Piecewise deterministic Markov processes for MCMC - A large deviations analysis of the zig-zag sampler

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Abstract

Over the last decade piecewise deterministic Markov processes (PDMPs) have emerged as a new tool for MCMC simulation, potentially mitigating the problems of slow convergence and heavy computational cost exhibited by many other methods. The two main examples of such processes are the bouncy particle sampler and the zig-zag sampler. The idea of using PDMPs extends the ubiquitous discrete time MCMC methodology towards a new continuous time approach, having several advantageous aspects, for example non-reversibility and the possibility to reduce the computational effort per iteration by using subsampling techniques. In order to employ this new PDMP methodology a solid understanding of mathematical properties of these methods is necessary. Whereas the theoretical properties of PDMPs have been an active research area in recent years, our understanding of the performance of the corresponding MCMC methods is still incomplete. In particular knowledge of the speed of convergence of time averages is essential in choosing the most suitable sampling technology for a particular problem and in tuning the parameters of the chosen method.
In this talk I will discuss recent work on using large deviation results for empirical measures to study and compare the performance of PDMPs. We will start with a general discussion of non-reversible MCMC methods and the use of empirical measure large deviations in the simulation setting. We then focus on PDMPs, in particular the zig-zag sampler, and a large deviations analysis based on the Feng-Krutz approach; no previous knowledge of either PDMPs or large deviations will be necessary. This is based on joint work with Joris Bierkens and Mikola Schlottke.

Keywords: MCMC, piecewise deterministic Markov processes, large deviations

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