

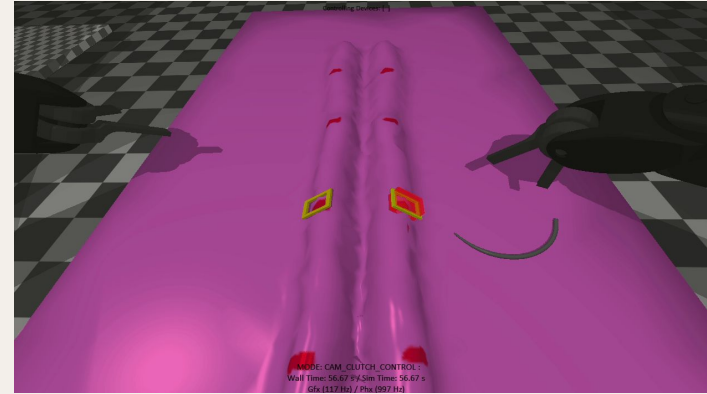
A reinforcement learning approach to robotic suturing

Project Teaser

Group 20

Members: Walee Attia, Jocelyn Hsu, Jihoon Kim

Mentors: Dr. Anqi Liu, Dr. Adnan Munawar, Dr. Manish Sahu, Dr. Peter Kazanzides



[1] 2021-2022 AccelNet Surgical Robotics Challenge

BACKGROUND

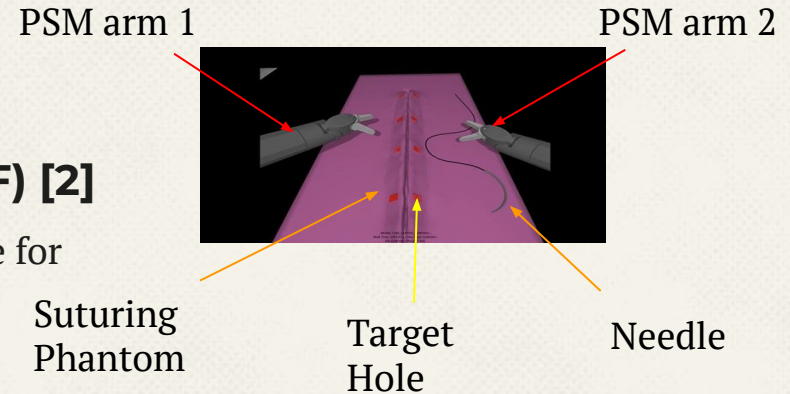
Surgical Robotics Challenge (SRC) [1]

A simulation platform to develop algorithms to address various questions in surgical robotics automation with:

- Two 7-DOF instrument arms based on dVRK needle drivers
- Controllable camera based on the dV Endoscopic Camera Manipulator
- Suturing phantom
- Needle with a suture

Asynchronous Multibody Framework (AMBF) [2]

A real time dynamics simulator that serves as the backbone for the Surgical Robotics Challenge environment



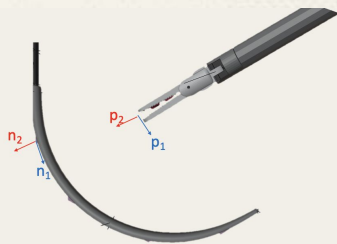
Novelty

OpenAI Gym [3]

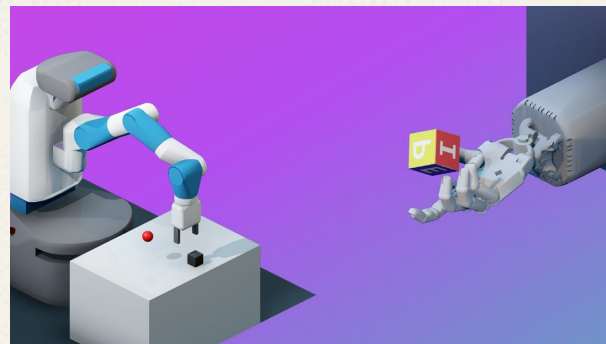
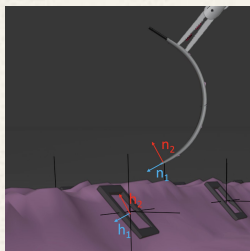
OpenAI Gym is an open-source RL framework that offer realistic simulation environments with easy integration.

Reward Function

Grasp

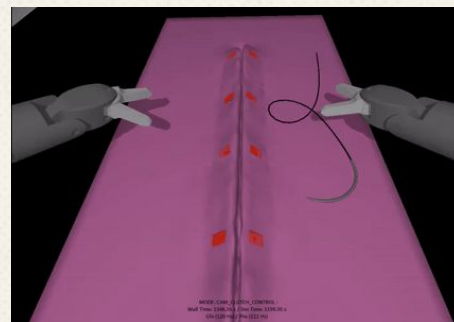


Insert



[3] Gymnasium documentation

RL: DDPG & HER



REFERENCES

- [1] 2021-2022 AccelNet Surgical Robotics Challenge (online). Collaborative Robotics Toolkit (CRTK). Retrieved February 19, 2023, from <https://collaborative-robotics.github.io/surgical-robotics-challenge/challenge-2021.html>
- [2] A. Munawar, Y. Wang, R. Gondokaryono, and G. S. Fischer, “A real-time dynamic simulator and an associated front-end representation format for simulating complex robots and environments,” in 2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS). IEEE, Nov. 2019. [Online]. Available: <https://doi.org/10.1109/iros40897.2019.89685688>
- [3] Gymnasium documentation. Basic Usage. (n.d.). Retrieved February 19, 2023, from https://gymnasium.farama.org/content/basic_usage/