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Seminar

Speaker: **Professor Thomas Lee**
Department of Statistics
University of California-Davis

Title**:** **Fiber Direction Estimation in Diffusion MRI**

Time: **3:20 – 4:20pm, *Wednesday*, September 24, 2014**

Place: **552 Hill Center**

Abstract

Diffusion magnetic resonance imaging is a medical imaging technology to probe anatomical architectures of biological samples in an in vivo and non-invasive manner through measuring water diffusion. It is widely used to reconstruct white matter fiber tracts in brains. This can be done in several steps. Typically, the first step is to estimate the diffusion direction(s) for each voxel of the biological sample under study by extracting the leading eigenvector from the estimated diffusion tensor at each voxel. As it is reasonable to assume that the diffusion directions from neighboring voxels are similar, a local smoothing may be applied to the estimated tensors or directions to improve the estimation of diffusion directions. Finally, a tracking algorithm is used to reconstruct fiber tracts based on (estimated) diffusion directions.

Most commonly used tensor estimation methods assume a single tensor and do not work well when there are multiple principal diffusion directions within a single voxel. The first part of this talk describes a new method which is able to identify and estimate multiple diffusion directions within a voxel. This method is based on a new parametrization of the multi-tensor model and it produces reliable results even when there are multiple principal diffusion directions within the voxels. In the second part this talk proposes a novel direction smoothing method which greatly improves diffusion direction estimation in regions with crossing fibers. This smoothing method is shown to have excellent theoretical and empirical properties. Lastly this talks presents a novel fiber tracking algorithm which takes (estimated) diffusion directions as input an accommodates multiple directions within a voxel. The overall methodology is illustrated with data sets collected for the study of Alzheimer's disease.

This is joint work with Debashis Paul, Jie Peng and Raymond Wong.

***** Refreshments will be served @2:50pm in Room 502 Hill Center *****

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