Master's Thesis:
Pulse Optimization for pseudo-continuous Arterial Spin Labeling MRI

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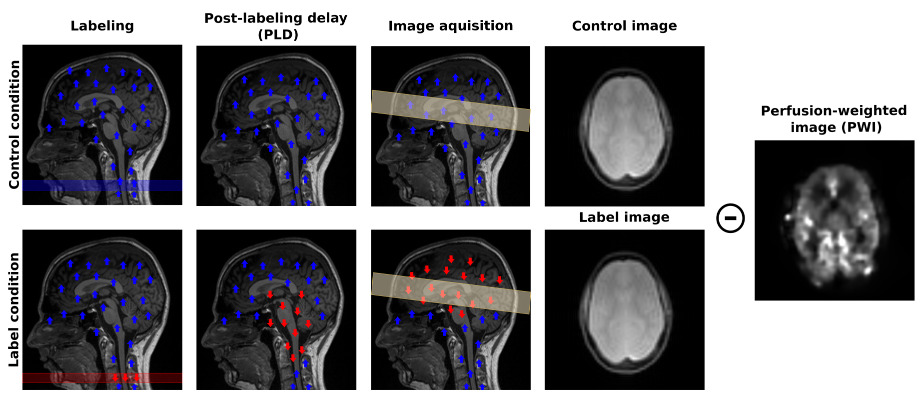
Overview

This master thesis project focuses on the optimization of radiofrequency (RF) pulses for pseudo-continuous Arterial Spin Labeling (pCASL) magnetic resonance imaging. The objective is to investigate and improve RF pulse design and labeling efficiency while considering hardware constraints, B0 and B1 field inhomogeneities, and specific absorption rate (SAR) limitations. The work will involve numerical simulations, sequence development, and quantitative evaluation of labeling performance to identify RF pulse configurations that enhance perfusion signal quality and robustness. A general framework for RF pulse optimization exists in the BART toolbox, which will be the starting point for the project. This framework will be adapted and extended to meet the specific requirements of pCASL imaging, specifically the optimization of the labeling pulse train. The project offers the opportunity to work on advanced MRI sequence design and optimization methods, contributing to the development of more reliable and efficient ASL imaging techniques for research and clinical applications.



Basic acquisition scheme of an ASL experiment: a label image (spins are magnetically labeled) and a control image (no spins are labeled) are acquired after a defined post-labeling delay. The perfusion image is then obtained by subtracting the control image from the label image.

Specific tasks

- Familiarization with the BART toolbox and its RF pulse optimization framework
- Extension and adaptation of the existing RF pulse optimization framework to accommodate the specific requirements of pCASL imaging. This includes the optimization of pulses in the context of moving spins.
- Testing and validation of the optimized RF pulse configurations through numerical simulations and sequence development

Recommended Knowledge

- Fundamental MRI theory
- Interest in pulse design and optimization
- Basic C programming experience (and willingness to improve)
- Basic git workflow

Contact

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