Optimal scaling of random-walk metropolis algorithms on general target distributions

Jun Yang[1]; Gareth O. Roberts[2]; Jeffrey S. Rosenthal[3]

[1] University of Oxford
[2] University of Warwick
[3] University of Toronto

Abstract:
One main limitation of the existing optimal scaling results for Metropolis–Hastings algorithms is that the assumptions on the target distribution are unrealistic. In this paper, we consider optimal scaling of random-walk Metropolis algorithms on general target distributions in high dimensions arising from practical MCMC models from Bayesian statistics. For optimal scaling by maximizing expected squared jumping distance (ESJD), we show the asymptotically optimal acceptance rate 0.234 can be obtained under general realistic sufficient conditions on the target distribution. The new sufficient conditions are easy to be verified and may hold for some general classes of MCMC models arising from Bayesian statistics applications, which substantially generalize the product i.i.d. condition required in most existing literature of optimal scaling. Furthermore, we show one-dimensional diffusion limits can be obtained under slightly stronger conditions, which still allow dependent coordinates of the target distribution. We also connect the new diffusion limit results to complexity bounds of Metropolis algorithms in high dimensions.

Keywords:
Optimal scaling;random-walk Metropolis; Markov chain Monte Carlo;high dimensions

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