Open Master Thesis Topic: Combining Deep Reinforcement Learning and 3D Vision for Dual-arm Robotic Tasks

TECHNISCHE UNIVERSITÄT DARMSTADT

iROSA

November 10, 2022

Supervisors: Snehal Jauhri (Email: snehal.jauhri@tu-darmstadt.de), Georgia Chalvatzaki

1 Project Description

Recent breakthroughs in Deep Reinforcement Learning (RL) have led to an increased deployment of learning-based methods in robotics. Nevertheless, RL for robotics has been limited to simple setups that assume perfect knowledge about the robot's environment.

Recent work at the iRosa lab [1] (irosalab.com/rlmmbp) has successfully utilized Deep RL for performing mobile manipulation tasks (i.e. picking and placing objects using the robot arm while moving using the wheeled base of the robot). However, even in these experiments, the robot just used one out of its two arms, and the method assumed perfect perception of the environment (Fig. 1).

In this thesis, we aim to build on advances in 3D Vision [2] (stanford.edu/ rqi/pointnet) and combine them with Deep RL to learn using real-world, imperfect 3D information such as point-clouds or occupancy grids (Fig. 2). We also aim to solve the more challenging problem of dual-arm mobile manipulation instead of just using a single arm (Fig. 3).

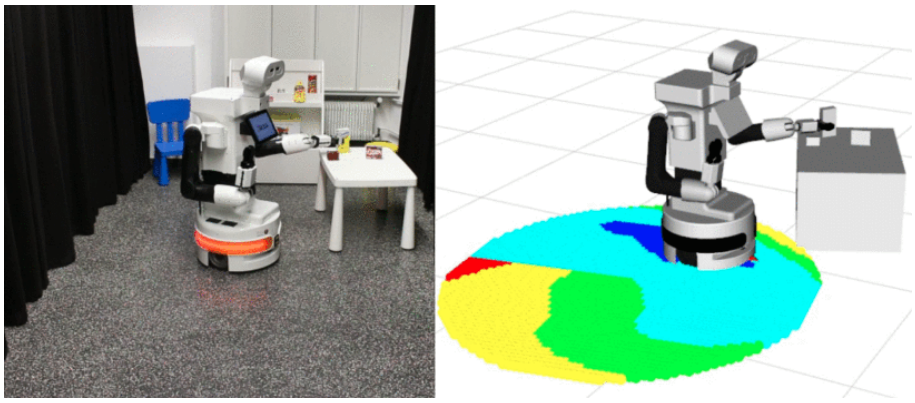

Figure 1: Recent work on learning to move the robot for single-arm object pick and place [1] (irosalab.com/rlmmbp). Perfect perception of the objects (grey boxes on the right) was assumed.

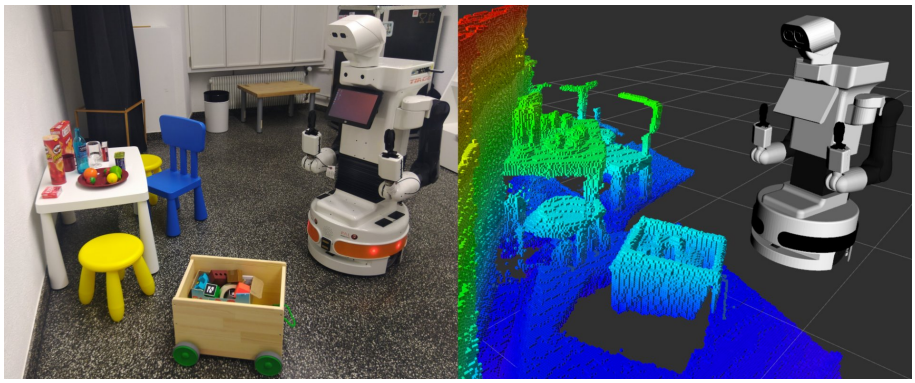

Figure 2: Learning from partial 3D information such as point-clouds or occupancy grids (shown above) is challenging and requires the effective combination of 3D Vision.