

Praxis der Forschung: Advanced Trajectory Segmentation with Movement Primitives

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1 Description

With the development of AI and ML, more researchers realized that high-quality, well-designed datasets play an equally important role as the algorithms. Some famous ones, like MNIST, ImageNet etc., offer either a training baseline or significantly increase the performance of algorithms. In the field of Robotics, especially in motion planning and movement primitives, however, such desirable dataset is hard to obtain, due to the various robot models and learning tasks. Besides, for the existing robot learning dataset, such as RoboTurk[1], the robot trajectory is normally given in a long and complex modality where different sub-tasks are composed together. For example a trajectory in pick and place task contains a sequence of *move - grasp - move* and *place* without boundaries, which brings difficulties to learn each individual sub-tasks or skills. In our previous work, we have already developed a tool to manually segment trajectories and thereafter to add labels for each sub-trajectories.

The first goal of this project is applying different trajectory segmentation algorithms to post-process existing datasets. Firstly segment a small portion of the dataset manually and then train the model to distinguish the different task phases. Once a model is well trained, apply it to other unlabeled trajectories in the dataset and thus get the whole dataset segmented.

Movement Primitives (MPs) is a well known conception for representing and generating modular and reusable robotic trajectories. In contrast to the time-step based learning methods which usually plan at each single time step, MPs motivates learning motion skills from a macro perspective. With the segmented dataset, the second goal of this project is to use MP and model sub-tasks skills from the segmented dataset, i.e. picking, moving, grasping etc.

2 Tasks

- **Literature Research:** Review existing robot learning datasets and algorithms in sequence segmentation.
- **Tool Learning:** Understand the functionalities and structure of our current segmentation tool.
- **Segmentation labels:** Create few artificial segmentation datasets with manually added labels.
- **Test algorithms:** Apply segmentation methods to the dataset and benchmark the result.
- **Movement Primitives:** Learn movement primitives for sub-skills from the big segmented dataset.

References

- [1] Ajay Mandlekar, Yuke Zhu, Animesh Garg, Jonathan Booher, Max Spero, Albert Tung, Julian Gao, John Emmons, Anchit Gupta, Emre Orbay, Silvio Savarese, and Li Fei-Fei. Roboturk: A Crowdsourcing Platform for Robotic Skill Learning Through Imitation. page 15. 00019.