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Title:

Gaussian variational approximation with structured covariance matrices

Abstract:
Variational approximation methods provide a scalable alternative to Markov chain Monte Carlo methods in Bayesian computational problems. In this talk we consider approximations to a posterior distribution from a Gaussian family when the model parameter is high-dimensional. Learning a Gaussian variational approximation is very challenging in high dimensions, because the number of parameters in the variational posterior covariance matrix grows quadratically with the number of model parameters which makes the variational optimization a very high-dimensional one unless further restrictions are made. In this talk we consider imposing sparsity in the precision matrix of such an approximation to reflect appropriate conditional independence structure in the model, which allows the Gaussian variational distribution to be both flexible and parsimonious. The sparsity is achieved through parameterization in terms of the Cholesky factor and efficient stochastic gradient methods are developed for the optimization. Alternative methods for structuring the covariance matrix of the posterior based on factor models will also be discussed briefly, and our approaches will be illustrated using generalized linear mixed models and state-space models for time series.