Technische Universität Hamburg-Harburg

Institut für Medizintechnische Systeme

MSc/BSc/Project Thesis

Title: High Speed Shear Wave Imaging with OCT

Background: Optical coherence tomography (OCT) is a well-established clinical technique which produces high resolution images of tissue structures. With OCE it is further possible to calculate mechanical tissue properties, which are of interest in a number of scenarios, including palpation to identify lesions. OCE is based on measuring shear wave characteristics. In our setup, a needle is driven by an oscillating piezo which induces a shear wave into a self-made gelatin phantom. Volumes of the phantom (3x3x2mm) are acquired at approximate 800Hz while the wave propagates through the tissue at 1-5m/s.

Tasks: Feasibility of OCE in self-made phantoms. The tasks include:

1. Fine tuning the experimental setup and the data acquisition.
2. Collecting large amounts of data and implementing a data processing pipeline to identify mechanical properties of a phantom. Training a neural network to identify the stiffness of a phantom is optional as well as a simulation of shear waves.
3. *Setting up an online evaluation to illustrate shear wave velocities

Several parts of the experimental setup have been already successfully established and merely need to be further adapted.

Requirements: Very good programming skills, interest in hardware setup and experimental work, ability to work independently

References: Song, Shaozhen, et al. "Strategies to improve phase-stability of ultrafast swept source optical coherence tomography for single shot imaging of transient mechanical waves at 16 kHz frame rate." *Applied physics letters* 108.19 (2016): 191104.

Difficulty: 💡💡💡💡💡

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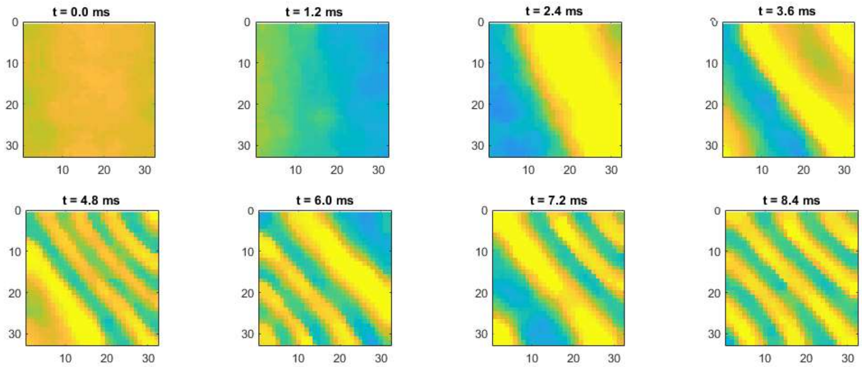

OCT-surface images (3x3mm) of a gelatin phantom. A shear wave can be identified at t=1.2ms with a speed of 3.9m/s. Several reverberations follow.