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Proposal of a Joint Inversion Imaging Approach for the Estimation of Brain Myelin Content using MRI

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Magnetic Resonance Imaging (MRI) is a useful method for detecting focal macroscopic tissue abnormalities in the brains of patients with neurodegenerative disorders. A variety of imaging techniques are commonly used to estimate the brain myelin content. Myelin water fraction (MWF) mapping using MRI has enabled researchers to directly examine myelination and demyelination in both developing and diseased brains. T1-, T2-, and T2*-weighted multi-echo data have been proposed to estimate MWF in the human brain. Although, even for the relatively simple two pool signal models, consisting of myelin water and non-myelin associated water, the number of dimensions of the parameter space for acquiring MWF estimates remains high, which makes the parameter estimation challenging. The aim of this research is to improve the accuracy and precision of brain myelin content mapping. Utilizing geophysical joint inversion concepts, we propose a novel joint inversion imaging approach where data from multiple contrasts are combined in a single optimization process. When compared to state-of-the-art methods for MWF estimation, the proposed method is expected to be less biased and less susceptible to noise.

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