

# Diffusion Model

## I. Encoder

$$q(x_t | x_0) = \mathcal{N}(x_t; \sqrt{\alpha_t} x_0, (1 - \alpha_t) I)$$

$$x_0 = \frac{x_t - \sqrt{1 - \alpha_t} \epsilon}{\sqrt{\alpha_t}}$$

## II. Decoder

$$q(x_{t+1} | x_t, x_0) = \mathcal{N}(x_{t+1}; M(x_t, x_0), \Sigma(t) I)$$

$$p_{\theta}(x_{t+1} | x_t) = \mathcal{N}(x_{t+1}; \mu_{\theta}(x_t, t), \Sigma(t) I)$$

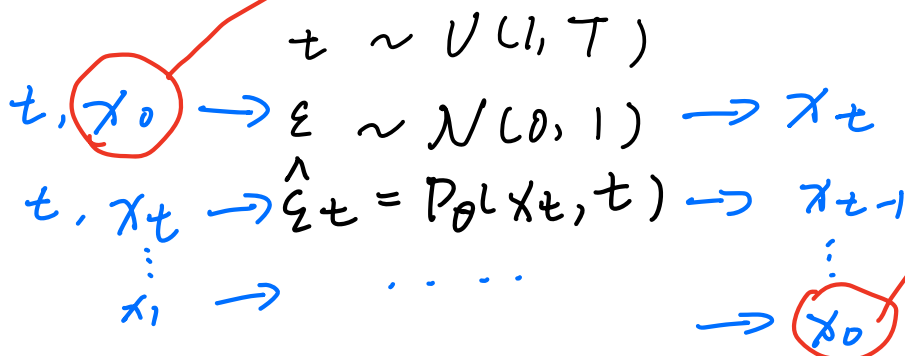
$$\frac{\sqrt{\alpha_t}(1 - \alpha_{t-1})x_t + \sqrt{\alpha_{t-1}}(1 - \alpha_t)x_0}{1 - \alpha_t}$$

$$\frac{1}{\sqrt{\alpha_t}} \left( x_t - \frac{1 - \alpha_t}{\sqrt{1 - \alpha_t}} \hat{\epsilon}_{\theta}(x_t, t) \right)$$

$$\arg \min_{\theta} \mathbb{E} \|\hat{x}_{\theta}(x_t, t) - x_0\|_2^2$$

$$\arg \min_{\theta} \mathbb{E} \|\epsilon - \hat{\epsilon}_{\theta}(x_t, t)\|_2^2$$

## III. Train.



LOSS