UNBIASED KINETIC LANGEVIN MONTE CARLO WITH INEXACT GRADIENTS

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We present an unbiased method for Bayesian posterior means based on kinetic Langevin dynamics that combines advanced splitting methods with enhanced gradient approximations. Our approach avoids Metropolis correction by coupling Markov chains at different discretization levels in a multilevel Monte Carlo approach. Theoretical analysis demonstrates that our proposed estimator is unbiased, attains finite variance, and satisfies a central limit theorem. We prove similar results using both approximate and stochastic gradients and show that our method's computational cost scales independently of the size of the dataset. Our numerical experiments demonstrate that our unbiased algorithm outperforms the ``gold-standard" randomized Hamiltonian Monte Carlo. This is joint work with Neil Chada, Ben Leimkuhler, and Peter Whalley.