Department of Applied and Computational Mathematics and Statistics Colloquium

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Graph Quilting: Graphical Model Selection from Partially Observed Covariances

Estimating a conditional dependence graph is a seemingly impossible task when several pairs of variables have no joint observation. Recovering the edges of the graph in such settings is extremely hard, because it requires us to infer conditional dependencies between variables with no empirical evidence of their covariation. This largely unexplored statistical problem arises in several situations. For instance, in neuroscience the activities of large populations of neurons are typically observed by recording multiple small subsets of cells nonsimultaneously with calcium imaging technology, such that the joint activities of several pairs of neurons remain unobserved. We call this statistical challenge the "Graph Quilting problem". In the Gaussian graphical model, the unavailability of parts of the covariance matrix translates into the unidentifiability of the precision matrix, which specifies the graph. However, we demonstrate that, under mild conditions, it is possible to correctly identify not only the edges connecting the observed pairs of nodes, but also a superset of those connecting the variables that are never observed jointly. We perform the latter task by applying the "Recursive-Complement" algorithm. We propose an L1-regularized graph estimator based on partially observed sample covariances, and establish its rates of convergence in high-dimensions. We illustrate the methodology using synthetic data, as well as data obtained from in vivo calcium imaging of ten thousand neurons in mouse visual cortex.

Wenesday, January 29, 2020
4:15PM – 5:15 PM
127 Hayes-Healy Center

Colloquium Tea 3:45 PM to 4:15 PM 101A Crowley Commons Room