

CycleGAN

Cycle-Consistent Adversarial Networks

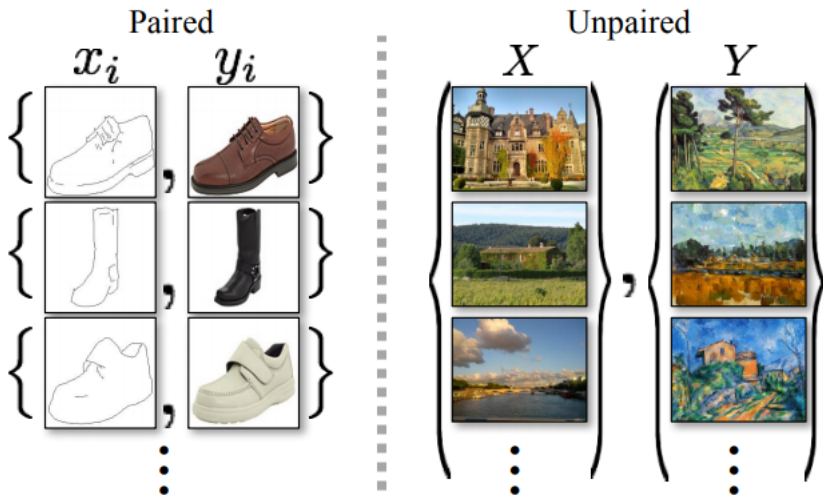
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Summary

- 1 Image-to-image translation
- 2 Mathematical Model
- 3 One-way GAN
- 4 CycleGAN
- 5 Have a try
- 6 Reference

Image-to-image translation



Mathematical Model

First step

$$G : X \rightarrow Y$$

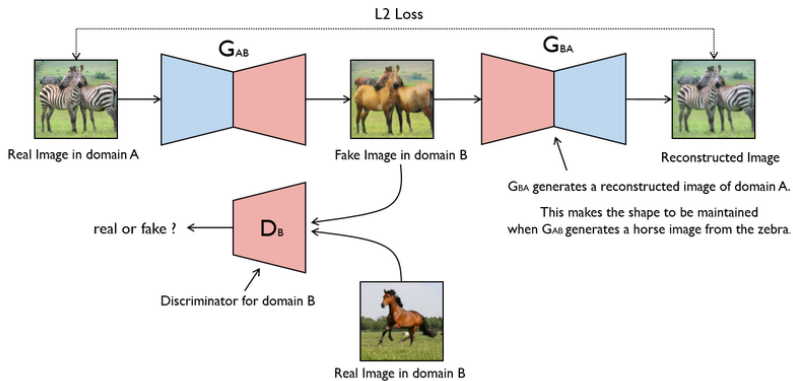
Second step

$$F : Y \rightarrow X$$

Cycle consistency loss

$$F(G(X)) \approx X$$

One-way GAN



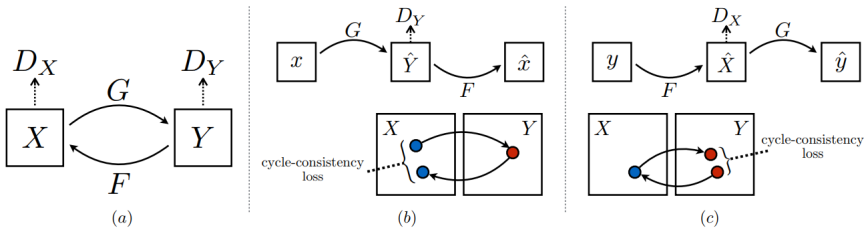
Adversarial Loss :

$$\mathcal{L}_{GAN}(G_{AB}, D_B, A, B) = \mathcal{E}_{b \sim B}[\log D_B(b)] + \mathcal{E}_{a \sim A}[\log(1 - D_B(G_{AB}(a)))]$$

Cycle Consistency Loss :

$$\mathcal{L}(G_{AB}, G_{BA}, A, B) = \mathcal{E}_{a \sim A}[\| G_{BA}(G_{AB}(a)) - a \|_1]$$

CycleGAN



Full Objective

Adversarial Loss :

$$\mathcal{L}_{GAN}(G, D_Y, X, Y) = \mathcal{E}_{y \sim P_{data(y)}} [\log D_Y(y)] + \mathcal{E}_{x \sim P_{data(x)}} [\log(1 - D_Y(G(x)))]$$

$$\mathcal{L}_{GAN}(F, D_X, Y, X) = \mathcal{E}_{x \sim P_{data(x)}} [\log D_X(x)] + \mathcal{E}_{y \sim P_{data(y)}} [\log(1 - D_X(F(y)))]$$

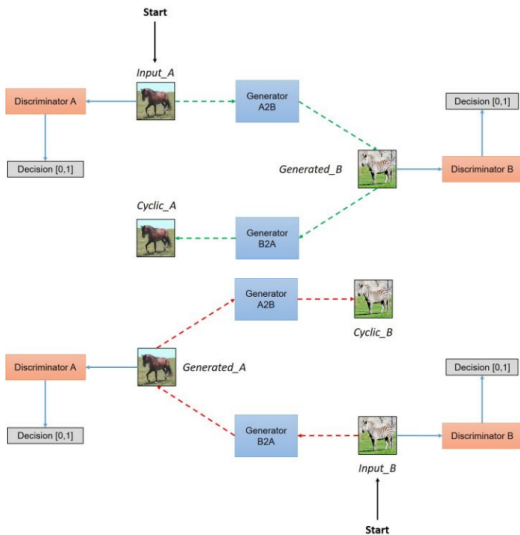
Cycle Consistency Loss :

$$\mathcal{L}_{cyc}(G, F) = \mathcal{E}_{x \sim P_{data(x)}} [\| F(G(x)) - x \|_1] + \mathcal{E}_{y \sim P_{data(y)}} [\| F(G(y)) - y \|_1]$$

Full Objective :

$$\mathcal{L}(G, F, D_X, D_Y) = \mathcal{L}_{GAN}(G, D_Y, X, Y) + \mathcal{L}_{GAN}(F, D_X, Y, X) + \mathcal{L}_{cyc}(G, F)$$

Full structure



Have a try



Reference

[1. CycleGAN Paper](#)

[2. CycleGAN PyTorch implementation](#)

Thank You for your attention !