The Johns Hopkins University
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Motion Correction and Pharmacokinetic Analysis in Dynamic Positron Emission Tomography

Dissertation Defense by
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Abstract
This talk will focus on two important aspects of Positron Emission Tomography (PET): (1) Motion-compensation, and (2) Pharmacokinetic analysis of dynamic PET images.

Motion-compensation in Dynamic PET Images: Dynamic PET images are degraded by inter-frame and intra-frame motion artifacts that can affect the quantitative and qualitative analysis of acquired PET data. I will present a Generalized Inter-frame and Intra-frame Motion Correction (GIIMC) algorithm that unifies in one framework the inter-frame motion correction capability of Multiple Acquisition Frames and the intra-frame motion correction feature of (MLEM)-type deconvolution methods. GIIMC employs a fairly simple but new approach of using time-weighted average of attenuation sinograms to reconstruct dynamic frames. Extensive validation studies show that GIIMC algorithm outperforms conventional techniques producing images with superior quality and quantitative accuracy.

Parametric Myocardial Perfusion PET Imaging using Physiological Clustering: We propose a novel framework of robust kinetic parameter estimation applied to absolute flow quantification in dynamic PET imaging. Kinetic parameter estimation is formulated as nonlinear least squares with spatial constraints problem where the spatial constraints are computed from a physiologically driven clustering of dynamic images, and used to reduce noise contamination. The proposed framework is shown to improve the quantitative accuracy of Myocardial Perfusion (MP) PET imaging, and in turn, has the long-term potential to enhance capabilities of MP PET in the detection, staging and management of coronary artery disease.

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