



Human arm musculoskeletal simulation for day to day activities

Hardik Jain, Shrishti Mishra and Vidhi Shah - Department of Mechanical Engineering

Prof. Vineet Vashista, Department of Mechanical Engineering

Indian Institute of Technology Gandhinagar, Gujarat



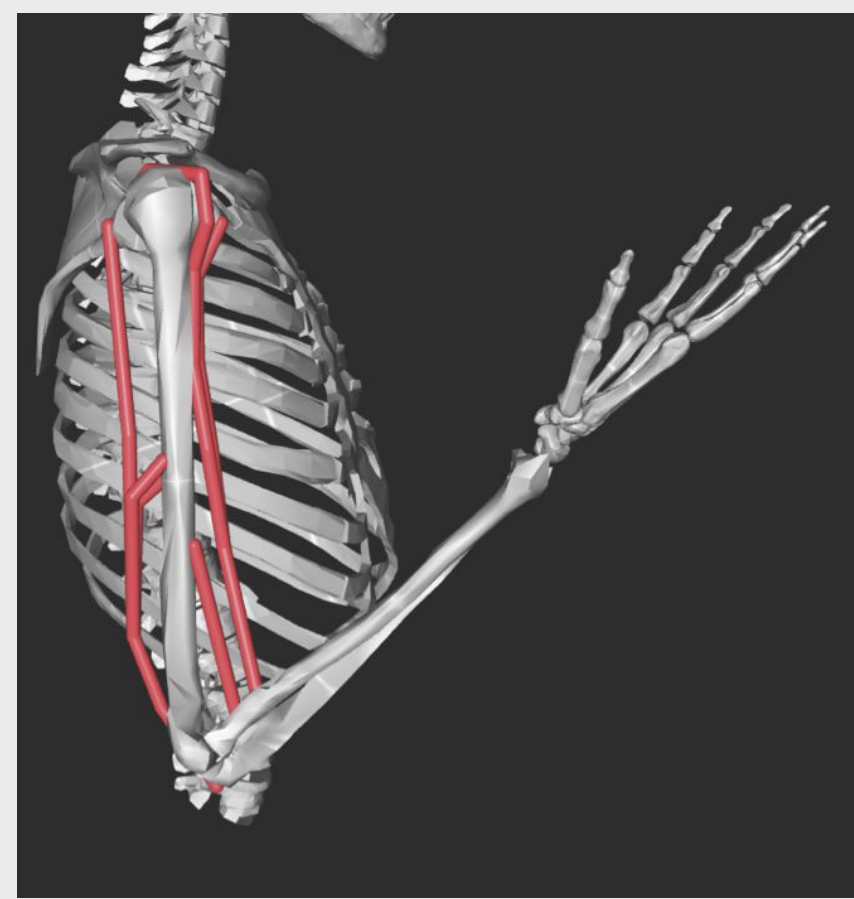
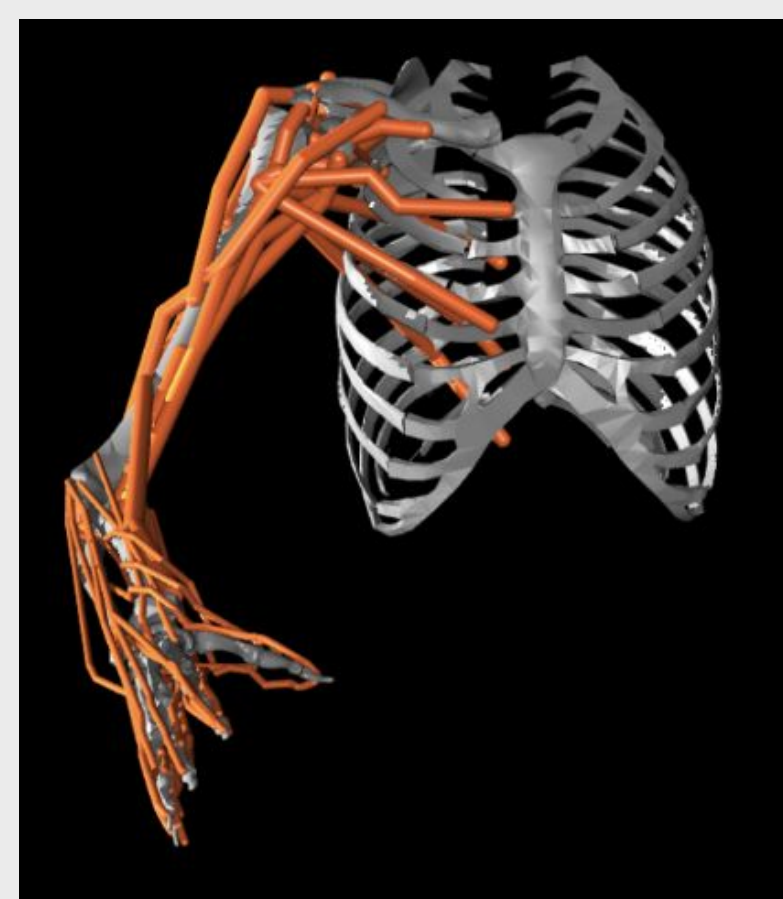
Abstract and introduction

Abstract

The project focuses on the simulation of various human tasks necessitating the use of hands, utilising basic musculoskeletal models within MyoSuite environment. The objective is to utilise Reinforcement Learning (RL) algorithms to implement the tasks.

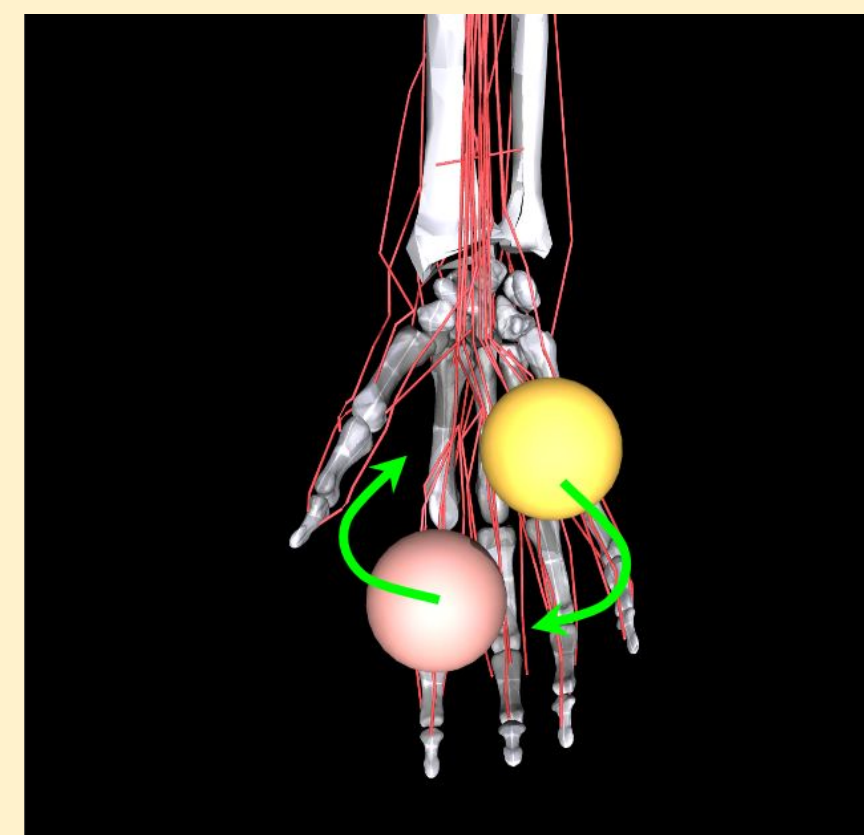
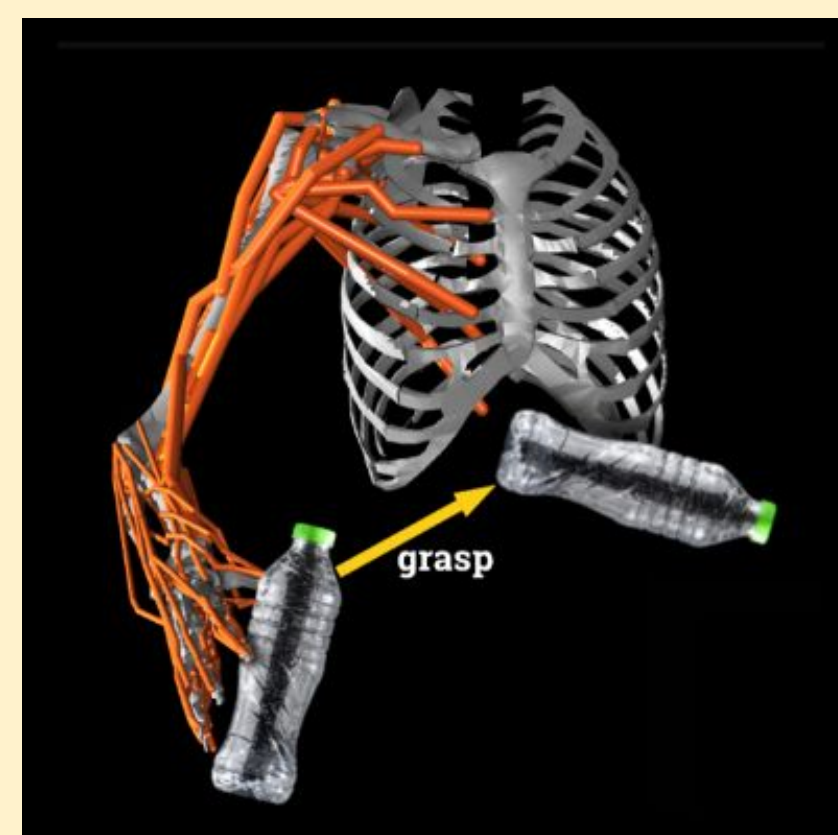
Introduction

MyoSuite is a collection of musculoskeletal environments and tasks. These are simulated with the MuJoCo physics engine. OpenAI Gym enables the use of RL algorithms on the models.



Objectives

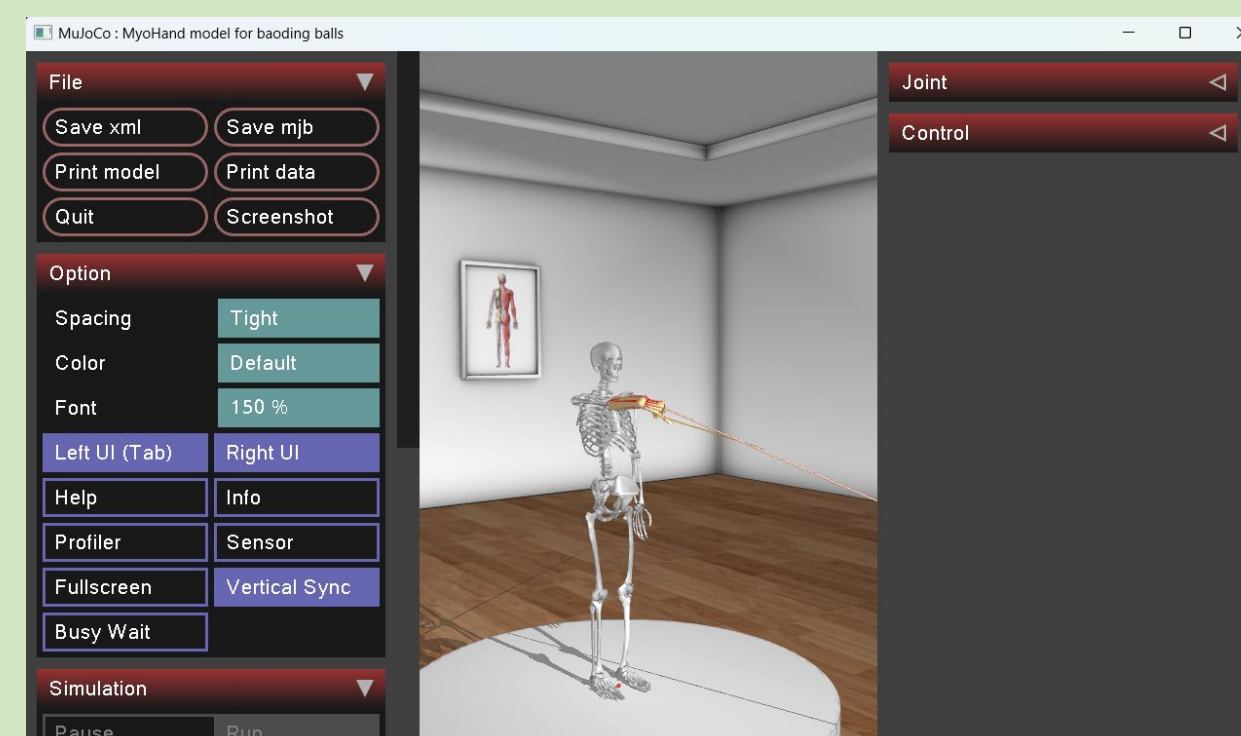
- Our objective is to improve the efficiency of the path taken by the musculoskeletal parts in doing a task by optimising the mechanics involved in it.
- It aims to minimise the energy expenditure and follow the most optimum path by tuning the different parameters of the actuators.



Current status

Currently, we have achieved the following:

- Explored all the MyoSuite models and its utilities.
- Understood the various task variations that can be incorporated into MyoSuite models.
- Understood the MuJoCo physics engine and its functionality.
- Understood the basic codes of the various models.
- Started to understand how RL is incorporated into the code to achieve the desired result.



Planned workflow and tentative timelines

Week 1-3: Researched on the project topic and explored various repositories such as MyoSuite and MyoSim.

Week 3-6: Began developing a thorough understanding of the code and becoming acquainted with the MyoSuite environment.

Week 7-10: Comprehending the code, analyzing simulations, and adjusting parameters for visualization and graph analysis.

Week 11-14: Selection of a model and implementation of the code, followed by thorough analysis.

Acknowledgement & references

We would like to thank Prof. Vineet Vashista for his guidance and providing us with an interesting opportunity to work under him. We would also like to thank Jenish Kumar Chauhan, an M.Tech student for guiding us through the problems we encountered.

References:

<https://github.com/MyoHub/myosuite/tree/main>
<https://github.com/google-deepmind/mujoco>

Expected learning outcomes

- Understand the mechanics of the muscles, tendons and bones in movement of our arms.
- Gain a deeper understanding of the RL algorithms as they will be used to implement the musculoskeletal simulations.
- Proficiency in integrating the MyoSuite environments with the MuJoCo physics engine and OpenAI Gym.