MONASH University

MONASH ENGINEERING

Faculty of Engineering

ASPIRE Summer Research Program 2026-2027

Project Title: Learning autonomous endoscope control strategy in surgical robotics

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Objective

Surgical robotics improves precision and visualisation but increases the cognitive and physical burden on surgeons, particularly when coordinating endoscope (camera) control with multiple instruments during robot-assisted minimally invasive surgery (RAMIS). This project investigates a shared-control paradigm for surgical robotics in which the robot autonomously controls the camera while the surgeon focuses on manipulating the tools. Such a system could support more effective human-robot collaboration, reduce the surgeon's workload, and improve procedural efficiency

Project Details

The project tackles a key challenge in automating the endoscope control in surgical robotic: learning effective control strategy from demonstrations. In recent years, imitation learning rises as one of the popular methods that generates action from expert demonstration. It has the potential to learn camera control strategy from recorded demonstrations performed by expert surgeons. However, imitation learning remains underexplored in autonomous surgical camera control task. One major limitation is the scarcity of publicly available, annotated expert demonstrations from real surgical procedures. Additionally, imitation learning in general assumes that the training dataset is of high quality, which is unrealistic in surgical settings, where human demonstrations inherently contain noise. To counter this problem, we proposed a method for training imitation learning using noisy demonstrations. The method has already been validated on both simulated and real-world robotic manipulation tasks. The objective of this project is to validate the effectiveness of the proposed imitation learning for surgical robotics The student will generate or use a simulated dataset containing noisy camera-control demonstrations to train an imitation learning model within a surgical simulation platform and analyze the proposed approach. Successful validation would provide an important foundation for the future development of shared-control systems for autonomous endoscope control in surgical robotics.

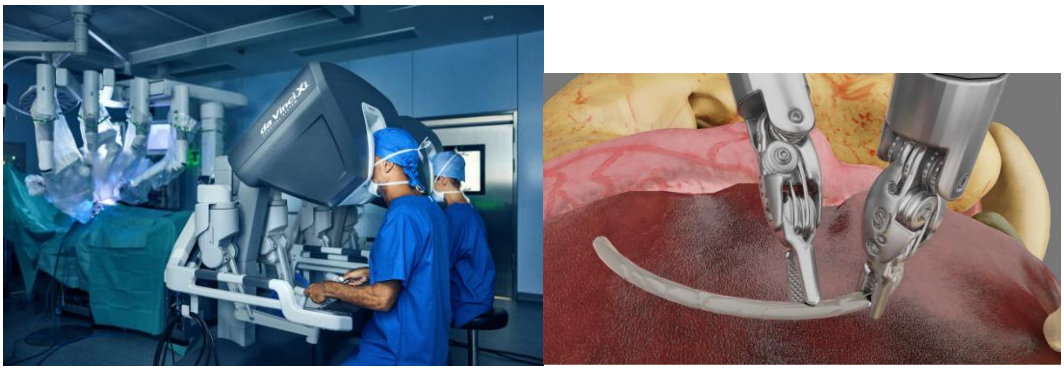

Figure 1

Project Timeline

TASK	1	2	3	4	5	6	7	8	9	10
Literature review										
Familiarize with training an imitation learning model										
Familiarize with the surgical simulation platform										
Training the imitation learning model on the surgical platform and analyze the results										
Performing a physical experiment to validate the simulation results										
Writing the report										

Prerequisites

Desirable skills and experience:

- Python
- Neural network and deep learning

Student Placement Agreement

A student placement agreement must be signed by the project supervisor and the student prior to commencement of the ASPIRE program.

LV0554-72741 ASPIRE Program Co-Curricular-Student-Placement-Agreement-Short-term.docx

Additional Information

Applicants may be required to attend an interview.