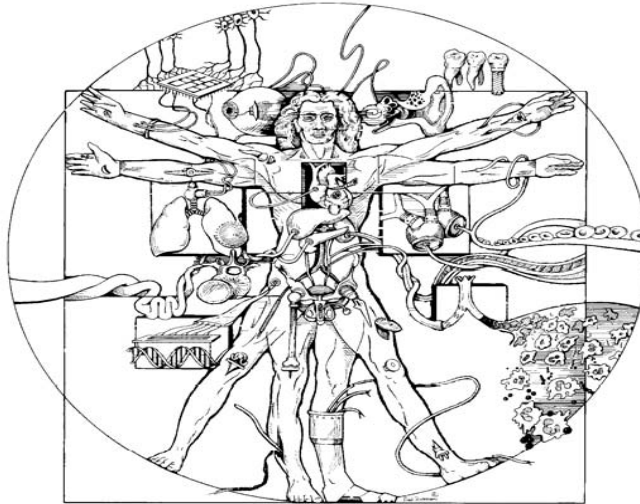


# Biomedical Engineering Seminar



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## “Statistical Image Reconstruction Methods and Applications in Biomedical Imaging”

Abstract: Statistical image reconstruction, also known as model-based iterative image reconstruction, can yield significantly improved image quality, compared to its nonstatistical counterpart, by employing accurate physics and noise models. Statistical reconstruction methods have been successfully applied to various imaging modalities. In this talk we first overview a framework for statistical image reconstruction and next address three relevant issues through examples from PET (positron emission tomography) and optical bioluminescence and fluorescence tomography. First, we present computationally efficient methods for analyzing the resolution and noise properties of edge-preserving "nonquadratic" regularization. "Quadratic" regularization tends to over-smooth the edges and its properties are well-understood while there has been little research on quantitative analysis of edge-preserving nonquadratic regularization. Second, we develop fast convergent iterative algorithms. Starting from a framework of optimization transfer, also known as MM (majorize-minimize or minorize-maximize) algorithms, and introducing the "ordered subset" idea (also known as incremental gradient or block iterative), we derive several algorithms, which rapidly converge to solutions. Third, we efficiently implement the forward model, which images (or objects) into data. The forward mapping and its adjoint are repeatedly calculated in iterative algorithms and so its efficient implementation saves the cost substantially. We present efficient forward mappings based on inverse Fourier rebinning for fully 3D cylindrical PET scanners. We also demonstrate fast "on-the-fly" forward mappings for optical bioluminescence and fluorescence tomography. The methods presented here are applied not only to PET and optical tomography but also to SPECT, CT and confocal microscopy. We also show the applicability of the methods, beyond imaging, to mapping quantitative trait loci regulating mRNA expression (eQTLs) by using microarray data from radiation hybrid cells.

**Thursday, August 28, 2008**

**12:00 pm**

**MRB 102**

Host: Ted Trouard, Ph.D. (626-2177)

*Persons with a disability may request a reasonable accommodation by contacting the Disability Resource Center at 621-3268 (V/TTY). Requests should be made as early as possible to allow time to arrange the accommodation*