Chair of Imaging and Computer Vision | RWTH AACHEN UNIVERSITY

Master/- Bachelor Thesis

Ambient EMI Sensing for Room-Noise–Aware Low-Field MRI: Adaptive Noise Mitigation to Improve SNR

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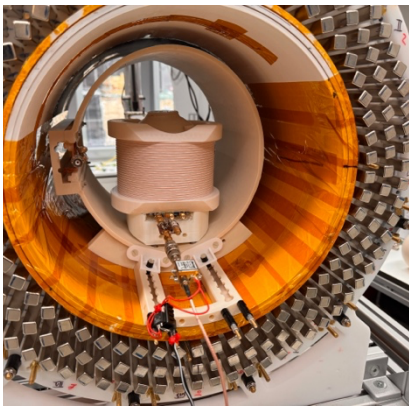
Keywords

Low-Field MRI | **RF** | **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. In realistic clinical and lab environments, the received MR signal can be strongly affected by ambient electromagnetic interference (EMI) from building infrastructure and nearby electronic equipment. Measuring this environmental noise provides a basis for reducing its impact and improving the achievable signal-to-noise ratio (SNR) and scan robustness.

Tasks

The aim of this work is to develop a framework for measuring and characterizing environmental electromagnetic noise in the MRI room and translating it into actionable SNR improvements for a low-field MRI system. Depending on your interests, you will design a noise sensing setup (e.g., pickup coils or dedicated probes), implement synchronized acquisition, and build a repeatable measurement protocol across time, locations, and operating conditions. You will evaluate mitigation strategies such as noise-aware scan scheduling, shielding/grounding recommendations, and post-processing approaches (e.g., reference-noise regression) using the measured noise as an input. Finally, you will validate the impact on MR data quality with phantom experiments, quantifying SNR gains and robustness improvements under controlled noise scenarios.

Your Profile

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

- RF-Networks up to 5 Mhz
- Python
- 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.