
Stochastic Variational Inference

Shibhansh Dohare

IIT Kanpur

14644

sdohare@iitk.ac.in

Siddhartha Saxena

IIT Kanpur

150719

siddsax@iitk.ac.in

Jaivardhan Kapoor

IIT Kanpur

150300

jkapoor@iitk.ac.in

1 Problem Definition

Variational Inference is one of the most popular method for Bayesian inference with faster convergence than MCMC methods to calculate non-conjugate prior and likelihood models using optimization. The idea is to first propose a family of distributions which can approximate the target distribution then use optimization to choose the closest member from the family. But VI comes with its limitations like not being able to scale on a larger dataset and the boundations imposed in choosing the prior and likelihood models due to the requirement of calculation of expected values in the Evidence Lower Bound (ELBO) among many others. We aim to improve upon those approximations by reconsidering the lower bound that we maximize, among other mentioned methods.

2 Project Goals

There are quite a few project goals that we have and we would want to explore further and achieve as many as possible.

- We shall do a literature survey to explore the the recent improvements done in the basic Variational Inference, as well as finding the issues related to them, to further improve them.
- We'll implement the Stochastic VI algorithm to some of the VI models on which it has not been done before.
- Try to reduce the limitations imposed by the calculation of expected value via a sampling method or otherwise.

References

- D. M. Blei, A. Kucukelbir, and J. D. McAuliffe. Variational Inference: A Review for Statisticians. *ArXiv e-prints*, 2016.
- Tamara Broderick, Nicholas Boyd, Andre Wibisono, Ashia C. Wilson, and Michael I. Jordan. Streaming Variational Bayes. *NIPS*, 2013.
- M. Hoffman, D. M. Blei, C. Wang, and J. Paisley. Stochastic Variational Inference. *ArXiv e-prints*, 2012.
- Yingzhen Li, Richard E. Turner, and Jose Miguel Hernandez Lobato. Stochastic Expectation Propagation. *NIPS*, 2015.
- Andrew C. Miller, Foti Nicholas, and Ryan P. Adams. Variational Boosting: Iteratively Refining Posterior Approximations. *ArXiv e-prints*, 2012.
- Maxim Rabinovich, Elaine Angelino, and Michael I. Jordan. Variational Consensus Monte Carlo. *NIPS*, 2016.
- Rajesh Ranganat, Dustin Tran, and David M. Blei. Hierarchical Variational Models. *ArXiv e-prints*, 2016.

Rajesh Ranganath, Sean Gerrish, and David M. Blei. Black Box Variational Inference. *AISTATS*, 2014.