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COMPUTATIONAL AND APPLIED MATHEMATICS  
Inverse Problems & Imaging Seminar

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Objective Image Quality Assessment for Sparsity-exploiting Image  
Reconstruction in CT

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Jones 226, 5747 South Ellis Avenue

ABSTRACT

The broad goal of this research aims to provide objective image quality metrics that can be used for unified hardware/software systems design. More specifically, imagine designing a dedicated breast CT system where the total X-ray exposure is fixed. With sparsity-exploiting image reconstruction algorithms, there is the option to realize systems with sparse view-angle sampling and a high SNR for each projection. One could also redistribute the total exposure and acquire projections at a high angular sampling density and low SNR per projection. To make a determination of scan configuration and image reconstruction algorithm/parameters it is necessary to have useful quantitative image quality metrics.

Traditional technical metrics such as image root-mean-square-error, image contrast-to-noise ratio, edge/point spread functions, NQE/DQE provide useful characterizations of tomographic images, but they are incomplete. As a result, much systems work in CT involves parameter setting by eye. Such an approach can be successfully implemented when the scan geometry/image reconstruction algorithm is fixed and the general subject properties are known. But the reconstruction-by-eye approach is not practical when considering multiple configurations and image reconstruction algorithms. The impracticality results from both the sheer number of images to look at and because the overall appearance of images is difficult to compare subjectively when switching configuration or recon. algorithm.

The class of metrics which we are attempting to develop center on designing a detection task for small objects at the limit of visibility to the tomographic system.