# *Colloquium*

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**"Automated, Robust Bayesian Analysis of Functional and Quantitative Image Data using Functional Mixed Models and Isomorphic Basis-Space Modeling"**

In this talk, I will describe flexible new Bayesian methods to analyze functional and quantitative image data. The methods are based on functional mixed models, a framework that can simultaneously model multiple factors and account for correlation within and between the functions. I use an isomorphic basis-space approach to fitting the model, which leads to efficient calculations and adaptive smoothing yet flexibly accommodates the complex features characterizing these data. The method is automated and produces inferential plots indicating regions of the function or image associated with each factor, simultaneously considering practical and statistical significance, and flagging significant regions based on Bayesian false discovery rate. I will overview the Gaussian wavelet-based functional mixed model of Morris and Carroll (2006), and discuss how to robustify this model so it handle outlying curves and local regions of curves, downweighting their effect. This is accomplished using heavy tailed sparsity priors in the wavelet space, which also affords the method great adaptiveness in wavelet coefficient selection, leading to adaptiveness in estimation of fixed and random effect functions. Simulation studies show that this approach is robust enough to model data with extremely heavy tails (Cauchy), yet still performs well when the data are Gaussian, and yields estimators and inference with outstandingly adaptive properties, demonstrating a remarkable ability to remove spurious local features induced by outliers and noise while retaining true features characterizing the signal. We also prove the local robustness condition, that as a region of an individual curve goes to infinity, its influence on the fixed effect functions goes to zero. These methods are applicable to any functional or quantitative image data sampled on a fine grid; here we apply the method to MALDI-TOF proteomic data.

**Monday February 7th, 2011**
ROOM 306
Statistics Building
University of Georgia
Athens, GA 30602
4:40 P.M. – Room 306, Statistics Building

**Refreshments BEFORE talk at 4:15 P.M. in room 230 (The Cohen Room)**