Rejection Sampling Variational Inference

Christian A. Naesseth, Francisco J. R. Ruiz, Scott W. Linderman, David M. Blei

Linköping University, Columbia University, University of Cambridge

December 9th, 2016
Overview

- **Goal:** General variational inference for probabilistic models
- Reparameterization allows for low-variance gradient estimators
- But it is available for some distributions only
- We show how to extend reparameterization to other distributions
Main Idea

Every random variable that we can simulate on our computers is ultimately a transformation of elementary random variables

- In theory, this should allow for reparameterization of any distribution
- Challenge: rejection sampling steps
  - Discontinuities
  - We cannot push gradient inside integral
Main Idea

*Every random variable that we can simulate on our computers is ultimately a transformation of elementary random variables*

- In theory, this should allow for reparameterization of any distribution
- Challenge: rejection sampling steps
  - Discontinuities
  - We cannot push gradient inside integral
- Our approach: Marginalize out auxiliary variables
- Leverage ideas from reparameterization used in rejection sampling (60+ years of research)
Results

Model: Sparse gamma deep exponential family

![Graph showing ELBO over time for different methods: ADVI, BBVI, G-REP, RSVI. The x-axis represents time in seconds (s), and the y-axis represents ELBO values. The graph compares the performance of these methods in terms of the ELBO loss over time.](image-url)