

# **New Methods for Active Tactile Object Perception and Learning with Artificial Robotic Skin**

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## **Summary:**

This thesis proposes new methods to tackle key challenges for active tactile object perception and learning in robotics. It proposes, for the first time, novel active pre-touch and touch-based unknown workspace exploration strategies. It introduces robust tactile feature descriptors to perceive the textural properties of the objects. And presents the first tactile-based approach to explore and determine the center of mass of the rigid objects. Moreover, it proposes a novel probabilistic active touch learning method to efficiently learn about objects as well as a new active tactile object discrimination to strategically discriminate among objects via their physical properties. For the first time in tactile learning domain this thesis proposes tactile transfer learning techniques which enable the robotic systems to re-use their past tactile experience (prior tactile knowledge) to learn about new objects with low number of training sample or even one. Furthermore, it introduces a novel tactile-based framework to enable the robotic systems to safely manipulate deformable objects with dynamic center of mass. In addition, it describes a novel approach for touch modality identification during the tactile human-robot communication.

## **Biography:**

Mohsen Kaboli received his bachelor degree in electrical and electronic engineering and master degree in signal processing and machine learning from the Royal Institute of Technology (KTH) in Sweden, in 2011. In March 2012, he received a scholarship from the Swiss National Foundation for 18 months in order to continue his research as a research assistant at the Idiap lab, Ecole Polytechnique Federale de Lausanne (EPFL).

April 2013, he was awarded a three-year Marie Curie scholarship. Since that time he has been at the Institute for Cognitive Systems (ICS) directed by Prof. Gordon Cheng in Technical University of Munich (TUM). In November 2013, he visited the Shadow Robot Company for two months. Mohsen has been a visiting researcher at the Human Robotics lab, the department of Bioengineering at Imperial College London supervised by Prof. Ettien Burdet from February till April 2014. From September 2015 till January 2016, he spent 5 months as a visiting research scholar at the Intelligent Systems and Informatics lab directed by Prof. Yasuo Kuniyoshi at the University of Tokyo, Japan.