

Design and Testing of Vision Algorithms for an Interactive Soft Robotic Hand

Matthew Du¹, Zhanfeng Zhou¹, and Xinyu Liu^{1 2}

¹ Department of Mechanical and Industrial Engineering, University of Toronto, Ontario, Canada

² Institute of Biomedical Engineering, University of Toronto, Ontario, Canada

Soft robotic grippers are safer to use for interacting with humans than hard robotic grippers because of their deformable structure and dexterity. Current research in robotic grippers and soft robotics investigates ways to use soft robotic grippers for mechanical search or in-hand manipulation tasks. However, despite their inherent safety, there is a lack of research on the advantages of using soft robotic grippers in human-robot interaction applications. Since the start of the COVID-19 pandemic, there has been a rise in demand for methods to reduce human-to-human contact, making devices like these particularly useful. This project works to develop algorithms for locating objects grasped in a human hand using an in-hand RGB-D camera and object segmentation and detection algorithms to plan the best path and orientation for the soft robotic gripper to grab those objects without making contact with the human hand. The objective goals are that it can identify objects of many shapes and sizes from within a complex background and control the soft gripper to grab objects securely without making contact with the human hand. The design is assessed based on the number of successful grasps it can make and the number of distinct objects it can identify. Progress so far is the algorithm can accurately locate a set of pre-trained objects, then identify an optimal grasp based on analysis of a voxel grid generated from an accumulated point cloud of that object. Future work on developing algorithms for more variety of grasping positions can help support the safety and versatility of the soft robotic gripper in human-robot interaction applications.