SEMINAR NOTICE

Department of Electrical and Systems Engineering

MAXIMUM LIKELIHOOD IMAGE RECONSTRUCTION FOR PET IMAGING USING NON-STANDARD RADIONUCLIDES

PhD Preliminary Research Examination

Norbert Agbeko
PhD Candidate
Department of Electrical and Systems Engineering
Washington University in St. Louis

Abstract: There is an increased interest in the production and use of non-standard positron emitting isotopes for Positron Emission Tomography (PET) imaging. Isotopes such as Br-76 and Y-86 which are not pure positron emitters introduce additional effects not included in the standard model for PET imaging, hence the need for new models and algorithms to ensure quality images and quantitative accuracy. These radionuclides have complex decay schemes and emit prompt gamma rays, called cascade gamma rays, in addition to the positron. The cascade gamma rays lead to an increase in the random coincidences detected and a reduction in contrast in the reconstructed image. In addition, the radionuclides emit high energy positrons with long positron range which leads to lower spatial resolution. In high-resolution small animal imaging in particular, positron range is the limiting factor in resolution recovery when non-standard radionuclides are used.

We have developed a model for estimating the shape of the cascade distribution by extending the standard forward model for PET to allow for additional photon energies and for photons not traveling apart on a straight line. The cascade estimate, together with an estimate of single scatter, is incorporated into an extended version of the EM algorithm for PET imaging which computes ML estimates of scale factors for the cascade and scatter distributions in addition to the ML image estimate. We have also developed a model for estimating the blurring due to positron range within the image space using spatially varying, density dependent kernels. The correction for positron range is applied in new algorithm that separates the positron range correction from the standard EM algorithm.

DATE: Thursday, October 7, 2010
TIME: 12:00 p.m.
PLACE: Bryan Hall, Room 305

Thesis advisor:
Dr. Joseph O'Sullivan

This seminar is in partial fulfillment
of the Doctor of Philosophy degree

Washington University in St. Louis
SCHOOL OF ENGINEERING & APPLIED SCIENCE