

Masterarbeit

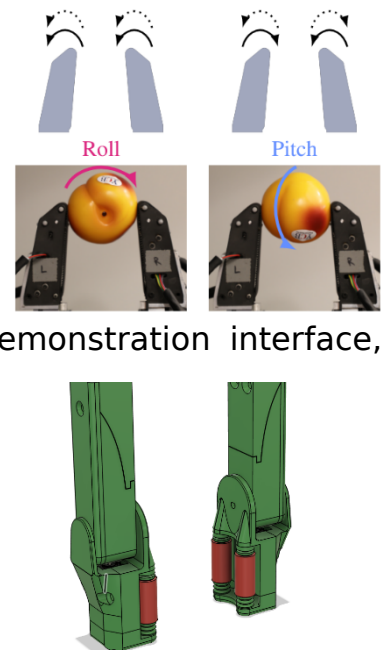
Learning In-Hand Manipulation from Human Demonstrations with Two-Finger Robotic Grippers

Problem formulation

In-hand manipulation with standard two-finger grippers is promising, but it remains unclear how gripper design affects learning from human demonstrations. This thesis compares two concepts for object reorientation inside the grasp: a literature-inspired active-contact gripper [1] and a novel in-house gripper with additional DOF for rolling and pitching. The goal is to study how embodiment influences intuitiveness for human teaching, demonstration quality, and the performance of imitation learning for in-hand manipulation tasks.

Task definition

The student will investigate learning in-hand manipulation from human demonstrations with two different gripper concepts. Tasks include reviewing relevant literature, defining benchmark reorientation tasks, implementing an intuitive demonstration interface, collecting demonstrations, training a baseline imitation-learning method, and experimentally comparing both grippers. The evaluation will consider teaching effort, demonstration consistency, task success, and policy generalization across objects and target poses, leading to design insights on gripper morphology and learnability.



Requirements

- Solid knowledge base and experience in deep learning and robotics.
- Coding skills in Python and C++.
- Experience with ROS, CAD, and 3D printing is beneficial

Literature

[1] G. Xie, R. Holladay, L. Chin, and D. Rus, "In-Hand Manipulation With a Simple Belted Parallel-Jaw Gripper," IEEE Robot. Autom. Lett., vol. 9, no. 2, pp. 1334–1341, Feb. 2024, doi: 10.1109/LRA.2023.3346750.

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