Chair of Imaging and Computer Vision

RWTH AACHEN UNIVERSITY

Master/- Bachelor Thesis

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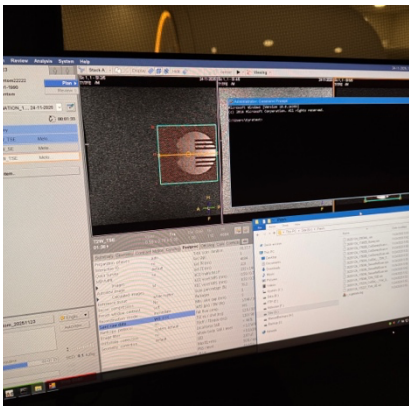
Minimal-Profile Time-of-Flight Sensor System for Automatic Patient Position Detection in Low-Field MRI Bores

Keywords

Low-Field MRI | **Software** | **Hardware** | **Simulation**

Background



Magnetic resonance imaging (MRI) is an imaging technique that uses magnetic fields and radio waves to create detailed images of the inside of the body. Low-field MRI systems work with a weaker magnetic field. In the DeLoRi project, together with the Fraunhofer MEVIS Institute, we are developing a low-field MRI device to support cancer diagnostics. Efficient operation requires fast and reliable patient setup, but manual positioning and scan-volume definition are time-consuming and can be error-prone. A compact time-of-flight (ToF) depth-sensing approach enables automatic position detection while preserving maximum bore space and maintaining patient comfort.

Tasks

The aim of this work is to develop an automatic patient position detection framework for a MRI system using ToF depth sensors while occupying only minimal bore space. Depending on your interests, you will design a slim sensor integration concept (e.g., flush-mounted modules or a low-profile ring), define MRI-compatible packaging constraints, and implement a synchronized data acquisition pipeline for depth maps. You will then develop algorithms to estimate patient position and gross pose and to derive a recommended scan volume (slice stack/coverage), including robustness against occlusions and confounders such as coils and accessories in the field of view. Finally, you will validate accuracy and repeatability on the setup using phantoms and staged scenarios, quantifying setup-time reduction and required bore-space footprint.

Your Profile

For the successful implementation of the project, you should have an interest in one or more of the following subject areas:

- Point Cloud Registration
- Image Recognition
- General Hardware Interest

Our Offer

We offer a collaborative culture in a dynamic team of students, PhD candidates, and postdocs that values new ideas and lively discussion. A workstation can be provided in our student office, together with modern IT infrastructure that includes around 2000 CPU cores and 100 GPUs. You will also have access to a workshop and rapid prototyping facilities, to support fast iteration from design to hardware.