TECHNISCHE UNIVERSITÄT MÜNCHEN
Human-centered Assistive Robotics
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July 21, 2020

M A S T E R ' S T H E S I S
for
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Deep reinforcement learning for dexterous hand manipulation

Problem description:

Multi-fingered hands are very flexible and capable of performing a variety of tasks on objects of diverse shapes and sizes. However, achieving a human-like dexterity for a prosthetic hand is a big challenge due to its highly complex mechanisms. To address this challenge, state-of-the-art deep reinforcement learning methods are implemented [1]. These methods require human demonstrations of high quality and complex hand-crafted reward functions to achieve the desired robustness. In this thesis, we tackle these limitations by relaxing the necessity of high quality demonstrations [2] and by automatically defining reward functions for each specific task using human demonstrations and inverse reinforcement learning [3].

Tasks:

- Literature overview of learning from demonstrations and inverse reinforcement learning.
- Implementation of learning with behaviour cloning based on hand pose estimation [4].
- Implementation of an inverse reinforcement learning approach for dexterous hand manipulation [3].
- Assessment of the stability and transferability of the approaches for different tasks and scenarios.

Bibliography:

[1] A. Rajeswaran et al. Learning Complex Dexterous Manipulation with Deep Reinforcement Learning and Demonstrations, in *ArXiv170910087* Cs, Sep. 2017.
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[3] J. Fu, K. Luo, and S. Levine. Learning Robust Rewards with Adversarial Inverse Reinforcement Learning, in *ArXiv1710.11248* Cs, Oct. 2017.
[4] Li, Shile, and Dongheui Lee. Point-to-Pose Voting based Hand Pose Estimation using Residual Permutation Equivariant Layer, in *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*. 2019.

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Start:	03.07.2019
Intermediate Report:	16.06.2020
Delivery:	21.07.2020

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