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RESEARCH PRACTICE

for

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Learning by Demonstration with Dynamic Movement Primitives

Problem description:

There are many ways how a human can learn a skill. One of them is learning by demonstration from a teacher. This idea is now adapted to robotics, in which recorded human demonstrations are learned by robot. The movements are encoded and generalized into non-linear differential equations, namely Dynamic Movement Primitives (DMPs). These primitives can be applied to reproduce discrete and rhythmic actions. The main advantages of DMP formulations are its generalization ability and robustness against perturbation. It is unfeasible to record every motion for each specific task, thus by simply changing one parameter in the equations of the learned DMPs it is possible to generalize to new situations. Furthermore, robustness is necessary since noise is also being recorded while learning a movement by demonstration.
In this Forschungspraxis we want to use DMPs for learning and reproducing motions taught to a light weight robot. The actions are learned in joint space or Cartesian space and the results are then compared. For the Cartesian motion, the problem of singularity in orientation representation is specifically focused. The result will be validated by a 7dof KUKA light weight robot.

Tasks:

- Review of state of the art
- Implementation of DMP
- Improvements and enhancement of DMP for learning the orientation
- Experimental validation in simulation and on light-weight robots

Bibliography:

Ude, Ales, et al. "Orientation in cartesian space dynamic movement primitives." Robotics and Automation (ICRA), IEEE International Conference on. IEEE, 2014.

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Tomic, Teodor, et al. "Learning quadrotor maneuvers from optimal control and generalizing in real-time." Robotics and Automation (ICRA), IEEE International Conference on. IEEE, 2014.

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