Bachelor's Thesis:
TensorFlow Graphs for Physics-Based Deep-Learning in BART

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Overview

In recent years, deep-learning has become an integral part of MR image reconstruction. Neural networks are trained to reconstruct high-quality images $\mathbf{x}$ from few k-space data $\mathbf{y}$ and thereby reduce the scanning time. Physics-based neural networks usually require less training data by integrating knowledge about the MRI forward model in the network architecture by so-called data-consistency modules. Recently, a deep-learning framework supporting automatic differentiation has been added to the Berkeley Advanced Reconstruction Toolbox (BART) and data-consistency modules as-well-as physics-based neural networks have been added. Further, BART provides a wrapper to apply TensorFlow graphs and integrate the TensorFlow back-propagation algorithm in the automatic differentiation framework of BART.

The aim of this bachelor thesis is to integrate TensorFlow graphs into BART's implementation of physics-based neural networks. This would provide users worldwide a flexible option to define neural networks in Python and benefit from BART's generic implementation of data-consistency models.

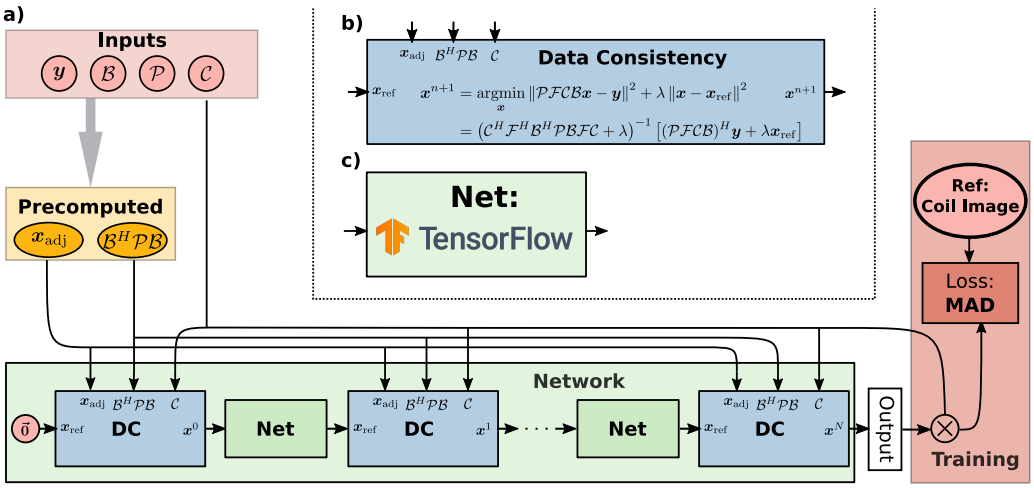

Figure 1: Desired integration of TensorFlow graph in physics-based neural network.

Specific tasks

- Investigation of existing code base
- Integrating TensorFlow graphs in the BART reconet command
- Train and evaluate neural networks defined in TensorFlow with BART
- Documentation and illustration of the results

Recommended Knowledge

- Strong programming background (preferably in C/C++ and Python)
- Basic experience on neural networks (preferably with TensorFlow)
- Interest in deep-learning with application to MRI

Contact

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