

Intelligent Planning for Robotic Grasping using a Soft Manipulator

The aim of this project is to develop intelligent planning algorithms for a soft robot manipulator. The robot will perform object grasping tasks, such as reaching into a cluttered cupboard and extracting an item. This project will investigate different planning approaches as well as the different structural requirements of the soft manipulator.

Soft manipulators are robots that are fabricated out of soft material, such as silicone. There is a significant recent interest in soft manipulators, as opposed to the more conventional robots that consist of rigid links, since they offer a variety of advantages. These advantages include safety near humans, natural compliance in response to external forces, and increased sensing opportunities through soft skin. A soft manipulator, however, is also more difficult to plan for, since the soft structure can continuously deform, whereas a robot with rigid links change shape at a limited number of known points --- its joints.

One important novelty of this project will be the ability of the soft manipulator to grasp objects both through a suction component and also by curling around objects. In the literature, suction and grasping through contact has been studied separately and both proved to be useful for different objects and environments. Our system will bring together the advantages of both approaches.

During this project, the student will be expected to:

- Perform a literature review on topics including soft robots, robot planning and grasping;
- Implement planners for soft robots and experiment with these planners on a simulated robot;
- Take part in the design and fabrication of the manipulator; and
- Implement and test planners on the physical real robot.

The student will be using equipment in the EPSRC National Facility for Innovative Robotic Systems at Leeds as well as the robotic and pose tracking platforms at the new Robotics Lab at the School of Computing. The student will also have full access to the soft robotic lab at the School of Mechanical Engineering.

The project will be co-supervised by:

Dr. Mehmet Dogar (School of Computing)

Dr. Ali Alazmani (School of Mechanical Engineering)

Dr. Dogar and Dr. Alazmani are new University Academic Fellows in the university, and they hope this project will lead to further collaboration and subsequent research proposals. The co-supervisors have complementary research expertise. Dr. Dogar's research focuses on

intelligent planning for robot manipulation and grasping. His previous research also includes the use of soft robot hands for grasping. His guidance will be most relevant for the intelligent planning aspects of the project. Dr. Alazmani's research focuses on the design and fabrication of soft elastic actuators and sensors. His guidance will be most relevant for the design and fabrication of the soft manipulator.