

Non-Reversible Guided Metropolis Algorithm

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Abstract

We construct a class of non-reversible Metropolis kernels as a multivariate extension of the guided-walk kernel proposed by Gustafson (1998). The main idea of our method is to introduce a projection that maps a state space to a totally ordered group. By using Haar measure, we construct a novel Markov kernel termed Haar-mixture kernel, which is of interest in its own right. This is achieved by inducing a topological structure to the totally ordered group. Our proposed method, the Δ -guided Metropolis-Haar kernel, is constructed by using the Haar-mixture kernel as a proposal kernel. The proposed non-reversible kernel is at least 10 times better than the random-walk Metropolis kernel and Hamiltonian Monte Carlo kernel for the logistic regression and a discretely observed stochastic process in terms of effective sample size per second. This is joint work with Xiaolin Song (Osaka University).

Keywords:

Markov Chain Monte Carlo; Reversibility; Haar Measure; Bayesian Inference.