Tamim Asfour, Ales Ude, Norbert Krüger, Justus Piater, Danica Kragic and Rüdiger Dillmann

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Humanoid Grasping and Manipulation

Autonomous grasping of household objects is one of the major skills that a humanoid robot necessarily has to provide in order to interact with the environment. In this talk we present and discuss several techniques for object grasping and manipulation with humanoid robots operating in human-centered environments. We present the following grasping capabilities on the humanoid robot ARMAR-III while performing manipulation tasks in a kitchen environment.

- Grasping of known single-colored and textured objects using model-based and appearance-based approaches [1].
- Grasping of known objects based on box decomposition of 3D shape object representations [2].
- Grasping of unknown objects using second-order relations between visually extracted multi-modal 3D features provided by an early cognitive vision system [3].
- Grasping with prior object knowledge and the learning of grasp affordance densities by exploration and imitation [4].
- Learning of pushing actions to support object grasping [5].

In addition, we show how Object-Action Complexes [6] are designed to capture the interaction between objects and associated actions and how they can be used as unified framework and basis for symbolic representations of sensorimotor experience.

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