



THE UNIVERSITY OF GEORGIA  
DEPARTMENT OF STATISTICS

# Colloquium Series

Thursday, February 23, 2023

4:00 PM, Room 204, Caldwell Building

**Dr. Ray Bai**

Assistant Professor of Statistics, University of South Carolina

## **GENERATIVE QUANTILE REGRESSION WITH VARIABILITY PENALTY**

Quantile regression and conditional density estimation can often reveal structure that is missed by mean regression, such as heterogeneous subpopulations (i.e. multimodality) and skewedness. In this talk, we introduce a deep learning generative model for joint quantile regression called Penalized Generative Quantile Regression (PGQR). Our approach simultaneously generates samples from random quantile levels, thus allowing us to infer the conditional density of a response variable given a set of covariates. Our method employs a novel variability penalty to avoid the common problem of vanishing variance in deep generative models. Furthermore, we introduce a new family of neural networks called partial monotonic neural networks (PMNN) to circumvent the problem of crossing quantile planes. A major benefit of PGQR is that our method can be fit using a single optimization, thus bypassing the need to repeatedly train the model at multiple quantile levels or use computationally expensive cross-validation to choose the penalty parameter. We illustrate the efficacy of PGQR through extensive simulation studies and analysis of real datasets.

### **About the Speaker**

Dr. Ray Bai is an Assistant Professor of Statistics at the University of South Carolina. He joined the Statistics Department at USC in August 2020. He earned his PhD from the University of Florida in 2018 and was a postdoc at the University of Pennsylvania Department of Biostatistics, Epidemiology, and Informatics from 2018 to 2020. His research interests include Bayesian statistics, high-dimensional models, semiparametric models, and deep learning.



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