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High-Resolution Reconstruction of Arterial Spin Labelling MRI Using Anatomical Priors

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This work investigates super-resolution reconstruction and deconvolution of perfusion arterial spin labelling (ASL) images using a high-resolution T1-weighted MRI with the aim of reducing the partial volume effect on the estimated cerebral blood flow (CBF). The MR acquisition matrix was factorized to model the down-sampling and blurring of the underlying ASL images, as well as MR coil sensitivity, Fourier encoding and k-space undersampling. The proposed methods were evaluated using simulation and real data in comparison with the standard reconstruction method, and an anatomical non-local means filtering combined with deconvolution. In simulations, both MR-guided deconvolution and reconstruction methods achieved the lowest normalised root mean square (NRMS) errors of 20% and 18.5% respectively, compared to the standard method with NRMS error of 29.5%. For real data, the guided deconvolution gave rise to the best results in terms of contrast and detail recovery. Evaluation of the guided reconstruction of the real data is in progress. In conclusion, the proposed methods provide a promising solution for improving the quality and quantitative accuracy of estimated CBF maps.

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