

Bilevel Learning for Arterial Spin Labeling

Master's Thesis



Perfusion image



Reference image
(avg=500)

Arterial Spin Labeling (ASL) is a non-invasive MR technique for measuring perfusion in tissue. Instead of using a contrast agent, this technique uses arterial blood water as an endogenous tracer. One application field of this technique is to measure the Cerebral Blood Flow (CBF) in the brain. The CBF represents an important physiological parameter for the diagnosis of brain disorders, in particular cerebrovascular diseases.

Objective:

As the SNR in ASL images is critically low, denoising is important. The aim of this thesis is to formulate and implement a bilevel optimization approach [1, 2] for ASL image denoising to obtain optimal regularization. The approach will be evaluated on numerical phantom and in-vivo data and compared to state-of-the-art approaches.

This project will be conducted in cooperation with the Institute of Medical Engineering (IMT).

Qualifications:

- Student of Biomedical Engineering, Information and Computer Engineering, Computer Science or Software Engineering and Management
- Basic knowledge in computer vision and optimization
- Programming experience in Matlab/Python and/or C++. Optional: Cuda
- Interest to work in an interdisciplinary team

Contact ICG:

Kerstin Hammernik
hammernik@icg.tugraz.at

Thomas Pock
pock@icg.tugraz.at

Contact IMT:

Stefan Spann
stefan.spann@tugraz.at

Rudolf Stollberger
rudolf.stollberger@tugraz.at

- [1] Kunisch K. and Pock T., *A Bilevel Optimization Approach for Parameter Learning in Variational Models*, SIAM J. Imaging Sci., 6(2), 938–983, 2012.
- [2] Chen. Y, Ranftl R. and Pock T., *Insights Into Analysis Operator Learning: From Patch-Based Sparse Models to Higher Order MRFs*, IEEE Trans. Image Process, 23(3), 1060-1072, 2014.