THE UNIVERSITY OF GEORGIA
DEPARTMENT OF STATISTICS
Colloquium Series

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4:00 PM, Room 204, Caldwell Building

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Bayesian Spatial Binary Regression for Label Fusion in Structural Neuroimaging

Alzheimer's disease is a neurodegenerative condition that accelerates cognitive decline relative to normal aging. It is of critical scientific importance to gain a better understanding of early disease mechanisms in the brain to facilitate effective, targeted therapies. The volume of the hippocampus is often used in diagnosis and monitoring of the disease. Measuring this volume via neuroimaging is difficult since each hippocampus must either be manually identified or automatically delineated, a task referred to as segmentation. Automatic hippocampal segmentation often involves mapping a previously manually segmented image to a new brain image and propagating the labels to obtain an estimate of where each hippocampus is located in the new image. A more recent approach to this problem is to propagate labels from multiple manually segmented atlases and combine the results using a process known as label fusion. To date, most label fusion algorithms employ voting procedures with voting weights assigned directly or estimated via optimization. We propose using a fully Bayesian spatial regression model for label fusion that facilitates direct incorporation of covariate information while making accessible the entire posterior distribution. Our results suggest that incorporating tissue classification (e.g, gray matter) into the label fusion procedure can greatly improve segmentation when relatively homogeneous, healthy brains are used as atlases for diseased brains. The fully Bayesian approach also produces meaningful uncertainty measures about hippocampal volumes, information which can be leveraged to detect significant, scientifically meaningful differences between healthy and diseased populations, improving the potential for early detection and tracking of the disease.

About the Speaker

Dr. Andrew Brown is an Associate Professor in the School of Mathematical and Statistical Sciences at Clemson University. He received my MS and PhD in Statistics from the Department of Statistics at the University of Georgia. His BS in Applied Mathematics is from the School of Mathematics at Georgia Tech. His research interests include uncertainty quantification, neuroimaging data analysis, Bayesian inverse problems, computer experiments and Gaussian Markov random fields.