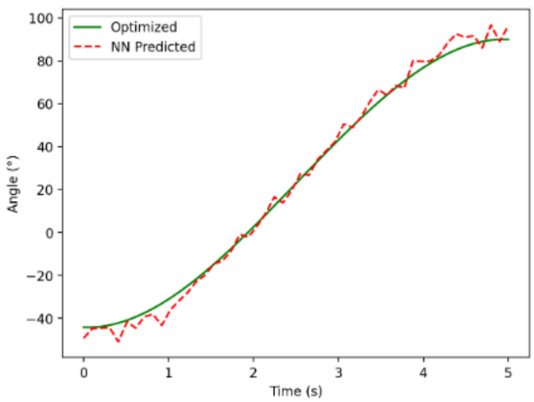
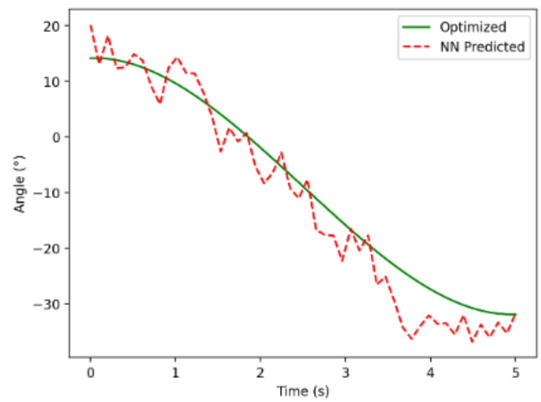
Assignment 4:

Plots of optimized trajectory and trajectory predicted my neural network model

Joint 1 Path

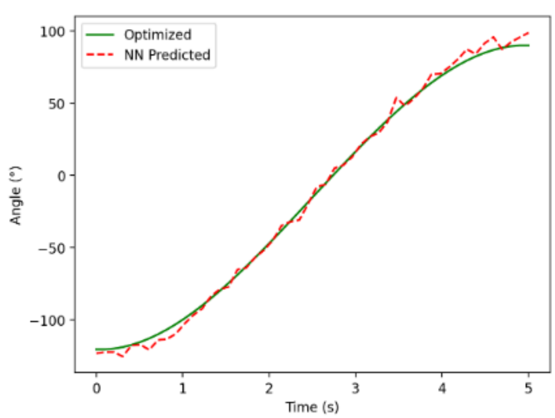


Joint 2 Path

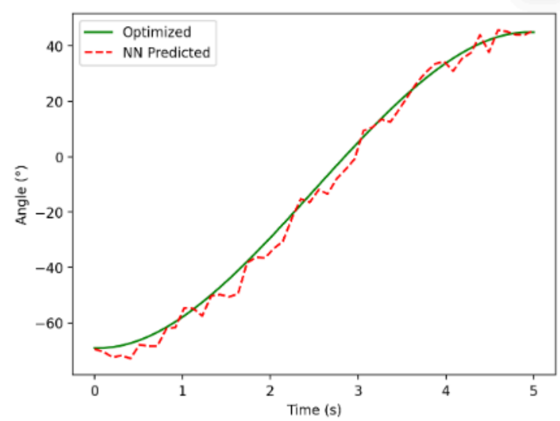


Current Prediction Mean Squared Error: 16.949082 sq. degrees

Joint 1 Path

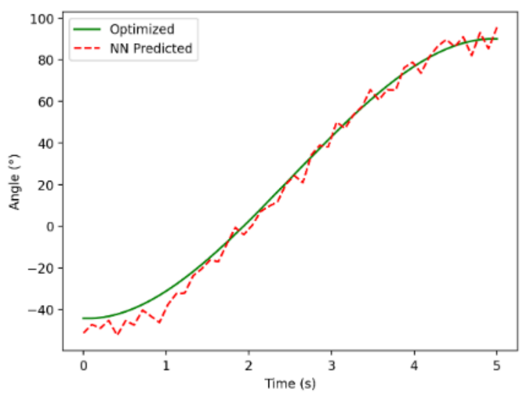


Joint 2 Path

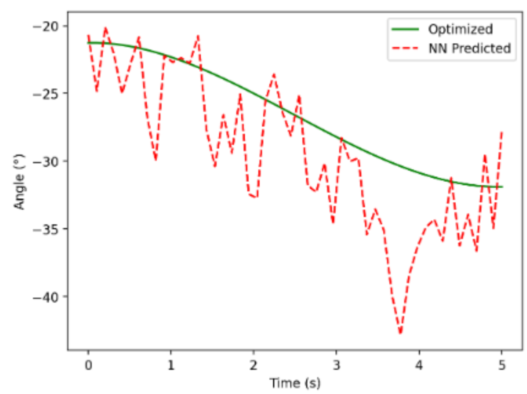


Current Prediction Mean Squared Error: 14.328213 sq. degrees

Joint 1 Path



Joint 2 Path



Current Prediction Mean Squared Error: 21.171307 sq. degrees

Short Summary:

This project implements a trajectory planning pipeline for a 2-link robotic arm by combining numerical optimization with machine learning. I used the SLSQP method to generate optimized trajectories that minimize acceleration while ensuring zero velocity at the start and end points. These optimized paths served as training data for a Multilayer Perceptron (MLP) neural network. The model was trained to map start and end joint configurations to a full, 50-point joint-space trajectory.

Performance was evaluated using Mean Squared Error (MSE), demonstrating high predictive accuracy. An interactive Streamlit dashboard was developed to visually compare the optimized (ground truth) and learned paths. Observations indicate that while the numerical optimizer is mathematically precise, the neural network generates predictions nearly instantaneously. This drastic reduction in latency makes learning-based methods ideal for real-time robotic control. Overall, the model successfully approximates complex optimized motions with high computational efficiency

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