TECHNISCHE UNIVERSITÄT MÜNCHEN
Human-centered Assistive Robotics
UNIV.-PROF. DR.-ING. DONGHEUI LEE

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F O R S C H U N G S P R A X I S
for
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Incremental Learning of Stable Dynamical Systems using Diffeomorphic Transformations

Problem description:

Recent work in Programming by Demonstration suggests to encode robotic skills into stable dynamical systems (DS). DS have been proven to be flexible enough to accurately represent complicated motions [1]–[4]. Moreover, robots driven by stable DS are guaranteed to reach the desired position, and can react in real-time to external perturbations. Stable DS systems are usually learned off-line by solving a constrained optimization problem [1, 3]. Alternative approaches [2, 4] are fast enough to work online, but they require an initial DS with a fixed structure.
In this Forschungspraxis work, the student has to implement an incremental learning algorithm to allow the on-line refinement of a diffeomorphic transformation. The learned diffeomorphism will transform the trajectories of a generic stable DS to match the demonstrated movements. To permit incremental learning, the diffeomorphism will be represented using an extreme learning machine (ELM) [5], and on-line least square approaches will be used to train the ELM's parameters. The developed approach will be compared with state-of-the-art approaches [1, 4] in terms of training time and accuracy.

Work schedule:

- Literature research on motion representation with dynamical systems
- Implement an incremental learning approach to refine a diffeomorphic transformation
- Comparison with state-of-the-art approaches [1, 4]

Bibliography:

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