

GUI integration for an ultrasound simulation framework

Project Management and Software Development
for Medical Applications

General Info

Project Title: [GUI integration for an ultrasound simulation framework](#)

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Project Abstract

For an ultrasound simulation framework a user interface strategy and implementation is required. The interface will give the user access to define a specific setup, control the simulation run and apply post-processing steps to the result.

Background and Motivation

Cardiovascular diseases account for one of the highest mortality rates in Europe and the United States. Its diagnosis and the visualization of the stenosis are of high interest and can best be done by intravascular ultrasound (IVUS).

To further develop the diagnostic value of IVUS images we have an ultrasound (US) simulation platform in development, which core elements are implemented in Matlab. It is capable to simulate the propagation of ultrasound signals within tissue for arbitrary setups to investigate the influence of different system settings, hardware parameters and acoustic tissue properties to the images. The calculated backscattered signal is processed to acquire typical ultrasound images.

This may help in improving diagnostics in the future and make hardware development easier.

Parameters of the US probe can be tested prior to expensive prototyping.

Right now the framework lacks of any user interactivity and all parameters are hardcoded. A user interface will have to address multiple issues:

- The definition of a specific setup
- The visualization of the wave simulation
- Applying parameters for the post-processing steps.

For the latter one a Matlab tool already exists, which can be integrated.

Student's Tasks Description

In the first step an overall strategy for the graphical user interface is defined. The workflow needs to be analyzed and the required visualizations need to be specified. How to design a complex yet easy to use interface, which accounts for different parameters and simulation setups? This includes a clear definition of the input and output of the data that will be passed to and from the interface.

In the next step the interface will be implemented. As the framework is written in Matlab, which also offers powerful tools concerning GUI creation. For this reason Matlab is the development platform of choice.

In the last step the functionality of the user interface is tested with multiple simulation runs concerning specific parameters.



Technical Prerequisites

The student should have experiences with Matlab programming. In the project the Matlab-intern concepts of creating GUIs and object oriented programming will be applied. Experiences with user interfaces overall and how to display scientific data will be helpful.

Administrative Info

Working Time: [3 months](#)

Project Location: [Garching](#)

Required Equipment: [Personal Computer](#)

Timeline and Milestones

To be defined

References

- [1] A. Karamalis, W. Wein, and N. Navab, "Fast ultrasound image simulation using the Westervelt equation.," in *International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI)*, 2010, vol. 13, no. Pt 1, pp. 243–250.
- [2] S.Kraft, A. Karamalis, D. Sheet, E. Drecoll, E.J. Rummeny, N. Navab, P.B. Noël, and A. Katouzian, "Introducing nuclei scatterer patterns into histology based intravascular ultrasound simulation framework," in *SPIE Medical Imaging*, 2013, accepted.

