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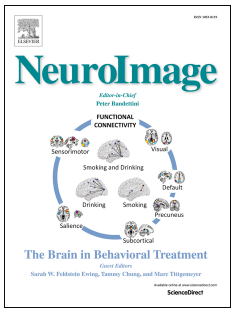


Using 3D spatial correlations to improve the noise robustness of multi component analysis of 3D multi echo quantitative T2 relaxometry data

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# Using 3D Spatial Correlations to Improve the Noise Robustness of Multi Component Analysis of 3D Multi Echo Quantitative T2 Relaxometry Data

## Highlights

- An accurate determination of T2 distribution in short T2 pool regime is not feasible, given the shortest achievable echo time in multi echo T2 relaxometry experiment is ~ 7-10 milliseconds.
- The voxel wise estimation of myelin water fraction value depends on three scalar values rather than entire T2 distributions (refer to appendix F): (i) Sum of signal contribution from short T2 pools; (ii) sum of contributions from non-myelin pools and (iii) accounting for the stimulated echo contributions.
- By utilizing 3D spatial correlations present in anatomical / pathological tissues and underlying $B1^+$-inhomogeneity or flip angle inhomogeneity map, the proposed approach estimates aforementioned scalar values more accurately than the competing algorithms, leading to the enhanced noise robustness of the reconstruction.
- Using measured $B1^+$-map to correct for the stimulated echo contributions would be suboptimal for reasons mentioned in the discussion section.

## ABSTRACT

**Purpose:** We present a computationally feasible and iterative multi-voxel spatially regularized algorithm for myelin water fraction (MWF) reconstruction. This method utilizes 3D spatial correlations present in anatomical / pathological tissues and underlying $B1^+$-inhomogeneity or flip angle inhomogeneity to enhance the noise robustness of the reconstruction while intrinsically accounting for stimulated echo contributions using T2-distribution data alone.

**Methods**: Simulated data and *in vivo* data acquired using 3D non-selective multi-echo spin echo (3DNS-MESE) were used to compare the reconstruction quality of the proposed approach against those of the popular algorithm (the method by Prasloski et al.) and previously proposed 2D multi-slice spatial regularization spatial regularization approach. We also investigated whether the inter-sequence correlations and agreements improved as a result of the proposed approach. MWF-quantifications from two sequences, 3DNS-MESE vs 3DNS-gradient and spin echo (3DNS-GRASE), were compared for both reconstruction approaches to assess correlations