Statistical Image Reconstruction from Correlated Tomographic Measurements

Adam Alessio
Division of Nuclear Medicine, University of Washington

May 9, 2005

Positron emission tomography (PET) scanners collect measurements of a patient's in vivo radiotracer distribution. This work considers the inverse problem of reconstructing an image from Fourier rebinned, positron emission tomography (PET) measurements. I will briefly discuss the rationale for the Fourier rebinning process. Then, I will present some methods for including the structure of the noise correlations in an accurate statistical reconstruction algorithm. These methods are extendable to situations beyond the Fourier rebinning application. The first order influence of the correlations appears in the conditional mean and the second order influence appears in the conditional covariance terms used in a penalized weighted least squares objective function. The use of complete covariance matrices in the weighting term can be simplified by a) reducing the dimensionality of the correlations and b) adopting a Markov random field assumption.