MONASH
ENGINEERING

MONASH University

Faculty of Engineering
Summer Research Program 2023-2024

Project Title: Learning cutting controllers from demonstrations

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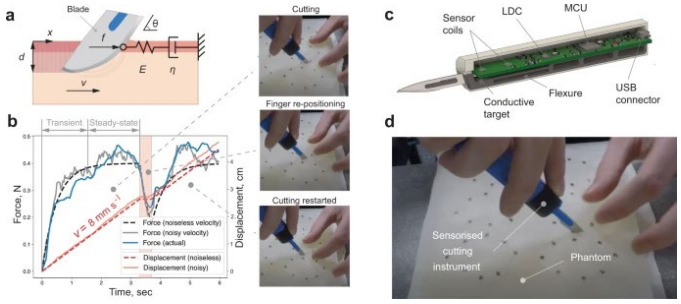
Objective

This project aims to develop methods to learn dextrous manipulation skills typically observed in surgery from human demonstration data. We will explore inverse reinforcement learning/ inverse optimal control approaches to identify the closed loop control strategies used by humans, with a focus on scalpel cutting.

Project Details



In robotics, before we can automate a task, we need to understand what it means to be good at this. For complex tasks requiring dexterous manipulation skills (eg. surgery), this can be hard to figure out, so it makes sense to try to learn this from data. This project will explore approaches to learn cutting from human data, building on recent work using custom sensorised scalpels:

Straižys, A., Burke, M., Brennan, P.M. et al. A generative force model for surgical skill quantification using sensorised instruments. Commun Eng 2, 36 (2023). https://doi.org/10.1038/s44172-023-00086-z

In this project, we will take a different approach, and look at jointly inferring both feedback and feedforward controllers in use by humans as they cut, to make automation of basic cutting skills more directly feasible.

Prerequisites

Excellent python programming skills, preferably taken units in machine learning, neural networks or control systems/optimisation. Familiarity with pytorch would be valuable.

Additional Information

Applicants should email me for further information and to discuss projects, and may be required to attend an interview.