TECHNISCHE UNIVERSITÄT MÜNCHEN
Human-centered Assistive Robotics
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M A S T E R ' S T H E S I S
for
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Development of an interactive teaching method

Problem description:

Modern lightweight robots can be instructed by kinesthetic guidance as a form of Programming by Demonstration, which is an adequate technique for simple tasks. However, more complex tasks often need to be implemented using traditional programming techniques, as the user intent is not always clear from the demonstration. Especially, adaptation to environmental conditions can hardly be taught by demonstration without adding expert knowledge.
Some works propose the transfer of complex tasks to the robot by using only demonstrations, without the need for expert knowledge or advanced programming skills, e.g. [2]. We want to extend such frameworks by including multi-modal conditions such as positions, forces and grasp status. By relying on previous sensor experiences [3], we are able to continuously monitor the robot performance and to decide whether something went wrong during execution [1]. This information is then used in an interactive teaching scheme between user and robot. Hereby, the robot shall require further demonstrations of the user in order to resolve unseen situations and to add alternative behaviors according to the environmental state. This allows teaching of tasks which include conditions during execution.

Tasks:

- Design of an interactive method for intuitive programming using visual dialogs
- Motion encoding for multiple solution strategies in probabilistic models (GMMs)
- Generate visual feedback about system state and task representation
- Conduct a user study to evaluate the intuitiveness of the method on a DLR lightweight robot

Bibliography:

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[3] Peter Pastor, Ludovic Righetti, Mrinal Kalakrishnan, and Stefan Schaal. Online movement adaptation based on previous sensor experiences. In *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, pages 365–371. IEEE, 2011.

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