Faculty of Engineering  
Summer Research Program 2021-2022

Project Title: Deep Learning-based 6 DoF Grasping with a Robotic Hand

Supervisor(s): Dr. Chao Chen, Dr. Akansel Cosgun  
Department: Department of Mechanical and Aerospace Engineering  
Email: Chao.Chen@monash.edu  
Website profile of project supervisor: https://www.monash.edu/engineering/chaochen

Objective

Robot manipulators are traditionally used for “top-down” grasps, which simplifies the problem to choosing an x,y, and orientation of the robot gripper, but adds constraints on how the objects can be grasped. Recently, new research has shown the feasibility of generating 6 Degrees of Freedom (DoF) using state-of-the-art deep learning methods. These approaches, however, are often applied on parallel-jaw robotic grippers which have a single DoF. This project aims to extend the state-of-the-art grasping approaches to a dexterous robotic hand.

Project Details

The hardware that will be used for this project is an experimental prosthetic hand (sketch shown in the figure). This robotic hand will be attached to a robotic arm. An RGB-D camera will be attached to the robotic arm and the point cloud data will be used as input to the neural network.

The project would consist of 4 stages:
1) Autonomously controlling the robotic arm and the fingers  
2) Real-world data collection from grasping trials  
3) Training a convolutional neural network that will output the robot wrist pose as well as the robotic hand joint configurations  
4) Evaluation of the approach by grasping different singulated objects from a table surface.

Prerequisites

- Strong programming skills in Python  
- Interest in publishing the results of research in a scientific journal  
- Experience with training deep neural networks is a plus  
- Hands-on experience with robots is a plus