Stat 221 final project description, Fall 2014
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Final project on sampling with stochastic gradient methods

Welling and Teh (2014) developed a method (SGLD) for fast posterior sampling on large Bayesian models using stochastic gradients. Their method is a case of Langevin dynamics which is also a case of Hamiltonian Monte Carlo (HMC). You will replicate the experiments in that paper and investigate the performance of this new sampling algorithm.

1 Literature review (5pts)

Read the papers in the bib folder, with the main focus on the Welling and Teh paper. Write a short technical account of their method, and why their method works. You may want to talk about HMC, and Langevin dynamics as well. We also included a recent paper that has a concrete proof using stochastic calculus which could be very helpful for this task.

2 Tasks (15pts)

1. (5pts) **Implementation #1**. Implement the method proposed by the authors and demonstrate using the experiments presented in Section 5.1 of their paper. Replicate Figures 1 and 2.

2. (5pts) **Implementation #2**. Implement the logistic regression example of 5.2 and replicate Figure 3.

3. (5pts) **Implementation #3**. Use the SGLD method to sample from the banana-shaped posterior in the Raftery model we saw in class. Replicate the key figures and present clear arguments on whether the method works or not, and why. Compare with your own implementation of the MCMC sampler for that model.

3 Conclusion (5pts)

Write a conclusion of your research giving a summary of theoretical and empirical results, and give concrete recommendations for the practicioners who wish to use the SGLD method for posterior sampling of a Bayesian model.