

Variational Bayesian Inference for Network Autoregression

Models

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Abstract

We develop a variational Bayesian (VB) approach for estimating large-scale dynamic network models in the network autoregression framework. The VB approach allows for the automatic identification of the dynamic structure of such a model and obtains a direct approximation of the posterior density. Compared to the Markov chain Monte Carlo (MCMC)-based sampling approaches, the VB approach achieves enhanced computational efficiency without sacrificing estimation accuracy. In a real data analysis scenario of day-ahead natural gas flow prediction in the German gas transmission network with 51 nodes between October 2013 and September 2015, the VB approach delivers promising forecasting accuracy along with clearly detected structures in terms of dynamic dependence.

Keywords: Dynamic network; EM algorithm; MCMC algorithm; Vector autoregression