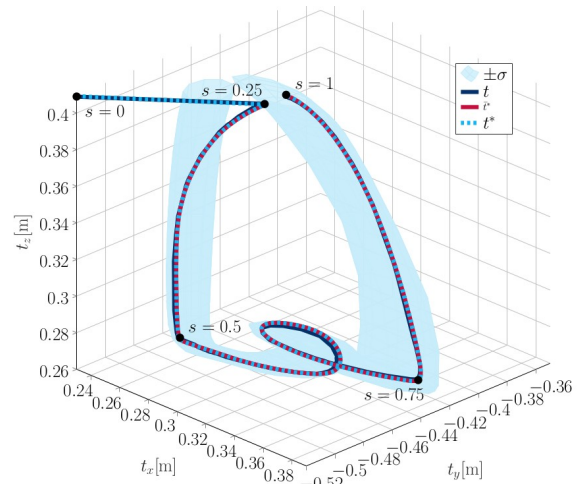


Research project / Student thesis

Learning from demonstration of robotic manipulation tasks

Motivation

The field of learning from demonstration (LfD) covers a variety of approaches [1] with the common aim of transferring human skills to robots. The basic principle is that a human is demonstrating the task, not only including plain motions but also interactions with environmental objects. A major difficulty is to create a suitable skill model from which reference trajectories for the robot can be generated. Popular approaches therefore are Hidden Markov Models (HMM), Gaussian Mixture Models (GMM) combined with Gaussian Mixture Regression (GMR) [2] or skill trees.



Exemplary motion trajectories generated by a skill tree model.

Task description

In a thesis/research project, a comprehensive literature research shall be carried out first, including the comparison of methods like HMM, GMM/GMR and skill trees. Then, the two most promising approaches shall be implemented in Matlab and compared. Important criteria for the comparison are the quality of motion generation, model complexity and ability to generalize to environmental changes (for example object position changes). Another aspect addresses the ability to adjust the skill model online in order to further optimize the generated motion and interaction trajectories.

Requirements

Basic knowledge of robotics modeling and control, as well as programming experience in Matlab are required.

References

- [1] Ravichandar, Harish, et al. "Recent advances in robot learning from demonstration." *Annual Review of Control, Robotics, and Autonomous Systems*, 3, (2020).
- [2] Calinon, Sylvain. "A tutorial on task-parameterized movement learning and retrieval." *Intelligent Service Robotics*, 9, (2016).

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