Posterior consistency of nonparametric location-scale mixtures for multivariate density estimation

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Abstract:

Multivariate density estimation represents one of the most successful applications of Bayesian Nonparametrics. In particular, Dirichlet process mixtures of normal kernels are the golden standard for density estimation and their asymptotic properties have been studied extensively, especially in the univariate case. However a gap between practitioners and the current theoretical literature is present. So far posterior asymptotic results in the multivariate case are available only for location mixtures of Gaussian kernels with independent prior on the common covariance matrix, while in practice as well as from a conceptual point of view a location-scale mixture is often preferable. In this paper we address posterior consistency for such general mixture models by adapting a convergence rate result which combines the usual low-entropy, high-mass sieve approach with a suitable summability condition. Specifically, we establish consistency for Dirichlet process mixtures of Gaussian kernels with various prior specifications on the covariance matrix including priors that parsimoniously model the covariance via a sparse factor model.
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Keywords:

Bayesian Nonparametrics; Bayesian consistency; Factor model; Large support; Sparse random eigenmatrices.