Exploiting model-based reinforcement learning for non-prehensile manipulation of deformable objects

Problem description:
Non-prehensile manipulation actions, like pushing or folding, aim at modifying the pose of an object without firmly grasping it. Non-prehensile manipulation is a hard task and, especially when the object to manipulate is deformable, it is far from being fully solved [1]. This is because the task at hand is hard to model and the complex model makes the design of a control policy non-trivial. Reinforcement learning (RL), or learning by self-practice, is an appealing approach widely used in robotics to learn complex skills. In particular, model-based RL approaches [2, 3], combined with non-linear optimal control approaches like the Iterative Linear Quadratic Gaussian (ILQG) [4], seem well-suited to execute non-prehensile manipulation tasks.

In this Master thesis work, the student has to implement a learning based approach for non-prehensile manipulation of deformable objects. The approach starts with a simplified task model, e.g. considering a rigid body, and improves both the task model and the control policy with data from real executions. The effectiveness of the developed approach is demonstrated with experiments on a real robot.

Tasks:
- Literature research on model-based reinforcement learning and non-prehensile manipulation
- Combination of PI-REM [2] and ILQG [4]
- Application of model-based RL to non-prehensile manipulation of a deformable object
- Evaluation on a real robot

Bibliography:

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Start: 20.08.2018
Intermediate Report: xx.11.2018
Delivery: xx.02.2018