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

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We introduce MALT: a new Metropolis adjusted sampler built upon the (kinetic) Langevin diffusion. Compared to Generalized Hamiltonian Monte Carlo (GHMC), the Metropolis correction is applied to whole Langevin trajectories, which prevents momentum flips, and allows for larger step-sizes. We argue that MALT yields a neater extension of HMC, preserving many desirable properties. We extend optimal scaling results of HMC to MALT for isotropic targets, and obtain the same scaling with respect to the dimension without additional assumptions. We show that MALT improves both the robustness to tuning and the sampling performance of HMC on anisotropic targets. We compare our approach with Randomized HMC, recently praised for its robustness. We show that, in continuous time, the Langevin diffusion achieves the fastest mixing rate for strongly log-concave targets. We then assess the accuracies of MALT, GHMC, HMC and RHMC when performing numerical integration on anisotropic targets, both on toy models and real data experiments on a Bayesian logistic regression. We show that MALT outperforms GHMC, standard HMC, and is competitive with RHMC.