Seminar

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Wednesday, February 1, 2012,
HH-3017, 10:00a.m.

Temporal regularization and artifact correction in single slow-rotation dynamic SPECT

Abstract:

Single photon emission computed tomography (SPECT) is a diagnostic functional imaging modality wherein the distribution of a radioactive tracer inside the body is estimated based on data acquired from around the patient by a slowly rotating camera. Conventional SPECT image reconstruction assumes that this tracer distribution remains static during acquisition. In this talk I will discuss imaging a time-varying distribution of radiotracer, which presents a highly underdetermined reconstruction problem. Recovering an accurate dynamic image from the acquired projection data requires including constraints, such as temporal regularization, during the reconstruction process. This work builds on the dSPECT approach of Farncombe et al.(1999), which uses simple inequality constraints to restrict the temporal behaviour of the reconstructed image.

I will first discuss a modification to the dSPECT algorithm which imposes a stronger constraint on the temporal behaviour of the time activity curve (TAC) in every voxel of the reconstructed image. The modified constraint promotes smooth temporal behaviour by restricting changes in the concavity of each TAC. Digital phantom simulations illustrate that this modified constraint provides more accurate images, with smoother, more consistent TACs within dynamic regions of interest. The new method is especially successful in simulations featuring high levels of noise and relatively gradual tracer kinetics.

In the second part of the talk, I will discuss artifacts which occur in dynamic images reconstructed from single slow-rotation data. These artifacts occur due to the fact that only a small number of views of the object are acquired by the camera at any one time. Artifacts caused by photon attenuation are particularly severe. Using realistic 3D phantom simulations, as well as real-life dynamic renal SPECT data, I will demonstrate methods for correcting these artifacts. These correction methods substantially improve the accuracy of reconstructed TACs in the presence of attenuation.