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M A S T E R ' S T H E S I S
for
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Object Representation and Recognition based on Tactile Exploration

Problem description:

In order for robots to solve tasks in unstructured environments, multimodal perception plays a key role. Computer vision technologies have become essential for an effective analysis of the scene, for planning the mission, and observing the behavior of humans in the robot workspace. However, vision alone is not enough to achieve a robust autonomy of robotics systems. Tactile perception is of fundamental importance for robots that physically interact with the external environment. Wisely leveraging tactile information provides robots with enhanced perceptive capabilities. Despite this potential, research in interpretation of tactile data is still at an early stage. The main objective of the thesis is developing a novel method of object recognition based on tactile perception. A recent approach [1] obtains interesting results in object recognition by leveraging pressure maps. Pressure maps obtained during an exploration phase are used to compute the so-called tactile-SIFT descriptors. In this thesis work, not only the pressure maps, but also contact forces will be exploited to achieve enhanced accuracy and robustness. In particular, through contact forces, normal vectors to the object surface will be estimated. Such geometrical properties of the object will allow leveraging powerful, well-known descriptors used in 3D computer vision, opening the possibility to a visuo-tactile unified object representation. The experimental setup will consist in an artificial skin (SAPHARI tactile skin) mounted on a KUKA LWR.

Tasks:

- Literature research about tactile object recognition
- Propose a novel object representation based on both contact forces and pressure maps
- Compare the results with other state-of-the-art approaches [1]

Supervisor:	Dr. Pietro Falco
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Bibliography:

[1] Shan Luo, Wenxuan Mou, Kaspar Althoefer, and Hongbin Liu. Novel tactile-sift descriptor for object shape recognition.