MSc Project: Deep Learning–Based Parameter Estimation in Quantitative MRI

Abstract: Magnetic resonance imaging is a non-invasive medical imaging modality with a high diagnostic value due to its strong soft tissue contrast. T_2* mapping, as part of the multi-parametric quantitative BOLD (mq-BOLD) protocol [1], enables oxygenation sensitive brain MRI and is more affordable and less invasive than positron emission tomography techniques. Promising applications of the mqBOLD technique comprise stroke, glioma and internal carotid artery stenosis [2, 3, 4]. However, this emerging technique still faces challenges, like e.g. the sensitivity of the T2* quantification to magnetic field inhomogeneities, which need to be solved for a translation into the clinical routine.

Over the last years, deep learning (DL) has revolutionized the field of medical imaging with applications for image reconstruction, segmentation and registration. DL methods have also been shown to be robust and efficient curve-fitters, making them promising for MR parameter mapping [5, 6]. A further advantage of DL-based parameter mapping is the possibility of combining it with e.g. (further upstream) DL-based image reconstruction tasks. Training the two tasks in an end-to-end fashion would allow them to benefit from each other.

In this project, we aim to develop a robust DL-based method for T2* quantification from multi-echo gradient echo MR data, which in the end can be combined with image reconstruction methods developed by other projects.

Finally, the key steps of the project are: (1) literature review and getting familiar with state-of-the-art methods, (2) implementing one of the state-of-the-art methods and (3) developing a solution for an optimized parameter mapping.

Requirements

- Interest and experience in medical imaging physics.
- Very good programming skills in Python (and PyTorch).
- Preferably, prior experience and understanding in machine learning.

Contact

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