$G: Z \to X$.

$D: X \to [0, 1]$.

$$L_D = -\mathop{\mathbb{E}}_{x \sim X} \log D(x) - \mathop{\mathbb{E}}_{z \sim} \log(1 - D(G(z)))$$

$$-\sum p(x) \log q(x)$$

$$-\log q(x_{true})$$

DCGAN

$$L_G = \mathop{\mathbb{E}}_{z \sim N(0, \mathbb{1})} \log(1 - D(G(z)))$$

$G(z) \to const$.

- Inpainting
- Virtual try-on
- Satelite → map
- GTA5 → real
- Face → cartoon

Image 2 Image translation

$$G(X_{D_s}, l_t) \rightarrow X \sim P_{D_t}$$

$$D(X, l) \rightarrow [0, 1]$$

$$L_D = -\mathop{\mathbb{E}}_{x \sim X} \log D(x, l_{true}) - \mathop{\mathbb{E}}_{\tilde{x} \sim P_{Di\to target}} \log\left(1 - D(G(x, l_{target}), l_{target})\right)$$

$$L_G = \mathbb{E} \log\left(1 - D(G(x, l_{target}), l_{target})\right) + \|G(G(x_s, t), s) - x_s\|_2$$

cycle-consistency loss

$$\hat{x} = G(G(x_s, t), s)$$

$$\|\hat{x} - x\|_2$$

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1) $G : R(E(x, l_s), l_t)$

$h_s = E(x_s, s)$

$x_t = R(h_s, t)$

$h_t = E(x_t, t)$

$\hat{x}_s = R(h_t, s)$

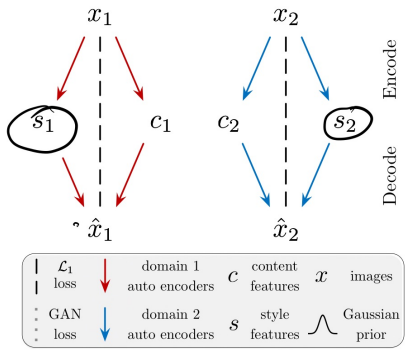
$\hat{h}_s = E(\hat{x}_s, s)$

$\|h_s - \hat{h}_s\|$

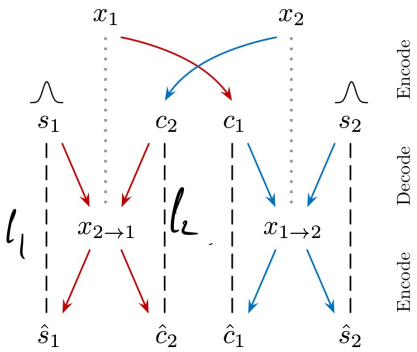
$h_{str} = E_{structure}(X)$

$h_{style} = E_{style}(X, L)$

$R(h_{str}, h_{style})$



(a) Within-domain reconstruction



(b) Cross-domain translation

$[c, z]$

$z \sim N(0, 1)$