



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



170

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3

*A Bayesian latent-variable model optimized with variational inference*



A diagram showing a large rounded rectangle representing a set  $N$ . Inside this rectangle, there are two circles. The left circle is dark gray and contains the letter  $z$ . The right circle is blue and contains the letter  $x$ . The letter  $N$  is located in the top right corner of the rectangle.

$z$

$x$

$N$

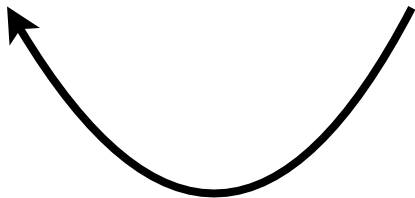
Maximizing ELBO

$\equiv$  Minimizing *reverse* KL

$\equiv$  “Aligning the forward and reverse processes”

$$\textit{Minimize} \left\langle \log \frac{q(x, z)}{p(x, z)} \right\rangle$$





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

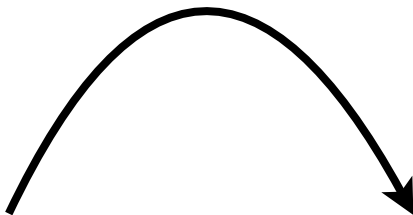
**Forward process**

*It's so over*

*We're so back*

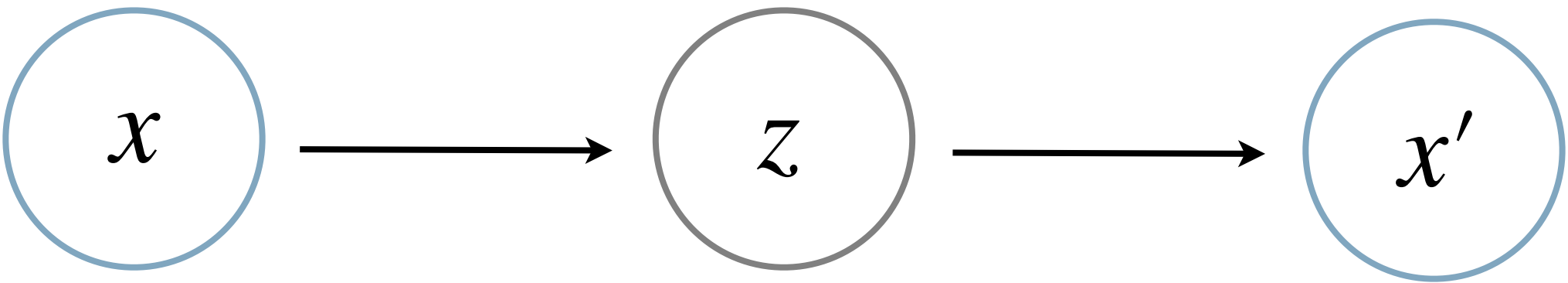
## Reverse process

$$p_{\theta}(x | z) \cdot p(z)$$



Forward process

Reverse process



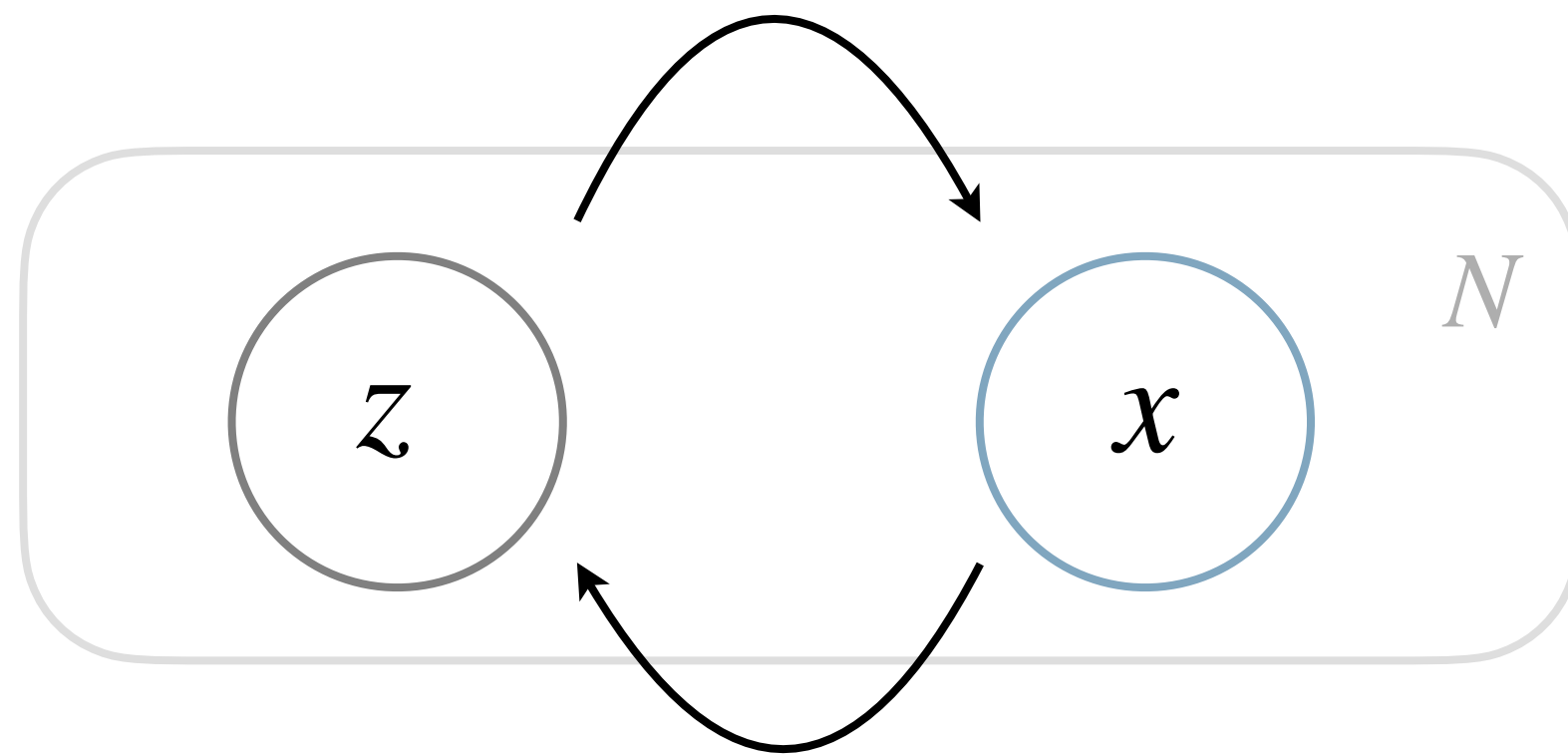
Latents

# A Bayesian latent-variable model optimized with variational inference

*We're so back*

**Reverse process**

$$p_{\theta}(x | z) \cdot p(z)$$



$$q_{\phi}(z | x) \cdot p(x)$$

**Forward process**

*It's so over*

Maximizing ELBO

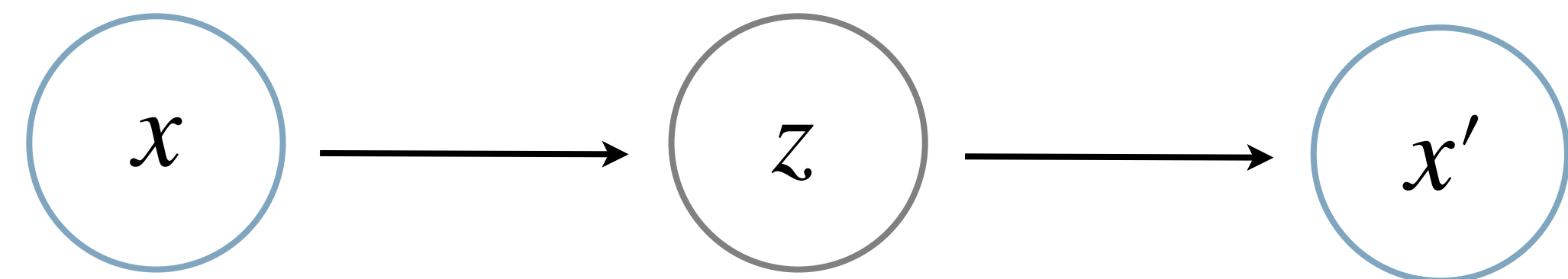
$\equiv$  Minimizing *reverse* KL

$\equiv$  "Aligning the forward and reverse processes"

$$\text{Minimize } \left\langle \log \frac{q(x, z)}{p(x, z)} \right\rangle$$

**Forward process**

**Reverse process**



**Latents**



**Christopher Yau**

@cwcyau

...

People do realise that a variational autoencoder comes from the application of variational inference to a Bayesian latent variable model right? It isn't an arbitrary loss function with a KL term stuck on to it with a tweakable parameter to balance the two?

<https://twitter.com/cwcyau/status/1440434674556227591>