THE UNIVERSITY OF GEORGIA
DEPARTMENT OF STATISTICS

Colloquium Series

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Tensor t-Distribution and Tensor Response Regression

In recent years, promising statistical modeling approaches to tensor data analysis have been rapidly developed. Traditional multivariate analysis tools, such as multivariate regression and discriminant analysis, are now generalized from modeling random vectors and matrices to higher-order random tensors (a.k.a. array-valued random objects). Equipped with tensor algebra and high-dimensional computation techniques, concise and interpretable statistical models and estimation procedures prevail in a wide range of applications. One of the biggest challenges to statistical tensor models is the non-Gaussian nature of many real-world data. Unfortunately, existing approaches are either restricted to normality or implicitly using least squares type objective functions that are computationally efficient but sensitive to data contamination. Motivated by this, we propose a simple tensor t-distribution that is, unlike existing matrix t-distributions, compatible with tensor operators and reshaping of the data. We then study the tensor response regression with tensor t-error, and develop penalized estimation and hypothesis testing under this t-modeling approach. A novel one-step estimation algorithm is developed for the penalized non-convex optimization, and is proven to converge to the global optimum. We study the asymptotic relative efficiency of various estimators under this model and establish the oracle properties in variable selection and near-optimal asymptotic efficiency. Extensive numerical studies show encouraging performance of the one-step estimator.

About the Speaker

Dr. Qing Mai is an Associate professor in the Department of Statistics of the Florida State University. She received her PhD from University of Minnesota in 2013. Her research interests include variable selection, high-dimensional data analysis, semiparametric and nonparametric statistics, dimension reduction. She is an Associate Editor of Biometrics and Computational Statistics and Data Analysis. Her research is funded by National Science Foundation.