Approximating exponential family models (not single distributions) with a two-network architecture

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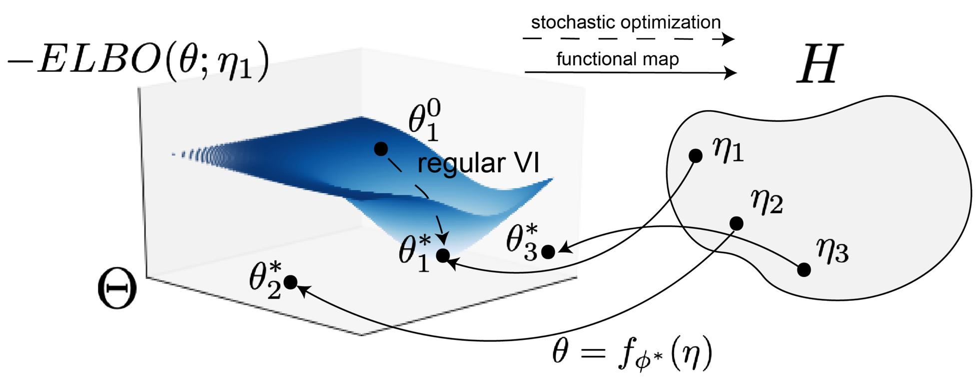
Motivation

- Variational inference (VI) incurs a cost of optimization ~~to find optimal variational parameters $\theta^* \in \Theta$ of the approximate inference model.~~
- Intractable exponential family models
  - an exp fam likelihood
  - i.i.d. observations
  - a nonconjugate prior
- We can learn a smooth function $f_{\phi^*} : H \rightarrow \Theta$ mapping η to θ^* using a two-network architecture called exponential family networks (EFN).



- EFNs ~~learn *models* of exponential families (not single distributions), and~~ afford substantial computational savings through amortized VI.

Methods

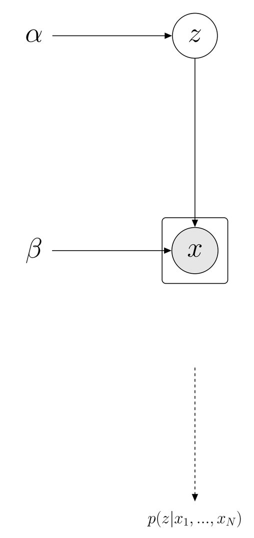
Exponential families as target models

- Exponential family models $\mathcal{P}$ have the form

$$\mathcal{P} = \left\{ \frac{h(\cdot)}{A(\eta)} \exp\left\{\eta^\top t(\cdot)\right\} : \eta \in H \right\}$$

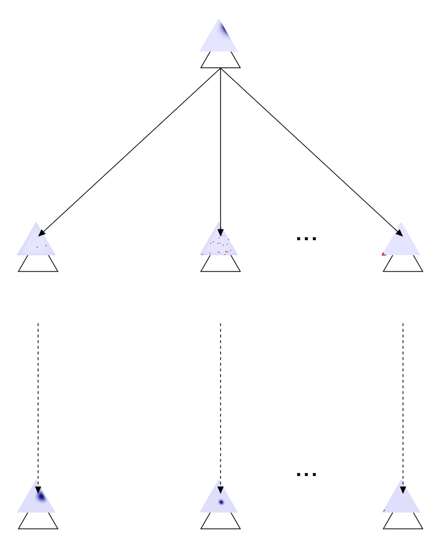
with natural parameter η, sufficient statistics $t(\cdot)$, base measure $h(\cdot)$, and log normalizer $A(\eta)$.

- We focus on the fundamental problem setup of probabilistic inference: N conditionally independent observations x_i given latent variable z.

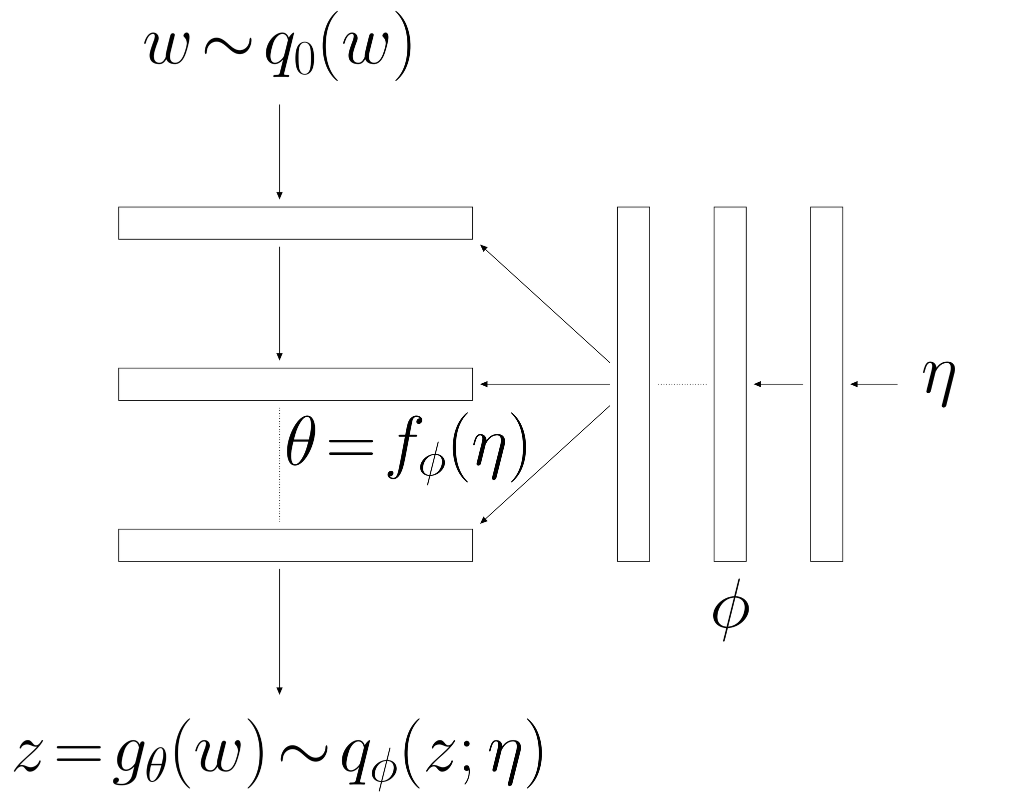


$$p_0(z) = \frac{1}{A_0(\alpha)} \exp\left\{\alpha^\top t_0(z)\right\}$$

$$p(x_i|z) = \frac{1}{A(z)} \exp\left\{\nu(z)^\top t(x_i)\right\}$$



Exponential family networks (EFNs)



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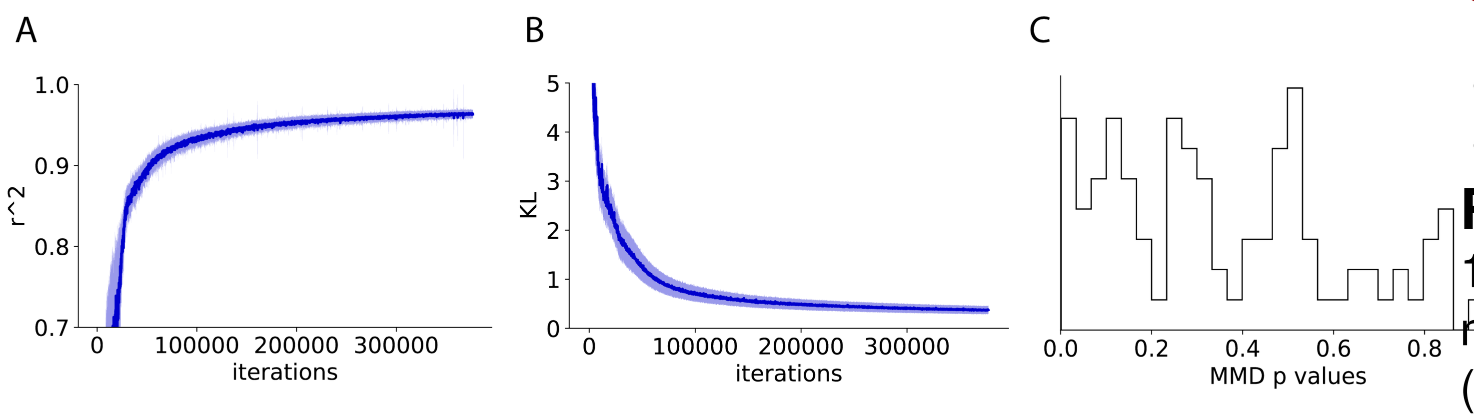
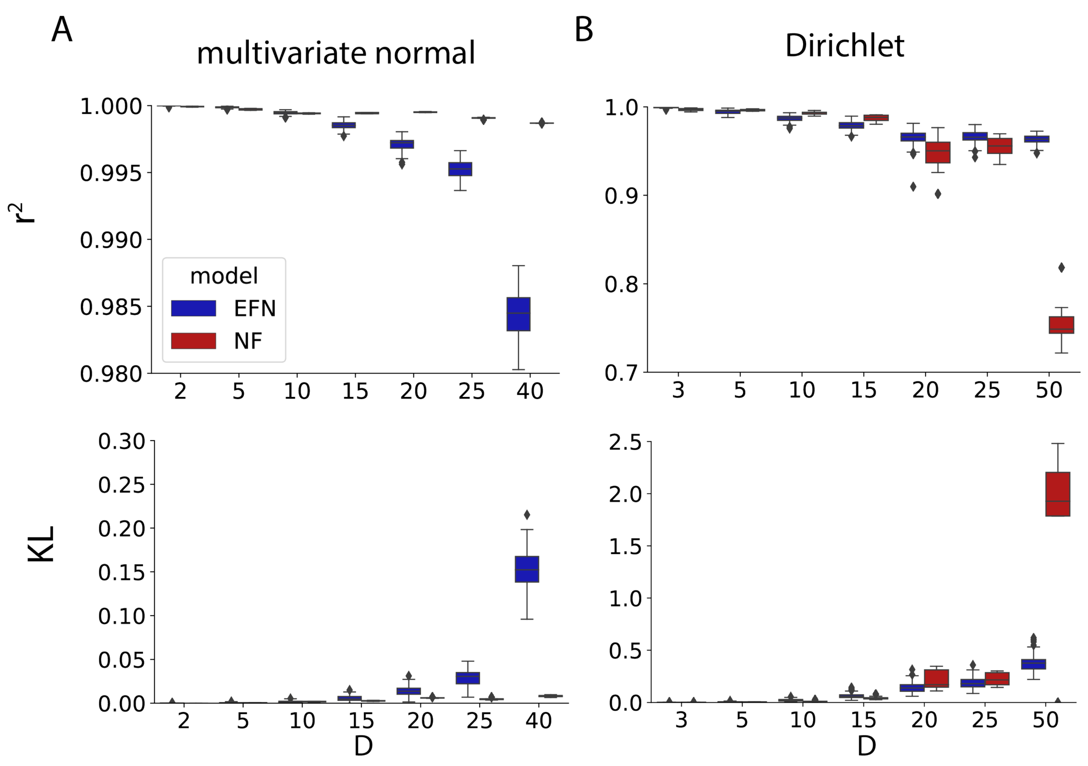
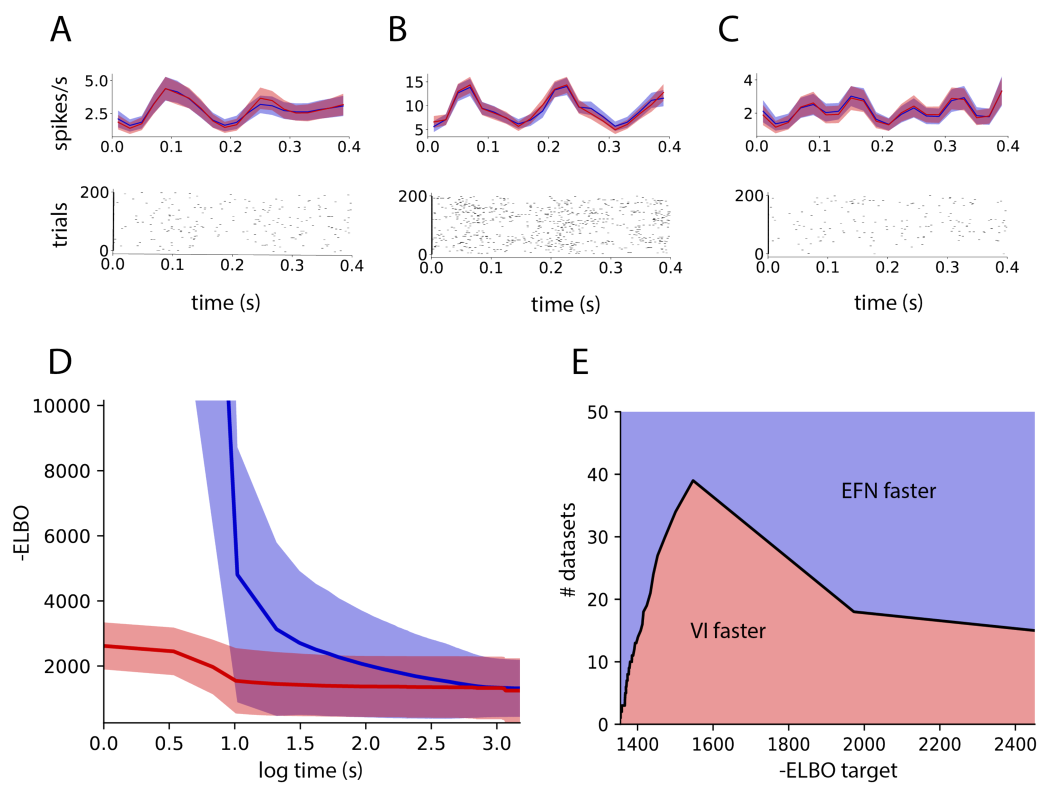




More stuff



Summary

- Summary point 1
- Summary point 2

References

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2. Dipoppa, M., et al. "Vision and locomotion shape the interactions between neuron types in mouse visual cortex." Neuron (2018).
3. Mastrogiuseppe, F., and S. Ostojic. "Linking connectivity, dynamics, and computations in low-rank recurrent neural networks." Neuron (2018).

Acknowledgements

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