TECHNISCHE UNIVERSITÄT MÜNCHEN
Human-centered Assistive Robotics
UNIV.-PROF. DR.-ING. DONGHEUI LEE

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B A C H E L O R T H E S I S
for
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Learning from Demonstration of Manipulation Tasks using Physically Realistic Simulations

Problem description:

To allow robotic platforms to execute everyday tasks, it is necessary to ground actions using trajectory planning mechanisms. One broadly used approach to this end is dynamic movement primitives (DMPs) [3], whose parameters are learned from trajectories demonstrated on real robot manipulators [2]. However, generating these trajectories using a real robot has two drawbacks. On the one hand, setting up a real platform is a tedious task that demands a significant amount of effort and time. On the other hand, real robots have an inherent risk of damage due to misuse or to wear and tear. This project addresses these limitations by implementing a physically realistic simulation of a robotic arm. The simulated platform is used for learning from demonstration of manipulation actions (e.g. pick, place, pour, etc.) compatible with task planning approaches [1]. The validity of the simulator is assessed by demonstrating and executing sequences of actions of task plans and by executing learned trajectories in a real platform.

Tasks:

- Literature review.
- Implementation of the simulated platform using the robot simulator V-Rep.
- Implementation of DMPs generation and execution from demonstrated trajectories.
- Performance assessment.

Bibliography:

[1] A. Agostini, C. Torras, and F. Woergoetter. Efficient interactive decision-making framework for robotic applications. *Artificial Intelligence*, 247:187–212, 2017.
[2] R. Caccavale, M. Saveriano, A. Finzi, and D. Lee. Kinesthetic teaching and attentional supervision of structured tasks in human–robot interaction. *Autonomous Robots*, pages 1–17, 2018.
[3] S. Schaal. Dynamic movement primitives-a framework for motor control in humans and humanoid robotics. In *Adaptive motion of animals and machines*, pages 261–280. Springer, 2006.

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