flürenbrock, Lukas Grossberger, Christian Daniel, and Gerhard Neumann. Bayesian context aggregation for neural processes. In *International Conference on Learning Representations*, 2021.