Optimization of reconstruction of pseudo-random undersampled MRI data.

The principles of compressed sensing were recently introduced to the field of Magnetic Resonance Imaging, and during the last few years a lot of effort have been put into finding suitable reconstruction methods and applications.

Today, the focus is on integrating compressed sensing principles with principles of parallell imaging and other regularization methods into one reconstruction pipeline.

Our research group have designed a new MR sequence which uses a pseudo-random sampling pattern in k-space to obtain acceleration factors of 8-16 (sampling 1/8 or 1/16 of the required data according to Nyquist) , and we have recently acquired socalled resting state functional MRI data of the human brain at a 7 Tesla Whole Body MRI scanner in Essen, Germany.

The aim of this project is to optimize the reconstruction chain for this dataset, using published methods and corresponding publicly available matlab-code. The student will develop knowledge of MRI reconstruction algorithms, regularization methods and matlab programming. Depending on the degree of success, the project will help answer whether compressed sensing regularization can improve image quality in functional MRI applications.

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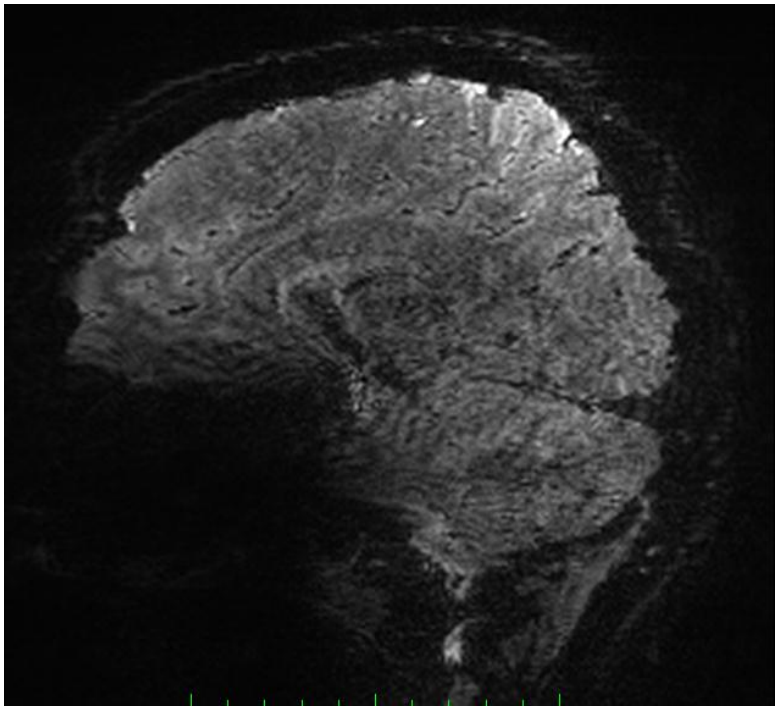

Figure 1. Example MR image acquired at 16 times undersampling factor and reconstructed using parallell imaging algorithms provided by the manufacturer of the MRI scanner. Can we do a better job?