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Compressed Sensing and Medical Applications

Low-rank plus sparse dynamic MRI

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Abstract: Dynamic MRI techniques acquire a series of images known as frames that encode physical and physiological information such as organ motion, contrast enhancement and signal relaxation. Fast imaging is required to enable simultaneous high spatial and temporal resolution, as well as appropriate volumetric coverage. Extensive correlations in spatiotemporal MRI data make possible the application of compressed sensing and low-rank matrix completion to accelerate data acquisition. The combination of both approaches is very attractive to increase imaging speed and can offer additional benefits on top of acceleration. For example, the low-rank plus sparse (L+S) reconstruction method can reconstruct undersampled dynamic MRI data with automatic separation of background (L) and dynamic (S) components and self-learn motion fields among frames. The separation of signal sources (background and innovations) and self-learning of motion represent new uses of sparsity in addition to increasing imaging speed. This talk will cover the basics of L+S matrix decomposition and its application to reconstruct undersampled dynamic MRI data with separation of background and dynamic components and self-learning of inter-frame motion fields. Reconstruction of highly-accelerated dynamic MRI data corresponding to cardiac perfusion, time-resolved peripheral angiography, and abdominal perfusion using Cartesian and golden-angle radial sampling will be presented to show feasibility and general applicability of the L+S method.