METROPOLIS ADJUSTED LANGEVIN TRAJECTORIES: A ROBUST ALTERNATIVE TO HAMILTONIAN MONTE-CARLO

L. RIOU-DURAND

ABSTRACT. Sampling approximations for high dimensional statistical models often rely on so-called gradient-based MCMC algorithms. It is now well established that these samplers scale better with the dimension than other state of the art MCMC samplers, but are also more sensitive to tuning [5]. Among these, Hamiltonian Monte Carlo is a widely used sampling method shown to achieve gold standard $d^{1/4}$ scaling with respect to the dimension [1]. However it is also known that its efficiency is quite sensible to the choice of integration time, see e.g. [4], [2]. This problem is related to periodicity in the autocorrelations induced by the deterministic trajectories of Hamiltonian dynamics. To tackle this issue, we develop a robust alternative to HMC built upon Langevin diffusions (namely Metropolis Adjusted Langevin Trajectories, or MALT), inducing randomness in the trajectories through a continuous refreshment of the velocities. We study the optimal scaling problem for MALT and recover the $d^{1/4}$ scaling of HMC proven in [1] without additional assumptions. Furthermore we highlight the fact that autocorrelations for MALT can be controlled by a uniform and monotonous bound thanks to the randomness induced in the trajectories, and therefore achieves robustness to tuning. Finally, we compare our approach to Randomized HMC ([2], [3]) and establish quantitative contraction rates for the 2-Wasserstein distance that support the choice of Langevin dynamics.

This is a joint work with Jure Vogrinc (University of Warwick)