2006 Program on the High Dimensional Inference and Random Matrices

Bayesian Focus Week

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POSTER PRESENTATIONS

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"Lognormal Graphs"

I introduce the concept of lognormal graphs; a fairly large class of graphs that includes power-law graphs. I study how graphs in this class may arise, in the real world, and I find that they do in two sets of circumstances: (i) they are a powerful attractor and therefore may arise as a limit of a large class of multiplicative aggregation processes; (ii) they may arise as an artifact of the way we measure the presence of relations among objects in a population of interest. I then show that power-law graphs provide a first-order approximation to lognormal graphs.

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"Objective Priors in Conditional Independence Models"

In this study, we work on the star-shape models, where the precision matrix Ω is structured by the special conditional independence. In which, there are k +1 groups of normally distributed variables. The p0 variables in the first group are called global variables; they are correlated with all other variables. Variables in other groups are called local variables. Local Variables from different groups are independent of each other, even though that local variables in same group are still correlated. We re-parameterize - into (D; T) using Cholesky decomposition and work on the new parameter sets for deriving its reference prior, which is showed to be equivalent to the right Haar measure. The posterior distribution of the (D; T) under reference priors is derived and given in the random posteriors form.

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"Computing the Normalizing Constant by Monte Carlo Method and Model Selection for Discrete Graphical Models"

Let us assume that we are dealing with a contingency table where all variables are binary taking values 0 or 1 under a multinomial sampling scheme. Our goal is to pick a graph G that's best for the data in the sense that it has the highest posterior density. This posterior of a graph G given data will reduce to the ratio of two normalizing constants if we use a uniform prior on all possible graphs and the conjugate prior on the natural parameters of the multinomial distribution in exponential family form. Neither this ratio nor the normalizing constant itself has a closed form when the graph G is non-decomposable. We will present a Monte Carlo method to compute these normalizing constants and then do model selection based on the ratio of these constants, with applications to graphical models with 4 vertices, using simulated sample data from the smallest non-decomposable model: the 4-cycle. Of all the 64 possible models with 4 vertices, 62 are decomposable. Therefore, we know the theoretical values for the constants and a comparison will be given between the theoretical values and our Monte Carlo estimates to demonstrate that our method can give a numerically accurate estimate for the constants.

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"Local Graphical Model Search"

Compared to general graphical model search methods, we present here our work on local graphical model search algorithms. Local graphical model search algorithms will apply to the problem if we are only interested in one gene Y in thousands of genes in the gene expression data, for example, and wish to understand the graphical structure of Y and its graphical structure, where usual(global) graphical model search methods will not be efficient and precise. Also, the prediction of Y based on the local graphical structure is one of our interests. Monte Carlo Markov Chain methods and Shotgun Stochastic Search will be tried to do the search. We will provide several examples to analyze the efficiency as well as the precision of our algorithms.