

A Bayesian Approach to Joint Estimation of Multiple Graphical Models

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Abstract: The problem of joint estimation of multiple graphical models from high dimensional data has been studied in the statistics and machine learning literature, due to its importance in diverse fields including molecular biology, neuroscience and the social sciences. This work develops a Bayesian approach that decomposes the model parameters across the multiple graphical models into shared components across subsets of models and edges, and idiosyncratic ones. Further, it leverages a novel multivariate prior distribution, coupled with a pseudo-likelihood that enables fast computations through a robust and efficient Gibbs sampling scheme. We establish strong posterior consistency for model selection, as well as estimation of model parameters under high dimensional scaling with the number of variables growing exponentially with the sample size. The efficacy of the proposed approach is illustrated on both synthetic and real data.