

# Improved PET Image Reconstruction Using Machine Learning Techniques

The Oakland University and School of Engineering and Computer Science communities are invited to attend Bao Yang's defense of her Ph.D. dissertation. Seating is limited. RSVP with Katie Loodeen at loodeen@oakland.edu.

## Improved PET Image Reconstruction Using Machine Learning Techniques

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**Time:** 9:00 – 11:00 a.m.  
**Date:** Wednesday, May 8, 2019  
**Location:** 347 EC

Positron emission tomography (PET) imaging plays an important role in scientific and clinical measurement of biochemical and physiological processes. The maximum a posteriori (MAP) algorithm incorporating prior information of the radiotracer distribution into the image reconstruction process yields smoothed PET images. In this thesis, we use dictionary learning (DL) based sparse representation in the formation of the prior for MAP PET image reconstruction. The DL based prior describes the image content efficiently and outperforms the mathematical model based priors.

The contribution of prior in MAP reconstruction is penalized by a weighting parameter. Varying the weight results in PET images with different noise/bias tradeoffs. In order to take advantage of useful information in MAP reconstructions from different weights, we propose to build an artificial neural network (ANN) based image enhancement scheme, which takes three MAP reconstructions as input and generates an enhanced PET image. The developed ANN model shows robustness in processing MAP reconstructions from different subjects.

Besides applying the machine learning techniques (DL and ANN) in static PET imaging, we also develop a DL based direct parametric reconstruction algorithm for dynamic PET imaging. By incorporating the DL prior and the temporal modeling into the reconstruction process, the proposed method improves the noise/bias tradeoff in the reconstructed parametric images.

