AbstractID: 13270 Title: Can Compressive Sensing Improve Low-contrast Object Detectability in Accelerated MRI Applications?

Purpose: Compressive Sensing (CS) methods can reduce image artifacts when reconstructing undersampled data sets. Most MRI applications of CS, however, have focused on high contrast objects such as gadolinium-enhanced vessels, rather than on low-contrast object detectability (LCOD). Using a novel computational framework, we rigorously examine whether CS reconstruction can improve the LCOD performance of several standard techniques for undersamped MRI reconstruction – across a variety of undersampling rates and strategies. **Methods and Materials:** The American College of Radiology (ACR) quality control (QC) phantom was imaged on a GE 14.0 1.5T MRI using our routine quality assurance protocol and an 8-channel head coil. The raw k-space data corresponding to the 5.1% contrast detectability plane was retrospectively undersampled along the phase-encoded direction at 10 different rates (10-100%) and, for each, using 3 different distribution strategies: 1) low-frequency band only; 2) uniform sampling; 3) random sampling (Poisson Disk). For the latter case, 5 sampling instances were generated at each rate. Each undersampled data set was reconstructed using 3 different strategies: 1) zero-filling with root sum-of-squares combination; 2) Tikhonov-SENSE; and 3) Compressive Sensing (L_1-minimization, finite difference sparsity). Reconstruction results were then analyzed with our in-house developed QC software to automatically determine the fraction of complete visually detectable spokes which, is a measure of LCOD performance. **Results:** Across all sampling rates and under all sampling strategies, the LCOD score for CS reconstructions was consistently equal to or higher than that of the other two reconstruction methods. The CS advantage was especially pronounced at very low sampling rates (≤30%). C**onclusion:** Although most CS work to date has focused on high-contrast objects, CS reconstructions consistently improved LCOD compared to several standard MRI reconstruction techniques for undersampled data. These results suggest that CS reconstruction is useful not only for undersampled high contrast objects, but can improve LCOD as well.