Homework #1- Machine Learning for Robotics (RBE 577)

Control Allocation via Deep Neural Networks

Control allocation is a method to distribute desired forces and moments to control effectors in a robotics system with redundant actuators. Please watch the 15 minutes introductory video for this homework.

The goal of this homework is to implement the findings from the research paper titled "Constrained control allocation for dynamic ship positioning using deep neural network", by R. Skulstad et. al., 2023

The paper introduces a novel approach for control allocation using deep neural networks.

To generate dataset follow the section 3.1. You can use 80/20 percent split for training and test data.

You need to apply proper regularization techniques that was discussed in the lectures to avoid overfitting.

Note:

You are not required to implement the Sequential Quadratic Programming (SQP) method that is discussed in section 2.1. In addition, since you don't have access to all the components of the Figure 4 of the paper, you are not required to re-generate all figures in the paper.

Team Collaboration:

- Teams of two can collaborate on the homework.

Final Deliverables:

1. Python code for the implementation along with a readme file containing the python version and version of all the packages used and how to run the code.

2. The pdf of the final report. It should contain the explanation of your methodology, lesson learned and hyperparameters of the neural network.

3. Plots of loss function in training and test data set as a function of epoch.