MICHIGAN STATE UNIVERSITY
Department of Statistics and Probability

COLLOQUIUM

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Covariate-Adjusted Tensor Classification and Other Applications in High Dimensions

Tuesday, September 10, 2019
10:20 AM - 11:10 AM
Refreshments 10:00 AM
C405 Wells Hall

Abstract

In contemporary scientific research, it is often of great interest to predict a categorical response based on a high-dimensional tensor (i.e. multi-dimensional array) and additional covariates. Motivated by applications in science and engineering, we propose a comprehensive and interpretable discriminant analysis model, called the CATCH model (in short for Covariate-Adjusted Tensor Classification in High-dimensions). The CATCH model efficiently integrates the covariates and the tensor to predict the categorical outcome. The tensor structure is utilized to achieve easy interpretation and accurate prediction. To tackle the new computational and statistical challenges arising from the intimidating tensor dimensions, we propose a penalized approach to select a subset of the tensor predictor entries that affect classification after adjustment for the covariates. An efficient algorithm is developed to take advantage of the tensor structure in the penalized estimation. Theoretical results confirm that the proposed method achieves variable selection and prediction consistency, even when the tensor dimension is much larger than the sample size. The superior performance of our method over existing methods is demonstrated in extensive simulated and real data examples. We further note that the proposed algorithm in CATCH model has applications beyond tensor classification. We investigate its performance in differential networks and quadratic discriminant analysis. Compared with state-of-the art methods, our algorithm has significantly lower computational cost when the true model is highly sparse.

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