

Project Work / Master Thesis

Title: Robot Guided Surface Scanning with Ultrasound

Background: Punctures are essential in medical diagnostic, e.g. for biopsies. A precise insertion of the needle is really important to successfully sample the tissue structures at the desired position. Ultrasound (US) guidance can be used for visualizing the anatomical structures but handling the US transducer and the needle simultaneously is challenging even for experienced physiologists. This project aims to realize US guided needle insertion with Augmented Reality (AR). The US transducer will be attached to a robot to scan different structures while tracking the transducer with AR glasses. The motion profiles can be used to generate 3D-US scans for visualization and orientation during needle placement.

Tasks: The main task will be the development of an experimental setup for robot guided scanning of phantoms with a 2D-US transducer. To realize this, a calibration between the ultrasound transducer and the robot is required. The calibration setup and systematic evaluation will be part of this work. Then, different algorithms for image stitching need to be implemented to gain volumetric data from the 2D-US scans.

- Preparation of phantoms with realistic haptics and US signal quality
- Design of experimental setup
- Setup and implementation for ultrasound calibration
- Implementation and realization of scanning structures with the ultrasound transducer and a robot
- Stitching of the 2D ultrasound images to retain volumetric data

Requirements:

- Very good programming skills (e.g., Matlab, C++, Python, ...)
- Experience in image processing
- Experience with robots or ultrasound
- Ability to work independently

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