Masther Thesis:
Bloch-based paramter quantification in MRI

Institut für
Medizintechnik
Stremayrgasse 16/3
8010 Graz

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. Typically, analytical models are used in the fitting process which assume that specific requirements within a sequence are met, e.g. complete spoiling or homogeneous RF transit fields. A complete description of the MRI signal, considering system imperfections, can be formulated using a differential equation system known as Bloch equations.

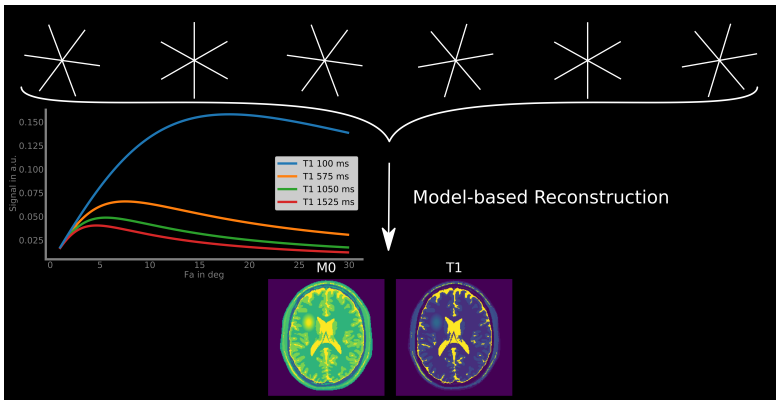
The aim of this master thesis is to examine the applicability of a full Bloch-equation based fitting procedure to quantify MRI relaxation constants such as T_1 or T_2. An existing Bloch solver as well as an optimization framework for quantification of tissue parameters constitute the basis of this work.

Specific tasks

- Literature review
- Investigation of existing code base
- Compuation of the Jacobian matrix of the Bloch equations
- Phantom simulations and comparison to existing method
- Phantom and in vivo MRI measurements and quantification
- Documentation and illustration of the results

Recommended Knowledge

- Python and Matlab
- Interest in optimization algorithms with application to MRI
- Basic git workflow



Example workflow of the existing toolbox.

Contact

DI Oliver Maier,
Tel.: +43 (316) 873 - 35408,
E-Mail: oliver.maier@tugraz.at

DI Christina Graf,
Tel.: +43 (316) 873 - 35403,
E-Mail: c.graf@tugraz.at