

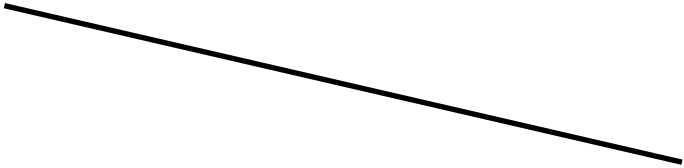
Siddhant Mishra-Sharma (MIT/AI FI) Summer School

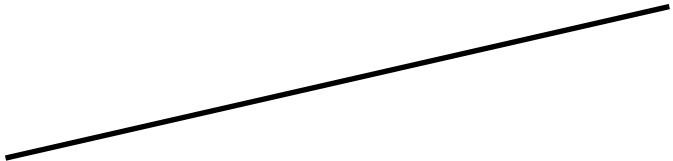
162

2

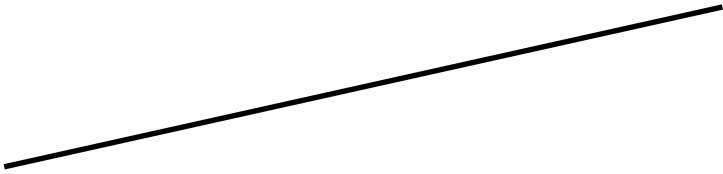
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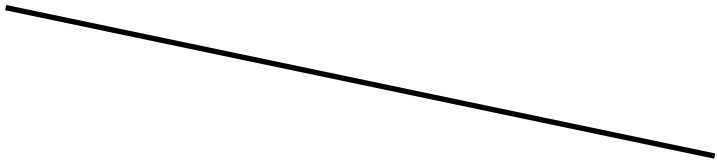
VAEs in practice















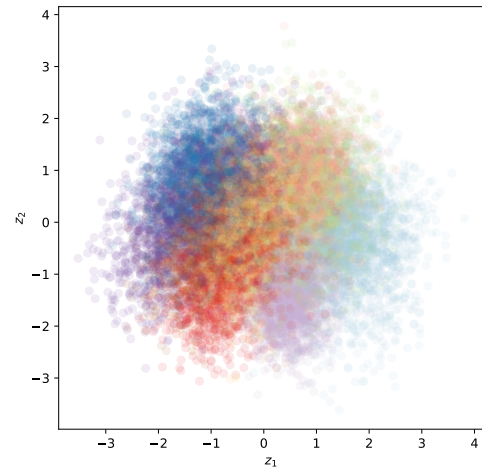
$$\text{ELBO} = \left\langle \log p_{\vartheta}(x \mid z) \right\rangle_{q_{\varphi}} - D_{\text{KL}}\left(q_{\varphi}(z \mid x) \parallel p(z)\right)$$

$$\langle \log p_{\vartheta}(x \mid z) \rangle_{q_{\varphi}} \quad \frac{\text{Reconstruction (e.g., MSE, ...)}}{\|x - x'\|_2^2}$$

2



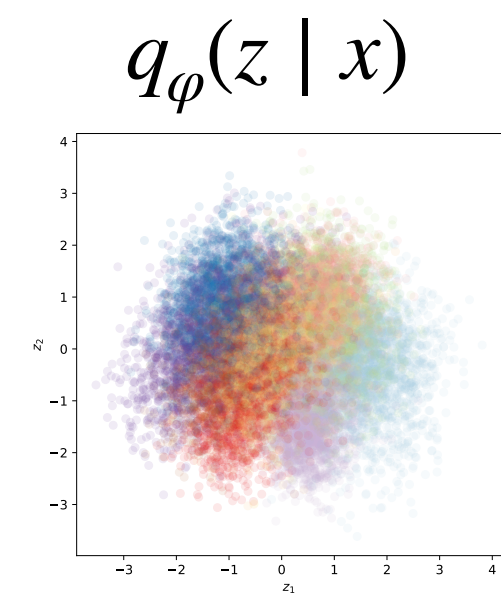
$$q_{\phi}(z \mid x)$$



$$D_{\text{KL}} \left(q_{\phi}(z \mid x) \parallel p(z) \right)$$

Regularization

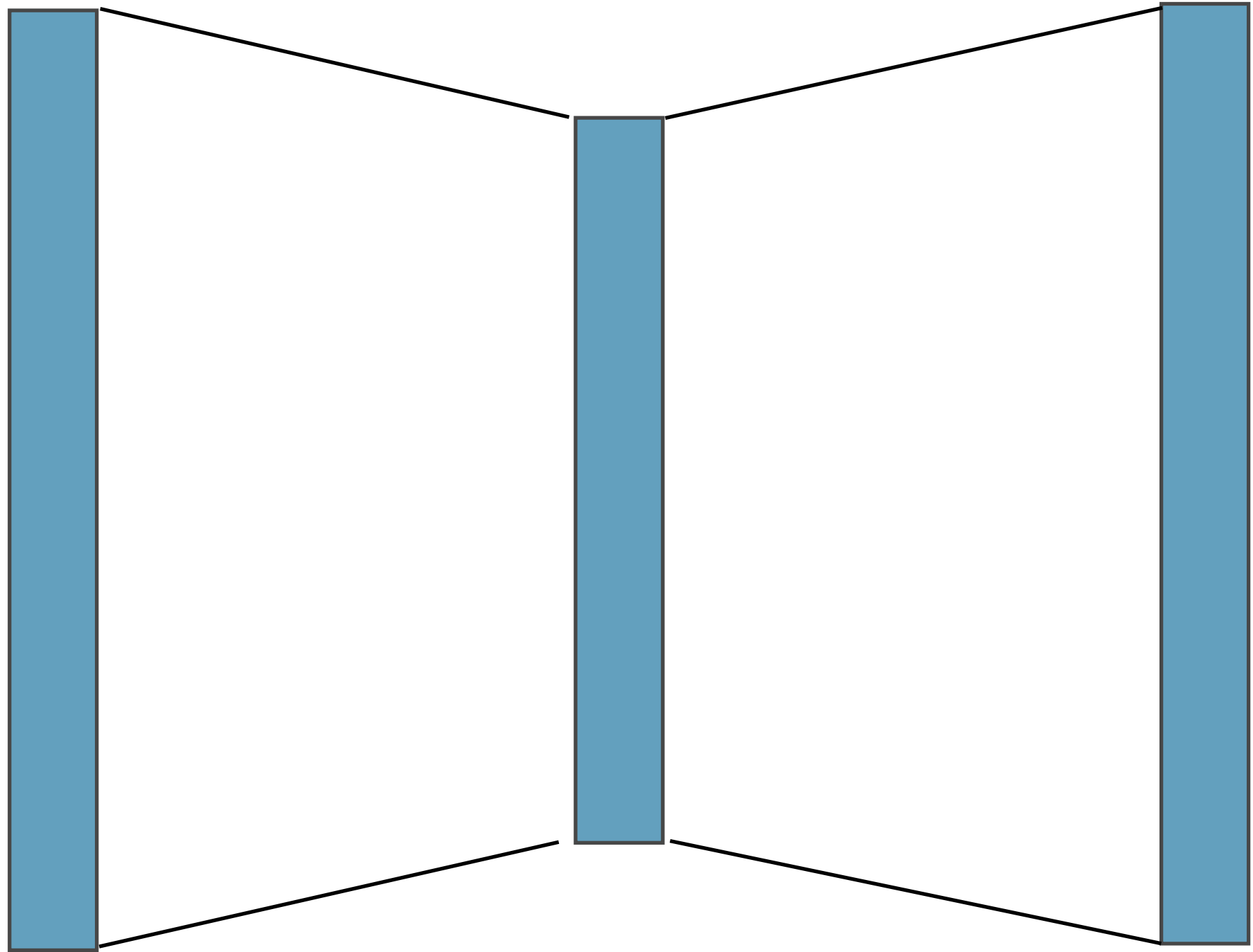
VAEs in practice



$$\text{ELBO} = \langle \log p_\theta(x | z) \rangle_{q_\phi} - D_{\text{KL}} \left(q_\phi(z | x) \parallel p(z) \right)$$

$$D_{\text{KL}} \left(q_\phi(z | x) \parallel p(z) \right)$$

Regularization



$\langle \log p_\theta(x | z) \rangle_{q_\phi}$ Reconstruction (e.g., MSE, ...) $\|x - x'\|_2^2$

A semantically meaningful latent space

The KL-term enforces simplicity in the latent space, encouraging learned semantic structure and *disentanglement*

Pure reconstruction

More latent regularization

