UNIVERSITY OF CAMBRIDGE
DEPARTMENT OF ENGINEERING

Hierarchical Decompositional Mixtures of Variational Autoencoders

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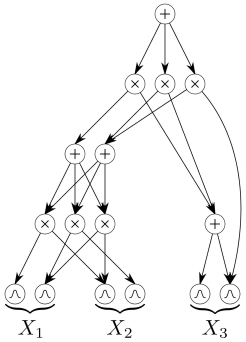
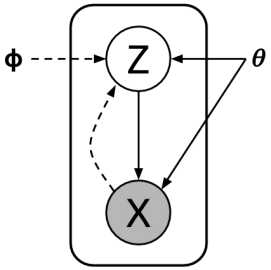
Computational and Biological Learning

In Short



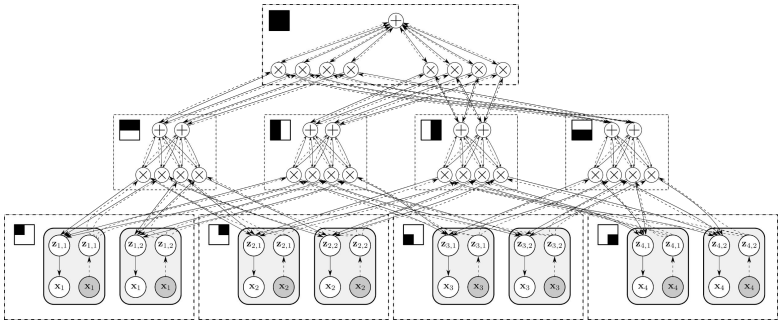
Sum Product Network

+



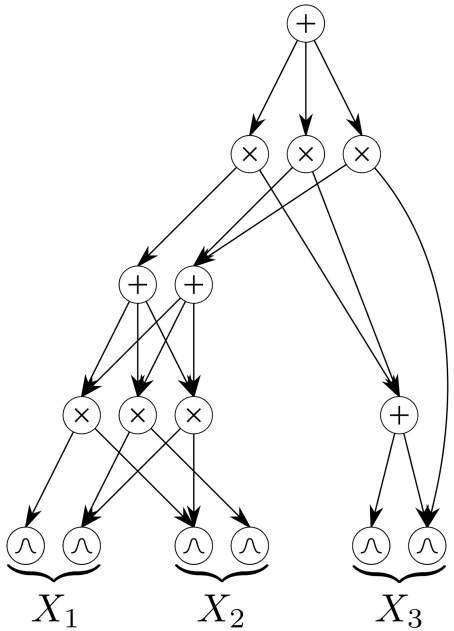
Variational Autoencoder

=



SPVAE

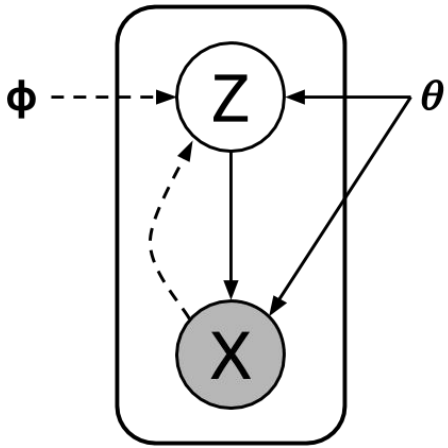
Sum Product Network



Deep mixture of factorized distributions

A glue to hold together many simple distributions

Variational Autoencoder



A latent variable probabilistic model

$$p(x) = \int p_\theta(x|z)p(z)dz$$

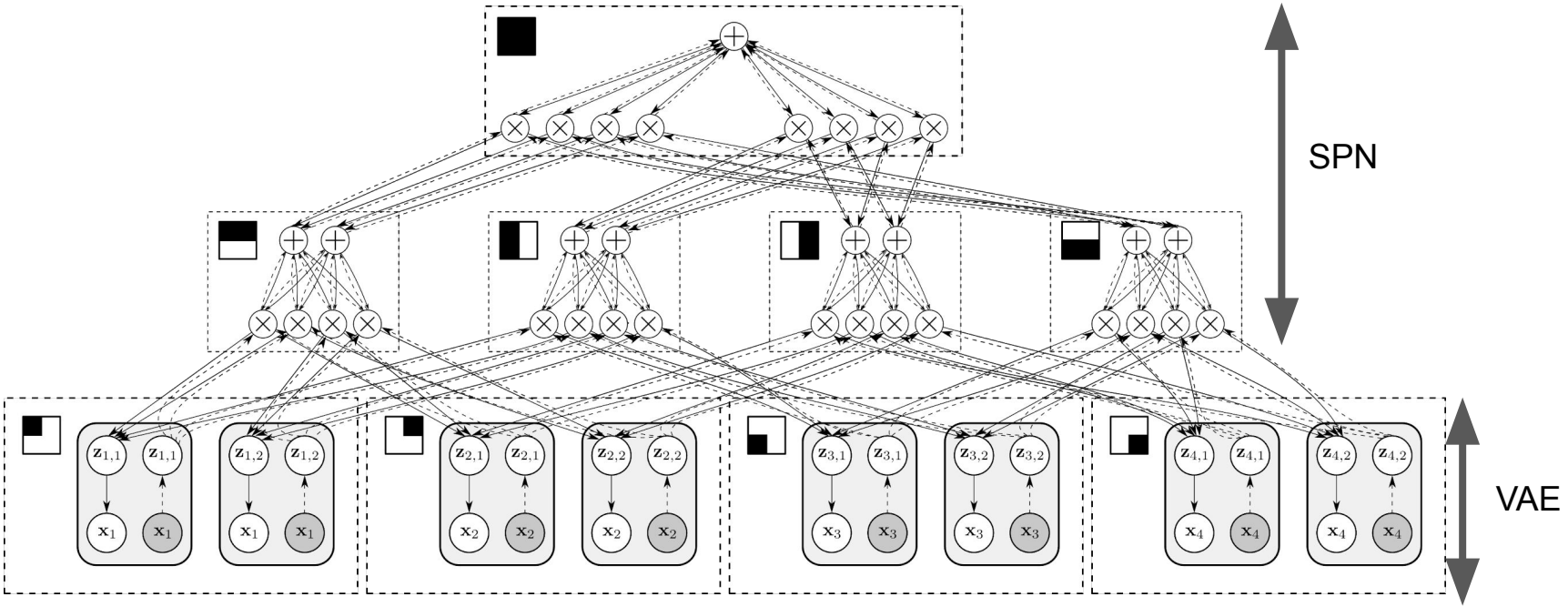
Generative Latent

Density Network
(Mackay 1995)

$$\log p(x) \geq \mathbb{E}_{q_\phi(z|x)}\left[\log \frac{p_\theta(x,z)}{q_\phi(z|x)}\right] = \mathcal{L}$$

Just another distribution

Sum-Product Variational Autoencoder



Sum-Product Variational Autoencoder

$$\sum_i P(x_i) \quad \checkmark$$

$$\text{logsumexp}_i(ELBO_i) \quad ?$$

Sum-Product Variational Autoencoder

$$\sum_i P(x_i)$$ ✓

$$\text{logsumexp}_i(ELBO_i)$$ ✓

Empirical Results

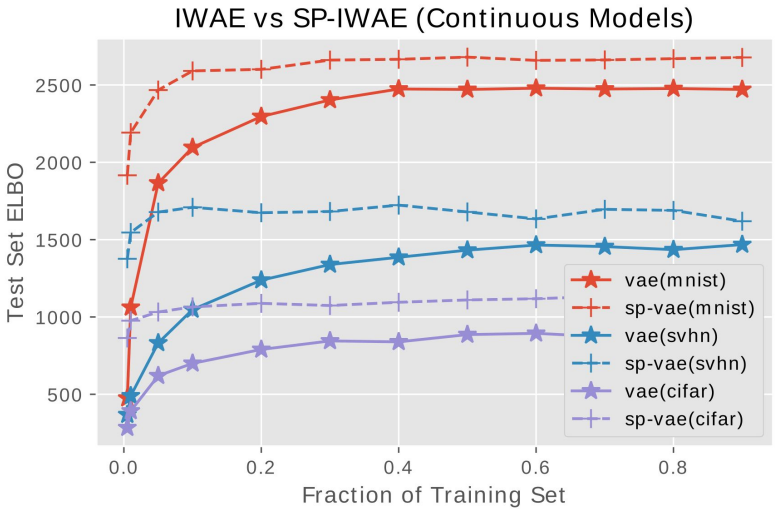
Better test set performance

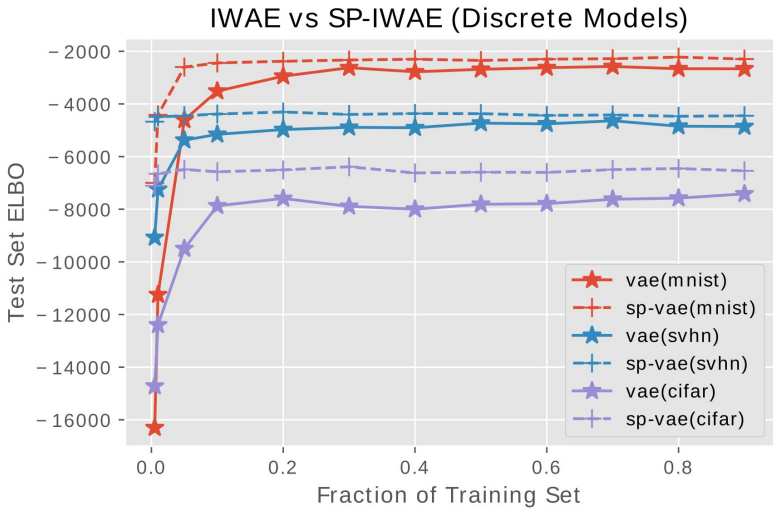
Table 1. Performance on test set, 5000-sample IWAE ELBO

	Continuous			Discrete		
	mnist	svhn	cifar	mnist	svhn	cifar
SPVAE	**2819**	**1936**	**1283**	**-1532**	**-3891**	**-5543**
VAE	2598	1442	896	-2351	-4965	-7200
Conv-SPVAE	2702	**2101**	**1397**	**-927**	**-3666**	**-4562**
Conv-VAE	**2907**	1896	1191	-2099	-4115	-6752

Empirical Results

More data efficient learning





Thank You

 https://github.com/cambridge-mlg/SPVAE