Research Interest June 2017

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My research interest is to use simulation and image reconstruction techniques for medical imaging field, apply mathematical model for nuclear medicine field and artificial intelligent for radiologic data.

My first project is to simulate and design nuclear medicine imaging devices such as small animal Positron Emission Tomography (PET), brain PET, whole body PET, cardiac Single Photon Emission Tomography, small animal SPECT, whole body SPECT, Compton Camera, and Positron Emission Mammography (PEM) for breast cancer imaging. My current project is to model and simulate cost effective, high resolution small animal SPECT scanner using Laser Induced Optical Barriers (LIOB) technique. In LIOB, an internally focused laser beam is used to locally alter the crystal structure of the scintillation material. This novel technique allows for a flexible and cost-effective production of pixelated scintillator crystals, compared to current fabrication methods, which are cumbersome, expensive, and involves sub- optimal tradeoff between key performance metrics of the detectors.

In my second project, I used solid-state detectors such as Cadmium Zinc Telluride (CZT) to improve intrinsic detector resolution, energy resolution and comparing with state-of-the-art systems for PEM. My new unique design of PEM scanner will allow to: greatly improve the spatial resolution due to the pixelated structure of the individual detectors; greatly improve the energy resolution due to the use of room temperature solid- state CZT detectors; achieve very high signal-to-noise ratio by rejection most of the scattered events and achieve very high detection efficiency for 511 keV photons. I use the C++, root, matlab and GATE Simulations. To reconstruct images, I used conventional image reconstruction techniques like filtered back projection (FBP), ordered subset expectation maximization (OSEM), and maximum likelihood expectation maximization (MLEM).

In my third project we are applying to fuzzy logic, Promethee method and decision theory to analyze the nuclear medicine imaging devices, image reconstruction techniques, breast cancer devices, and therapy techniques.

In my fourth project, we are interesting on artificial intelligent for medical imaging data taken from Near East Hospital. For our first and third projects, we are collaborating with Gordon Center for Medical Imaging, Massachusetts General Hospital and Harvard Medical School (http://gordon.mgh.harvard.edu/gc/people/collaborators/).