



The Hong Kong University of Science and Technology

Department of Mathematics

PhD THESIS EXAMINATION

Tensor Data: from Analysis to Applications

By

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ABSTRACT

Motivated by the variability of node popularity in empirical networks, we propose a novel probabilistic framework for directed network community detection called the two-way node popularity model (TNPM). The Rank One Approximation Algorithm (ROA) and Two-Stage Divided Cosine Algorithm (TSDC) are developed for the model fitting and community structure uncovering. In addition, we establish the consistency of ROA for community detection. Extensive numerical studies and real applications demonstrate the advantages of our proposed method in terms of both estimation accuracy and computation efficiency. Secondly, we consider the problem of detecting volatility structure change points for tensor sequence data. The majority of approaches to the problem focus only on the univariate or multivariate case. Tensor sequence data has not been considered so far. To address this, we propose a new method, which preserves the multi-dimensional data structure and overcomes the curse of dimensionality for covariance parameter estimation. Thirdly, we study the problem of measuring the dependence between variables. We define a new dependence measure called the Local Adjusted Chatterjee Correlation Coefficient (LAC3), which takes on its extreme values precisely at independence and almost surely functional dependence respectively. Furthermore, we establish the corresponding consistency and asymptotic theories. Extensive numerical studies and real data applications demonstrate the advantages of LAC3 in terms of local signal detection, generality property, and equitability property.

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(Open to all faculty and students)

The student's thesis is now being displayed on the reception counter in the General Administration Office (Room 3461).