Variational Inference with Normalizing Flows

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Introduction

- Calculating the true posterior distribution of inference tasks is in most cases an intractable problem.
- Lots of research on approaches for efficient approximation of the posterior, however the resulting classes prove to be of limited expressiveness.
- The authors in [1] introduce the notion of normalizing flows, sequences of invertible transformations applied to a simple initial density, to efficiently create more expressive families of candidate posteriors to be used for variational inference.
- We compare the performance of different types of normalizing flows on the MNIST dataset.

Our Work

- Reproduced experiment on MNIST using Linear Normalizing Flows
- Reproduced experiment on MNIST using NICE
- Extended the ideas of the paper and experimented with Invertible Convolutional Flows
- Created open-source Github repository with code and results: `github.com/ATML-Group-12/normalising_flows`

Theoretical Background

- **TODO!!!**
- Focus on theory between NFs here, specifically Linear NFs and NICE
- ELBO
- Stochastic Backpropagation
- Deep Latent Gaussian Models
- Flows
- Non-Linear Independent Components Estimation

Theoretical Background

TODO We formulate... $\mathcal{S} = \{s_1, s_2, s_3, s_4, s_5, s_6\}$
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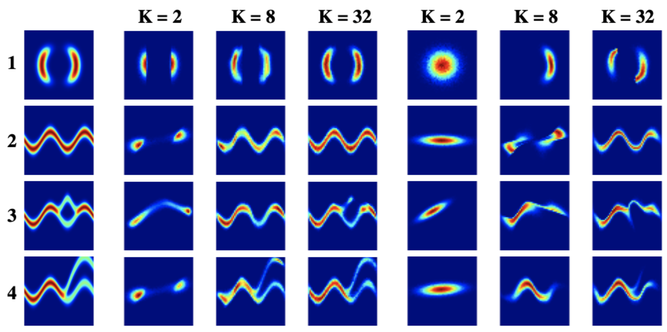
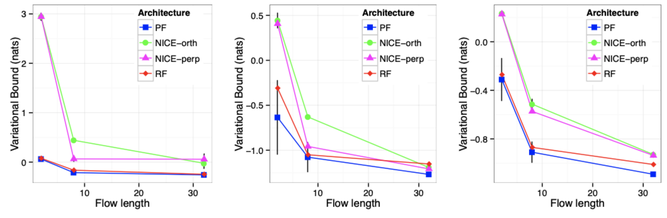


(a) (b) Norm. Flow (c) NICE

Experiments

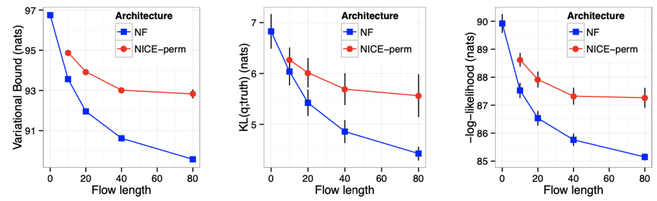
- DLGM + NF
- DLGM + NICE



(d) Comparison of KL-divergences.

Results

TODO!!! Results...



(a) Bound $\mathcal{F}(\mathbf{x})$ (b) $\mathbb{D}_{\mathrm{KL}}(q; p(z|x))$ (c) $-\ln p(\mathbf{x})$

Figure 4. Effect of the flow-length on MNIST.

Our Improvements and Extensions

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References

[1] Danilo Jimenez Rezende and Shakir Mohamed. Variational inference with normalizing flows, 2015.
[2] Laurent Dinh, David Krueger, and Yoshua Bengio. Nice: Non-linear independent components estimation, 2014.