Interest Region Detection for Semi-Autonomous Vision-based Grasping

State of the art prosthetic hands can be controlled by EMG-Signals. However, the number of different commands the user can give is very limited and the more dedicated commands the user has to send, the more training for this type of control is needed and accuracy drops. The KIT Prosthetic Hand [1] is designed to allow a semi-autonomous control. This allows the user to interact with the hand with a minimum amount of control signals. The remaining grasping process is executed and supervised autonomously by the prosthesis.

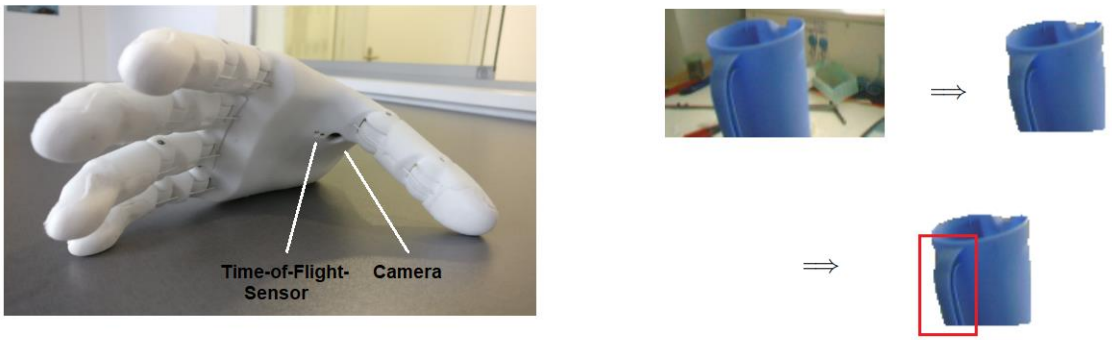

Fig.1 a) KIT Prosthetic Hand with camera and ToF Sensor b) Idea of Interest-Region Detection in Camera Image

To this end, context information is provided to the prosthesis by a camera, IMU and time-of-flight sensor. Currently the visual input data is evaluated by a CNN for object classification. The information about the object type is used for grasp selection. Other state-of-the art systems use segmentation CNN to detect the object dimensions [2].

The goal of this project is to design a vision algorithm that can find the region of interest in the camera image by fusing visual information with additional IMU- and ToF data. The goal of this segmentation is to identify the grasp-relevant region allowing a more precise identification of the users intended grasp. This work includes the design of the algorithm and a prototypical implementation on the embedded system of the hand. The implementation has to fulfil real-time constraints and must be aware of the available hardware resources from the Cortex M7 Controller (STM32). Knowledge in (embedded) C-Programming is required.

[1] Weiner, Pascal, et al. "The kit prosthetic hand: Design and control." *2018 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE, 2018

[2] Markovic, Marko, et al. "Stereovision and augmented reality for closed-loop control of grasping in hand prostheses." *Journal of neural engineering* 11.4 (2014)

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