

STATISTICS COLLOQUIUM

Thursday, November 13, 2008

Time: 3 PM

Location: McCarthy Hall, Room 480

“Spatial and Fourier Analysis of Stationarity in X-ray Computed Tomography”

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ABSTRACT

The statistical properties of medical images are central in characterizing the performance of imaging systems. Understanding the variability of the images helps to assess the detectability of tumors, for example. The noise in X-ray computed tomography (CT) is often characterized using Fourier-based metrics, such as the 3D noise-power spectrum (NPS). Under a stationarity assumption, the NPS (which is the variance of the Fourier coefficients) provides a complete representation of the covariance of the images, since the covariance matrix of the Fourier transform of the image is diagonal. Current methods of characterizing the noise ignore the correlations in the Fourier coefficients. In practice, such assumptions are obeyed to varying degrees. The objective of this work is to investigate the degree to which such assumptions apply in CT and to experimentally characterize the NPS and off-diagonal elements of the DFT covariance matrix. We test the stationarity assumption under varying experimental conditions using both spatial and frequency domain measures of stationarity. The results indicate that experimental conditions affect the degree of stationarity and that under some imaging conditions, local descriptions of the noise need to be developed to appropriately describe CT images.