Bachelor's Thesis:
Joint Reconstruction of MRI Scans

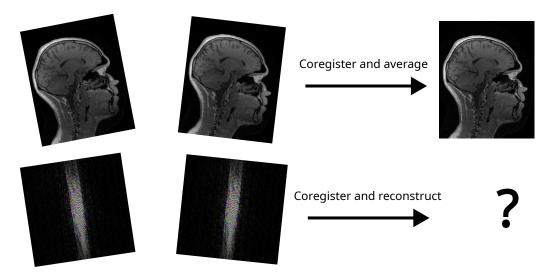Institute of Biomedical Imaging
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Overview

The long scan time of MRI is a major drawback, particularly concerning motion robustness. Patients must remain still inside the scanner to not create motion artifacts hampering the diagnostic value of the scans. Significant advancements in imaging technology such as parallel imaging, compressed sensing, and deep-learning methods have greatly reduced scan times. However, due to the reduced amount of data, these methods decrease the SNR with compared to fully-sampled data.

In the Big-Data project of the University Medical Center in Göttingen, 3D MP-RAGE data has been acquired for epilepsy studies. The (pre-)clinical protocol includes two scans of each patient/volunteer which are reconstructed independently by the vendor provided algorithms. In the post-processing, both scans are registered and combined to increase the SNR which in some cases leads to a higher diagnostic value.

The aim of this bachelor thesis is to perform the registration of the two scans in k-space to join the data and perform one reconstruction. Depending on the inter-scan motion, a robust strategy for estimation of coil-sensitivity maps might be required. Improved reconstructions might be tested by automatic segmentation pipelines in the post-processing.

Specific tasks

- Use available tools for image registration
- Register k-space data of multiple scan
- Perform reconstruction with BART
- Investigate effect of coil sensitivity maps
- Potentially evaluate effect on automatic segmentation
- Documentation and illustration of the results

Recommended Knowledge

- Basics in MRI reconstruction (ideally with BART)
- Scripting languages: Python, ideally BASH
- Work on server systems (SSH, terminal etc.) - or willingness to learn

Contact

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