Masther Thesis:
Investigation of a new regularization strategy for non-linear model-based parameter Quantification

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Overview

Quantiative MRI (qMRI) is a vital tool for clinical diagnostics. qMRI determines the underlying physical quantities of MRI images e.g. relaxation times constants, proton density or diffusion parameters, which can be used to enhance specification and quantification of diseases. However, qMRI suffers from prolonged scan time which limits its use in clinical routine diagnostics. Undersampling the k-space combined with model-base reconstruction can lead to a substantial decrease of scan time at similar image quality. Due to the iterative nature of model-based reconstruction the parameter quantification task can be computationally demanding, especially regarding total reconstruction time.

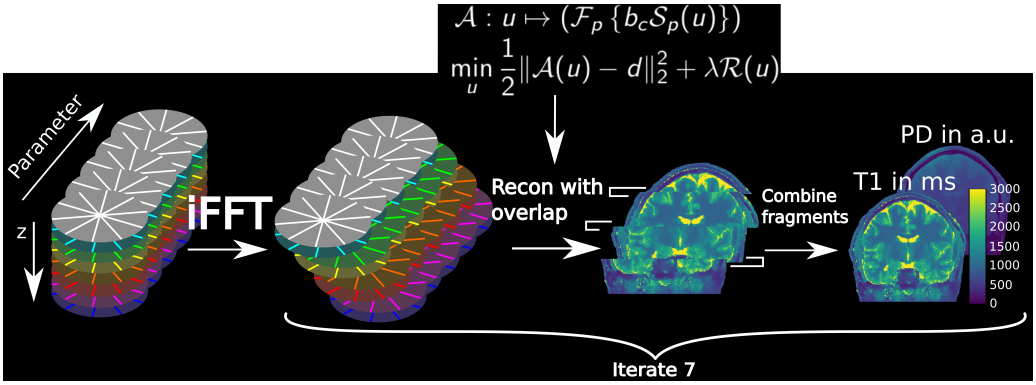
To this end, the goal of this master thesis is to investigate the applicability of a new regularization functional in the context of qMRI. The functional, together with an appropriate optimization algorithm, should be implemented in python and integrated into an existing toolbox. The work will consist of the following tasks.

Specific tasks

- Literature review
- Investigation of existing code base
- Implementation of regularization strategy $R(u) = \log(1 + |\nabla(u)|^2)$
- Phantom simulations and comparison to existing method
- Phantom and in vivo MRI measurements and quantification
- Documentation and illustration of the results

Recommended Knowledge

- Python
- Interest in optimization algorithms with application to MRI
- Basic git workflow
- Basic understanding of GPU programming is recommended but not necessary



Example workflow of the existing toolbox.

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