THE UNIVERSITY OF CHICAGO

Department of Statistics

STATISTICS COLLOQUIUM

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Estimation Over Multiple Undirected Graphs

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ABSTRACT

Graphical models are useful in analyzing complex systems involving a large number of interacting units. For example, in gene expression analysis, one key challenge is reconstruction of gene networks, describing gene-gene interactions.

Observed attributes of genes, such as gene expressions, are used to reconstruct gene networks through graphical models. In this presentation, I will focus on estimation of multiple undirected graphs, motivated from network analysis under different experimental conditions, such as gene networks for disparate cancer subtypes. A method for pursuing two types of structures, clustering and sparseness, is proposed based on the penalized maximum likelihood.

Theoretically, I will present a finite-sample error bound for reconstructing these two types of structures. This leads to consistent reconstruction of them simultaneously, permitting the number of unknown parameters to be exponential in the sample size, in addition to optimality of the proposed estimator as if the true structures were given a priori. Computationally, a necessary and sufficient partition rule is derived, on which estimation of multiple large graphs can proceed with smaller disjoint subproblems. This divide-and-conquer strategy permits efficient computation. Finally, I will demonstrate the proposed method on real examples.
