Chair of Imaging and Computer Vision

RWTH AACHEN UNIVERSITY

Master-Thesis

Advanced Deep Learning Methods for Accelerated and Robust Low-Field MRI Reconstruction

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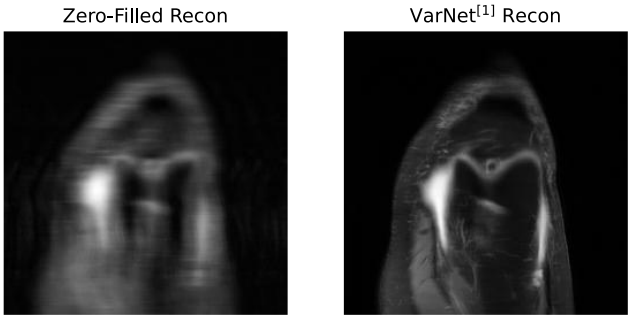
Keywords
MRI | Deep Learning | Reconstruction

Background

Low-field MRI systems offer significant advantages in terms of cost, accessibility, and portability, but they suffer from low signal-to-noise ratio and long acquisition times, which limit their clinical applicability. Deep learning–based reconstruction methods have recently shown great potential to enable highly accelerated MRI acquisitions, yet most existing approaches have been developed and validated primarily for high-field scanners. This thesis aims to investigate advanced deep learning techniques—such as transformer-based models or diffusion models—for accelerated and robust MRI reconstruction under low-field–like conditions, with a particular focus on extreme undersampling and artifact suppression.

Tasks

- Conduct comprehensive literature research.
- Familiarize yourself with public data and design comprehensive experimental pipeline.
- Simulate low-field MRI conditions on public high-field MRI datasets.
- Work with state-of-the art methods.
- Evaluate reconstruction performance under varying acceleration factors.



[1] End-to-End Variational Networks for Accelerated MRI Reconstruction.

Your Profile

- Strong programming experience in Python.
- First deep learning and machine learning experience (frameworks: Pytorch, Lightning, Numpy, Pandas).
- Experience with Git, Github, Gitlab.
- Preferably understanding of the MRI imaging technique.

Our Offer

The call for applications is aimed at master's students with a technical background (e.g. physics, informatics, electrical engineering) and is carried out in cooperation with Fraunhofer MEVIS. Our institute has state-of-the-art IT infrastructure and its own HTCondor Cluster. A workstation can be provided at the Chair of Imaging and Computer Vision Processing. As a supervisor I will consult and guide you through the work, through regular discussions. At the end of the thesis the work could be published in a top-tier conference. Feel free to contact me via email.