

Exploiting sparse conditional structure in MALA-within-Gibbs

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Abstract: Markov chain Monte Carlo (MCMC) samplers are numerical methods for drawing samples from a given, targeted probability distribution. We discuss one particular MCMC sampler, the MALA-within-Gibbs sampler, from theoretical and practical perspectives. We first show that the acceptance rate and step size of this sampler are independent of the overall problem dimension when (1) the target distribution has sparse conditional structure; and (2) if this structure is reflected in the partially updating strategy of MALA-within-Gibbs. If, in addition, the target distribution is also block-wise log-concave, then the sampler's convergence rate is dimension independent. From a practical perspective, we expect that MALA-within-Gibbs is useful for solving high-dimensional Bayesian estimation where we expect sparse conditional structure to occur in the posterior distributions of many practically relevant problems. In this context, a partitioning of the state that correctly reflects the sparse conditional structure must be found and we illustrate this process in two numerical examples.