**Master Thesis Theme Stefan Wanckel**

**“Theme”**

**Introduction**

Classical task planning approaches for robotic arm manipulators require in depth task-specific know-how and detailed environmental descriptions. Therefore, utilizing existing robotic setups for new use cases often require a complete overhaul of the task planning pipeline. Reinforcement Learning methods have shown promising results in learning the task planning behavior. By making use of unshaped, sparse reward functions, these algorithms are able to accomplish complex tasks that may even be composed of sequential subtasks. Perhaps one of the shortcomings of Reinforcement Learning techniques is the transferability of trained models to real environments. (some info about methods to close the sim-reality-gap)

**Aim**

The aim is to train reinforcement learning models in simulation and validate them on their physical counterpart. Herefore, simulation-reality gap closure plays an important factor. (also here the sim-real methods should be named)

**Approach**

A simulation environment for the robot manipulator “Universal Robots 5e” will be created and reinforcement learning DDPG (with HER extension), G-HGG and im-HGG will be used to train on different benchmarking tasks (Reach, Push, Stack, etc). Also, benchmarking tasks need to be defined. Then, the models will be validated by solving the same tasks on the real robot. This process is repeated after using methods to close the sim-reality-gap.

These methods are:

* Increase accuracy of model descriptions (robot description, object description in tasks)
* Dynamic randomizing(?)
* \_\_\_

**Working Schedule**

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|  | Dec | | Jan | | Feb | | Mar | | Apr | | May | | Jun | |
| **Literature Research** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Build Simulation** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Create Environment (with Pybullet engine) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Define Test Scenarios |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Learning** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| DRL-HER |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| G-HGG |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| img-HGG |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Sim Validation on Real Robot** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Setup hardware and real robot |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Validate each learning model |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Try Methods to close Sim-to-Real Gap |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Thesis** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |