Metropolis-Hastings via Classification

Veronika Rockova
University of Chicago Booth School of Business.

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Abstract
This paper develops a Bayesian computational platform at the interface between posterior sampling and optimization in models whose marginal likelihoods are difficult to evaluate. Inspired by adversarial optimization, namely Generative Adversarial Networks (GAN), we reframe the likelihood function estimation problem as a classification problem. Pitting a Generator, who simulates fake data, against a Classifier, who tries to distinguish them from the real data, one obtains likelihood (ratio) estimators which can be plugged into the Metropolis-Hastings acceptance ratios. The resulting Markov chains generate, at a steady state, samples from an approximate posterior whose asymptotic properties we characterize. Drawing upon connections with empirical Bayes and Bayesian misspecification, we quantify the convergence rate in terms of the contraction speed of the actual posterior and the convergence rate of the Classifier. Asymptotic normality results are also provided which justify inferential potential of our approach. We illustrate the usefulness of our approach on simulated data. (Joint work with Tetsuya Kaji)

References

[1] T. Kaji, V. Rockova. Metropolis-Hastings via classification, Preprint accessible at http://veronikarock.com/MHC.pdf