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

Multi-step Deep Reinforcement Learning in High-Dimensional Action Spaces

Description

In this project, we aim to extend, train and benchmark a deep hierarchical policy for manipulation tasks in a high-dimensional action spaces that require reasoning over long time horizons.

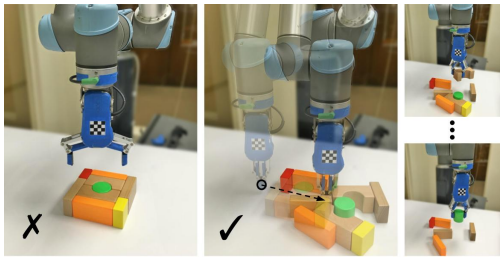

Figure 1: Example of pushing and grasping synergies [2].

Reinforcement learning from visual inputs for robotic manipulation is a topic of growing importance both for the scientific community and for industrial research. One popular approach, first proposed in [2], relies on a discretization of the action space according to the pixel space and a finite number of discrete rotations. However, the method proposed by [2] is limited to short time horizons and is thus not applicable to tasks that require reasoning over extended time horizons. Therefore at ALR, we very recently developed a novel approach for tackling settings with long time horizons [1]. The goal of this thesis is to adapt and apply this approach to a new challenging task involving reasoning over multiple objects, goals and time-steps .

Tasks

Your task will be to extend, train and benchmark the approach proposed in [1] on a new challenging task. You will work in a provided simulation environment, where the task has already been set up. In details, your task will involve

- Extending the approach of [1] to tackle the new challenging task.
- Training and tuning the developed model in simulation to achieve the best performance possible.
- Evaluating different design choices you made and benchmark your model against baseline models.

References

[1] Rodrigo Chau. Optimizing the long-term behaviour of deep reinforcement learning for pushing and grasping. In *Master Thesis, KIT*.

[2] Andy Zeng, Shuran Song, Stefan Welker, Johnny Lee, Alberto Rodriguez, and Thomas A. Funkhouser. Learning synergies between pushing and grasping with self-supervised deep reinforcement learning. In *IEEE International Conference on Intelligent Robots and Systems (IROS) 2018*, pages 4238–4245.