Sparsity-based Reconstruction Methods for Medical Imaging

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The current trend in imaging is to reconstruct accurate, high-resolution images from increasingly noisy and low-resolution measurements. In this talk, we describe recent approaches to solve this reconstruction problem in medical imaging contexts. These methods are inspired by sparse recovery methods employed in compressed sensing, where the signal to be reconstructed is assumed to have a sparse or low-complexity representation. This assumption is valid for a wide class of natural scenes and allows high-fidelity reconstructions from surprisingly few measurements. We are particularly interested in developing methods that are applicable to photon-limited settings, where the scene of interest is of low-intensity, or the images are acquired quickly at low exposure. Such situations occur in emission tomography and other medical imaging modalities. The observations are characterized using Poisson (counting) statistics, which lead to challenging optimization problems. We will show how ideas in convex programming and signal processing can be employed to accurately and efficiently reconstruct images and improve upon current state-of-the-art recovery algorithms.

About the speaker: Zachary T. Harmany is a PhD candidate in Electrical and Computer Engineering at Duke University in Durham, NC, and is a visiting researcher in Applied Mathematics at UC Merced this spring semester. His research is in signal and image processing, with an emphasis on reconstruction methods for photon-limited medical imaging modalities.