Denoising Objective Function

Part 3/7: Reverse Process

Simplified Loss

✓ Preferred

$$L_{simple} = E_{t,x_0,\varepsilon}[||\varepsilon - \varepsilon_\theta(x_t, t)||^2]$$

Works better in practice

Variational Lower Bound

$$L_{vlb} = E[\log p(x_0) - \log p_\theta(x_0)]$$

Theoretical foundation

🎯 Practical Training Process

1 Sample Timestep

$t \sim \text{Uniform}\{1,\ldots,T\}$

→

2 Sample Noise

$\varepsilon \sim N(0, I)$

→

3 Create Noisy Sample

$$x_t = \sqrt{\bar{\alpha}_t} \cdot x_0 + \sqrt{(1-\bar{\alpha}_t)} \cdot \varepsilon$$

→

4 Gradient Descent

Update θ to minimize loss

⚡ Optimization Objective

$$\text{minimize } ||\varepsilon - \varepsilon_\theta(x_t, t)||^2$$