AbstractID: 9761 Title: Fast Imaging with Sparse Sampling

Spatiotemporal imaging embodies a large class of imaging problems, which involve collecting a sequence of data sets to resolve both the spatial and temporal (or spectral) distributions of some physical quantity. Some popular examples of spatiotemporal imaging include cardiac imaging, functional neuroimaging, and spectroscopic imaging. To obtain high spatiotemporal resolution, many methods have been proposed in the last two decades, which include fast-scan methods, reduced-encoding methods, and parallel imaging methods. Sparse sampling is emerging as another effective means to further accelerate various imaging experiments. Encouraging results have been obtained utilizing the compressibility of natural images based on the compressive sampling theory developed by Donoho et al. and Candes et al. We have recently proposed a new method that can sample (k, t)-space very sparsely for spatiotemporal (or spatial-spectral) imaging. The new method is based on the theory of partially separable functions and preliminary results demonstrate significant improvements in spatiotemporal resolution for cardiac imaging, functional brain imaging, to spectroscopic cancer imaging.

This lecture will provide an overview of sparse sampling theories and discuss how these new theories can be used to significantly speed up the various imaging schemes.

Educational Objectives:

1. Understand the basic principle of sparse sampling
2. Understand the theory of partially separable functions and its application to sparse sampling
3. Understand the issues related to fast imaging using sparse sampling