Adaptive Importance Sampling via Stochastic Convex Programming

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Working paper. Originally posted November 2014.

- Manuscript

We show that the variance of the Monte Carlo estimator that is importance sampled from an exponential family is a convex function of the natural parameter of the distribution. With this insight, we propose an adaptive importance sampling algorithm that simultaneously improves the choice of sampling distribution while accumulating a Monte Carlo estimate. Exploiting convexity, we prove that the method's unbiased estimator has variance that is asymptotically optimal over the exponential family.