

Initial Proposal for Robot Arm Control Using Machine Learning

This project aims to develop a basic system to control a robotic arm using machine learning. The project will be carried out by Samarth Kabbur and Mukund Raman, who are both interested in how machine learning can be applied to robotics. The main idea of the project is to use machine learning to help control the robot arm by detecting and tracking objects in its environment.

Samarth has previously built a robot arm with an Arduino UNO controller. The controller takes in information like coordinates and orientation, which helps move the robot arm. A camera will be placed on the robot arm to capture images, and these images will be processed by a machine learning model. The model will detect and track an object (like an apple) in the camera's view, and then send commands to the robot arm to move and center the object in its field of view.

To train the machine learning models, we will use the COCO (Common Objects in Context) dataset. This dataset contains many different objects along with their labels and locations in images, which will help us train the model to detect and locate objects in real-time.

For this project, we plan to use the following methods and tools:

1. **Object Detection and Localization:** We will use machine learning to detect and locate objects in images. Libraries like OpenCV and MegaDetector will be used to help identify objects and give their location in the form of a bounding box (x, y coordinates).
2. **PID Control Loop:** We will use a Proportional-Integral-Derivative (PID) control system to help the robot arm move. The machine learning model will provide the coordinates of the object, and the PID controller will calculate how the arm should move to center the object in the camera's view.
3. **Deployment with Docker:** To make the system work in real-time, we will set up the machine learning model on a server using Docker. This will allow the robot arm's system to send requests for object detection and get quick responses to adjust its position.

The main deliverable will be the machine learning model that can detect and locate a specific object (such as an apple) in an image. The model should be able to provide the coordinates of the object so that the robot arm can track it.

The second deliverable will be the deployment of the model using Docker. This will allow the system to make fast, real-time predictions and adjust the robot arm's movements based on the object's location.

While the full integration of the robot arm with the machine learning model will be a key goal, controlling the arm in real-time will not be part of this project. However, this step can be explored in future work.



Image of the current robot arm hardware