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

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FORSCHUNGSPRAXIS

Reshaping of Task-related Forces by Interaction Mode Detection

Problem description:

For intuitive human robot collaboration, the human needs to physically interact with the robot in a shared workspace. Recently, it has been shown that the type of interaction can be classified, being it collision, intended interaction, task contact with the environment, or a combination of interaction and task contact [3]. State of the art has also shown that the robot's motions can be reshaped by physical interaction [2]. However, there has been put only minor attention on how to alter a learned force profile by kinesthetic teaching while the robot is in task contact with the environment.
To extend the state of the art, we want to combine the detection of human-robot interaction types with the reshaping of force profiles, such as used in force-based skills [1]. In detail, we want to reshape an existing force profile by kinesthetic teaching in the case that the interaction is intended by the human while the robot is in task contact.

Work schedule:

- Literature survey on motion and force profile reshaping techniques
- Implementation of an incremental retraining method applied on existing motions and forces.
- Experimental evaluation of the online adaption of trajectory and force profile on the KUKA LWR
- Documentation and analysis of the experimental results in comparison to existing works.

Bibliography:

[1] Fares J Abu-Dakka, Leonel Rozo, and Darwin G Caldwell. Force-based variable impedance learning for robotic manipulation. *Robotics and Autonomous Systems*, 109:156–167, 2018.

[2] Dongheui Lee and Christian Ott. Incremental motion primitive learning by physical coaching using impedance control. In *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, pages 4133–4140. IEEE, 2010.

[3] Martina Lippi and Alessandro Marino. Enabling physical human-robot collaboration through contact classification and reaction. In *2020 29th IEEE International Conference on Robot and Human Interactive Communication (RO-MAN)*, pages 1196–1203. IEEE.

Supervisor:	M. Sc. Thomas Eiband
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(D. Lee)
Univ.-Professor