VAE

Observed data is supposedly generated by an unknown function of continuous latent variables

$$X = G(z; \theta_g)$$

 We would like to infer these salient attributes z based on observed X,

$$pr(z \mid X) = \frac{pr(X \mid z)pr(z)}{pr(X)},$$
 Intractable

• Recognition Model approximates pr(z|X)

$$\mu, \sigma = Q(X; \theta_e)$$
$$q(z | X) = \mathcal{N}(\mu, \sigma)$$

VAE

z is assumed to have a prior probability distribution

$$pr(z) = \mathcal{N}(0,1)$$

The training loss for VAE becomes,

$$L = \frac{1}{N} (L_{reconstruction} + L_{divergence})$$

$$L = \frac{1}{N} ((\hat{X} - X)^2 + \beta \sum_{j}^{z_{dim}} KL(q_j(z \mid X) \mid |p(z)|))$$

Training Objective :

$$\theta_{e}, \theta_{g} = argmin\{\frac{1}{N}((\hat{X} - X)^{2} + \beta \sum_{j}^{z_{dim}} KL(q_{j}(z \mid X) \mid |p(z)))\}$$