

Project Report: Part 1 - Capturing and Visualizing Robotic Demonstrations

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1 Overview

This part focuses on capturing, processing, and visualizing robotic demonstrations for the implementation of the Kernelized Movement Primitives (KMP) algorithm.

2 Main Components

The process consists of four main components:

- **Data Collection**
- **Smoothing**
- **Visualization**
- **Replay**

From user demonstrations, we capture four major components:

- **Object Position:** Tracks the cube's position and orientation.
- **Joint Angles:** Captures joint angles for robot learning.
- **End Effector Position:** Used for visualizing the robot's trajectory.
- **Actions:** Inputs applied during the demonstration.

3 Implementation Details

3.1 `demo_record.py`

- Implements simplified controls using Pygame.
- Initializes the cube randomly in the environment.
- Saves demonstrations in HDF5 format.

3.2 `smoothing.py`

- Uses `interp1d` for data smoothing.
- Ensures smooth and continuous trajectories.

3.3 plotting.py

- Plots both raw and smoothed trajectories for visualization.

3.4 replay.py

- Replays recorded demonstrations for validation.

4 Data Visualization

4.1 Raw Data Visualization for Two Demonstrations

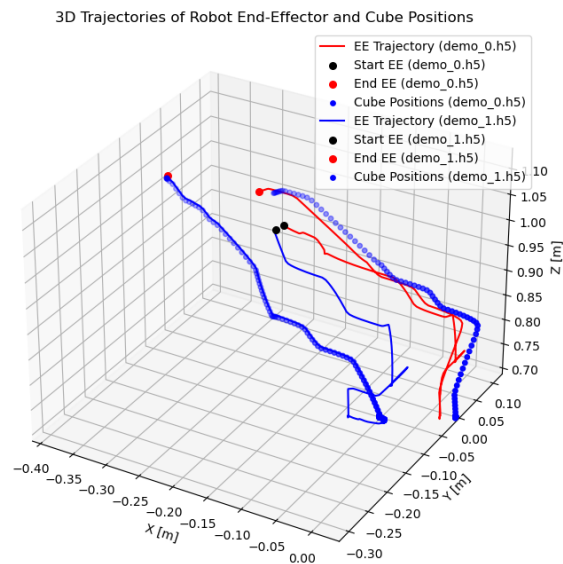


Figure 1: Raw data visualization for two demonstrations.

4.2 Smoothed Data Visualization for Two Demonstrations

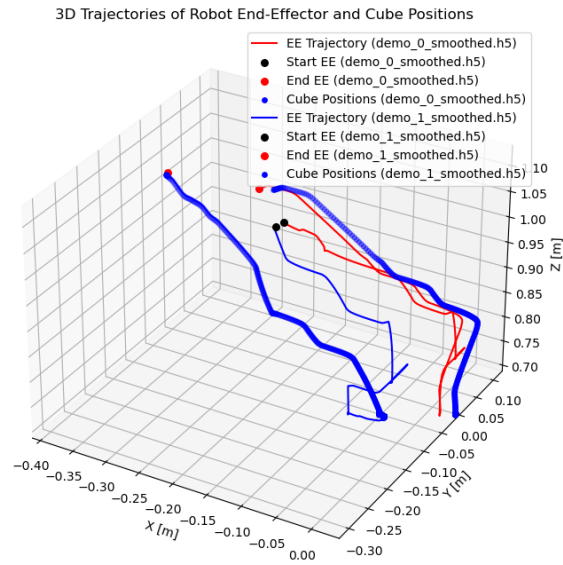


Figure 2: Smoothed data visualization for two demonstrations.