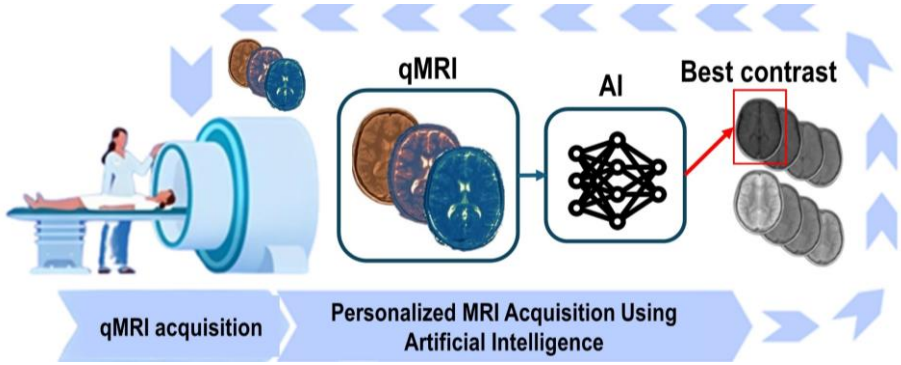
Towards AI-driven Online MRI Sequence Optimization for Precision Medicine

Research Line: Quantitative MR reconstruction
Project type: Master Project
Approx. duration: 6 to 9 months

Background: Magnetic Resonance Imaging (MRI) is essential in diagnostic radiology, providing detailed, non-invasive views of tissue structure. However, conventional MRI protocols are typically standardized and not tailored to individual patients. With the increasing availability of quantitative MRI (qMRI), with voxel-wise maps of intrinsic tissue parameters (e.g. T1, T2, PD), it is now possible to move toward patient-specific imaging. These tissue parameters enable synthesis of contrast-weighted images, opening the door to adaptive, personalized AI-driven MRI protocols that are optimized in real time.

Aim and Impact: The aim is to develop an AI-based algorithm that uses qMRI of a patient to synthesize diagnostic-quality contrast images and/or recommend personalized acquisition settings for subsequent scans. This approach seeks to enhance diagnostic precision, reduce scan time, and enable efficient, patient-specific imaging without redundant acquisitions.



Project strategy: The project will begin with a literature review covering MR physics, quantitative MRI (qMRI) principles, and existing approaches to sequence optimization. A neural network model will then be developed to explore the contrast space and identify acquisition settings that best fulfill diagnostic objectives. Implementation will be carried out in Python using libraries such as PyTorch. To ensure clinical relevance and reliability, the method will be validated with expert input.

Project designed for: a motivated master student interested in MR physics, medical image analysis, and AI seeking a 6-9 month master's thesis starting Aug/Sept 2025. Experience with Python and some familiarity with deep learning (preferably PyTorch) is expected.

Interested in this project?

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