Master's Thesis:
Distributed Computing for MRI Reconstruction with MPI/CUDA in BART

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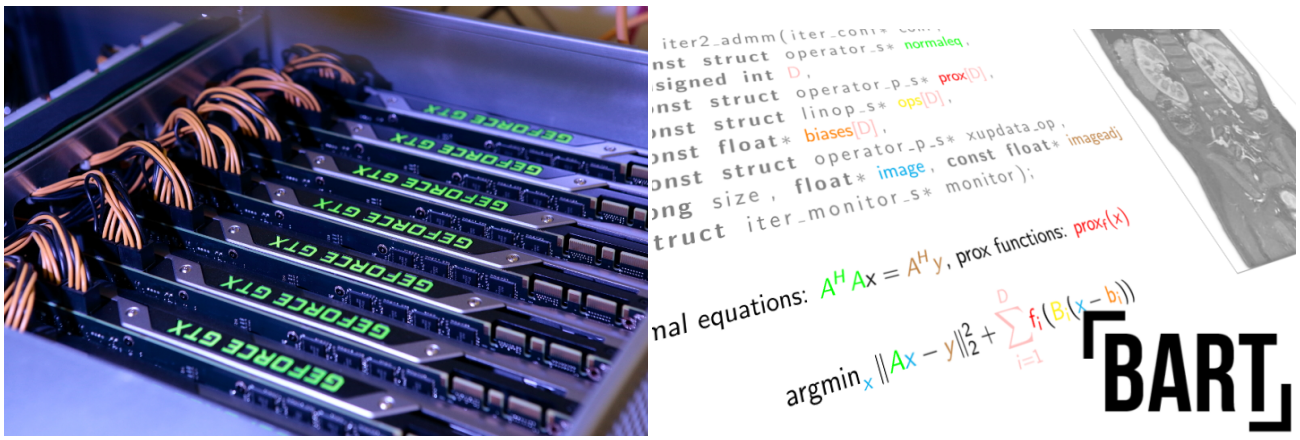
Overview

High dimensional MRI reconstruction (for example 3D + time) is computationally demanding and can require hundreds of GB of memory. The Berkeley Advanced Reconstruction Toolbox (BART) is the state of the art open-source software toolbox for MRI reconstruction that is mainly developed at the TU Graz. The numerical backend of BART has a unified interface of so-called md-functions that support transparent parallelization via OpenMP and offloading to GPUs using CUDA. Recently, initial support for distributed computing with the Message Passing Interface (MPI) has been added that allows for use of multiple nodes in HPC clusters for reconstruction.
As part of this thesis, the support for MPI should be extended to allow for more flexible and efficient use of distributed computing resources.



Specific tasks

- Literature review and familiarization with BART
- Extension of the MPI support in BART
- Performance optimization
- Performance evaluation on HPC clusters
- Documentation and illustration of the results

Recommended Knowledge

- C/C++ programming experience
- Basic knowledge of parallel programming (MPI, OpenMP, CUDA) – or willingness to learn
- Basic git workflow
- Basic knowledge on MRI reconstruction

Contact

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