Unpaired Image-to-Image Translation using Cycle-Consistent Adversarial Networks

Cycle GAN

IMAGE Generator 김영민 김지수 이다인

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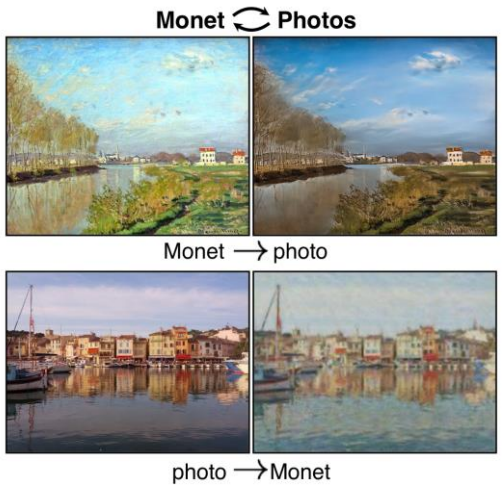
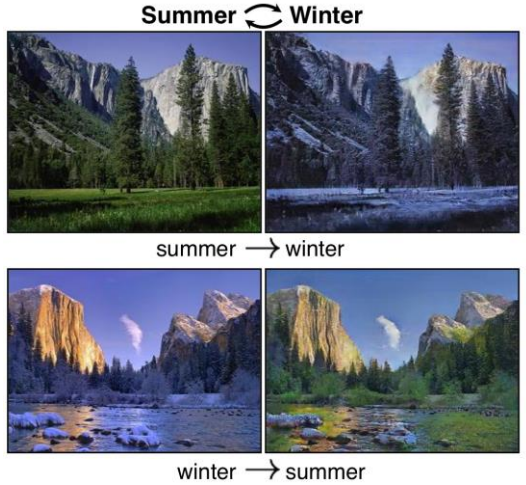
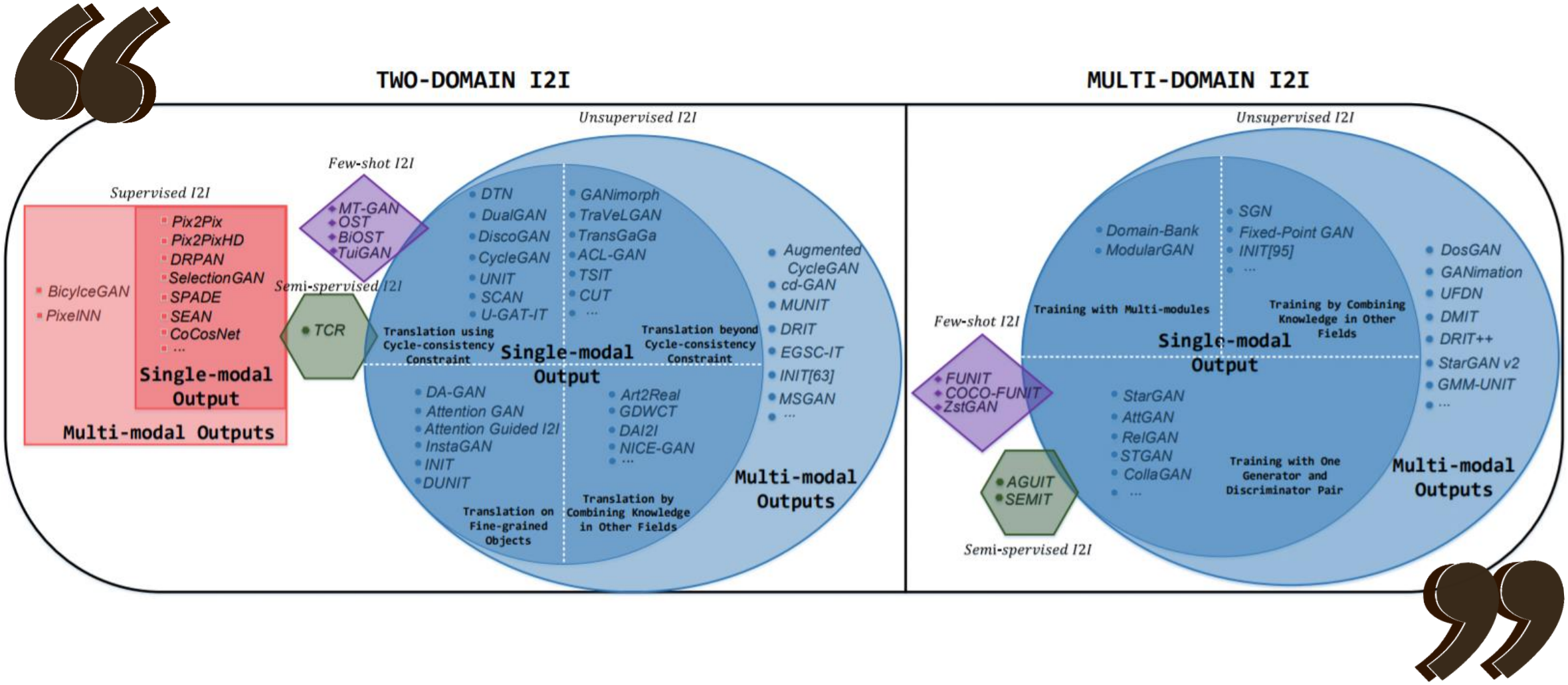
Cycle GAN





한 도메인의 이미지를 다른 도메인으로 해석하는
IMAGE TO IMAGE TRANSLATION 모델

Cycle GAN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Few-shot I2I
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BiOST
TuiGAN
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Training with One Generator and Discriminator Pair
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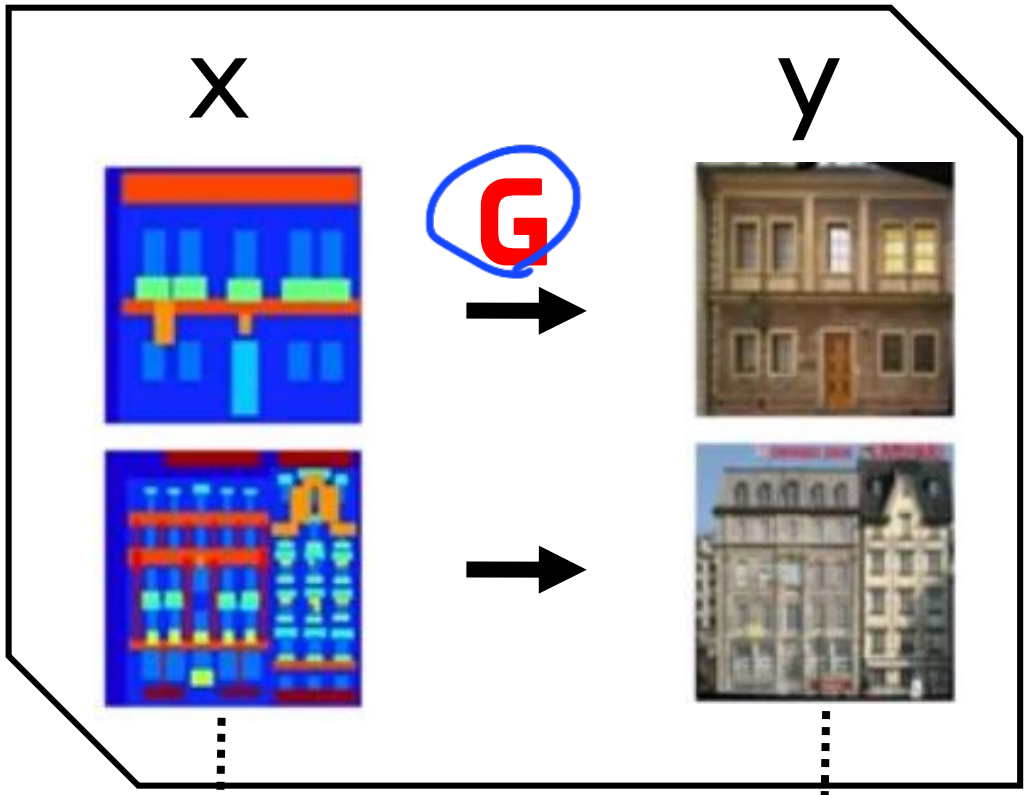
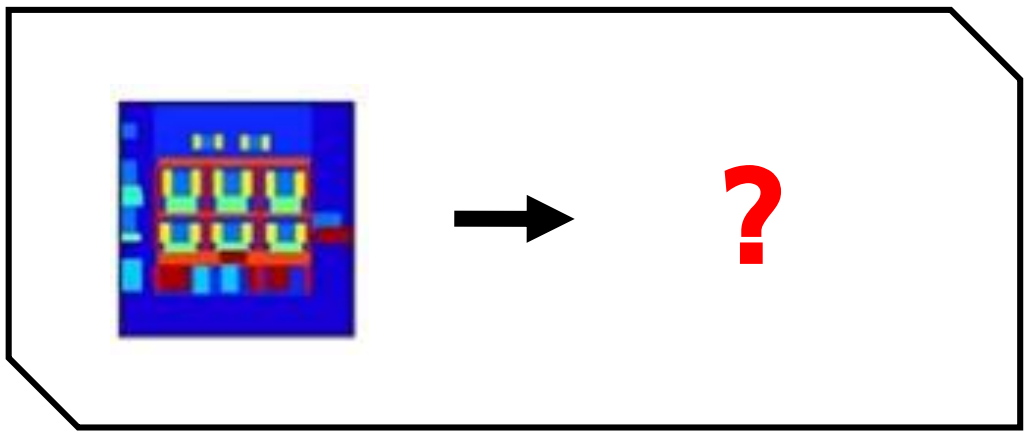
GANimation
UFDN
DMIT
DRIT++
StarGAN v2
GMM-UNIT
...
Multi-modal Outputs

pix2pix

Train(paired images)



Test

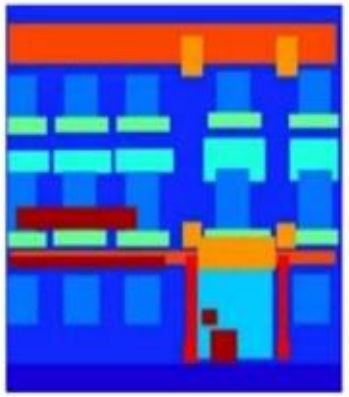


L1 loss

Loss 1

$$\sum_{(x,y)} \|y - G(x)\|_1$$

Generator가 생성한 이미지와 진짜 이미지 간의 차이

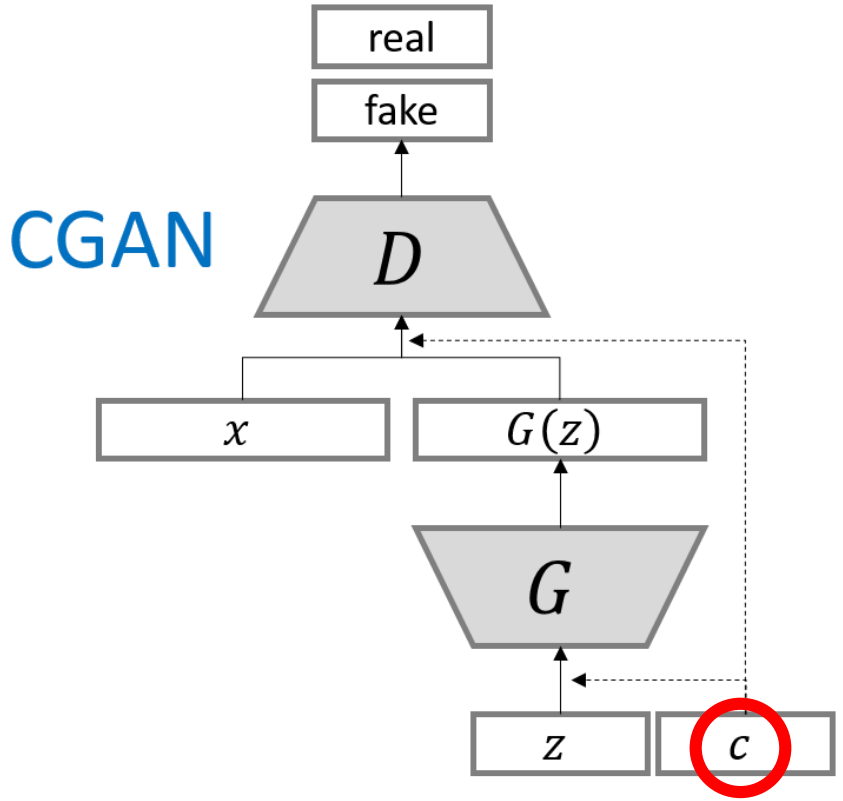


Input

Output

Ground Truth

cGAN loss



생성자(Generator)와 판별자(Discriminator)의
MinMax 게임 = GAN

+

추가 정보 c (conditional)

원하는 방향

조건부 생성모델 conditional GAN

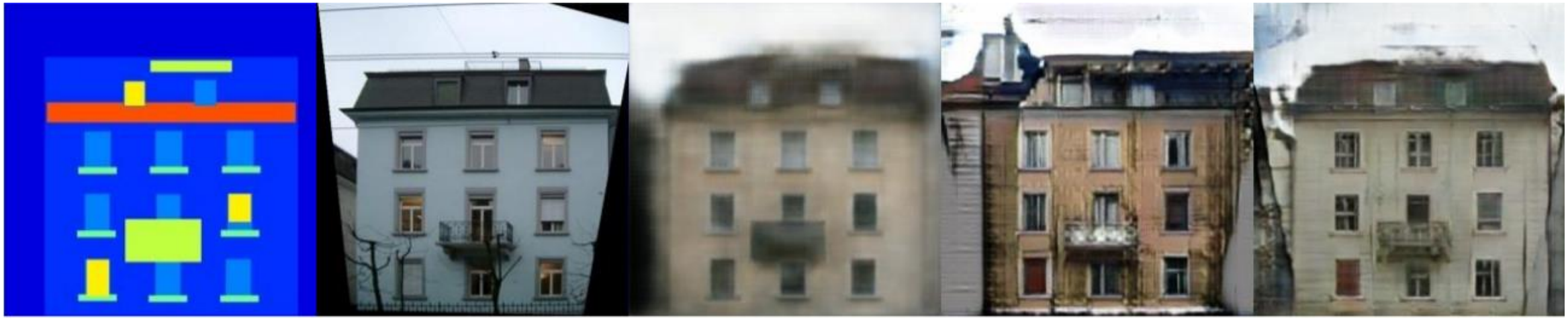
Loss 2

$$min_G max_D V(D,G) = \mathbb{E}_{x \sim p_{data}(x)}[logD(x|y)] + \mathbb{E}_{x \sim p_z(z)}[log(1 - D(G(z|y)))]$$

Pix2pix loss

Final Loss

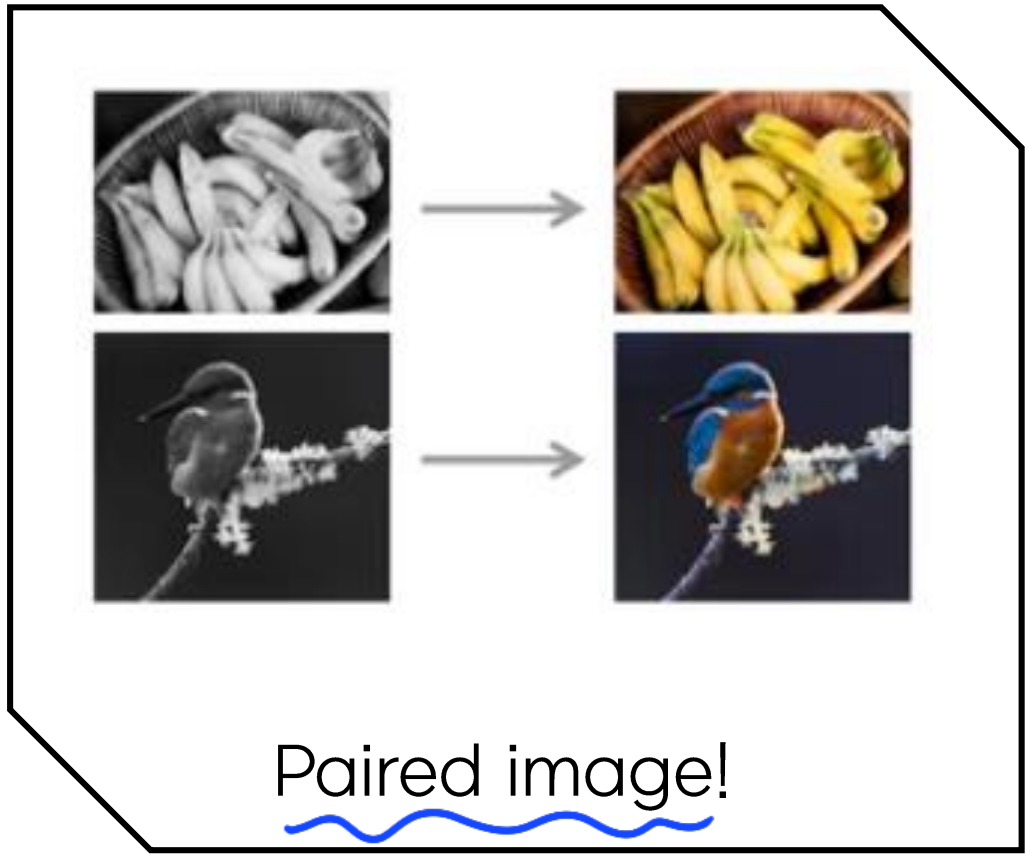
$$\sum_{(x,y)} \|y - G(x)\|_1 + L_{GAN}\,(G(x), y)$$



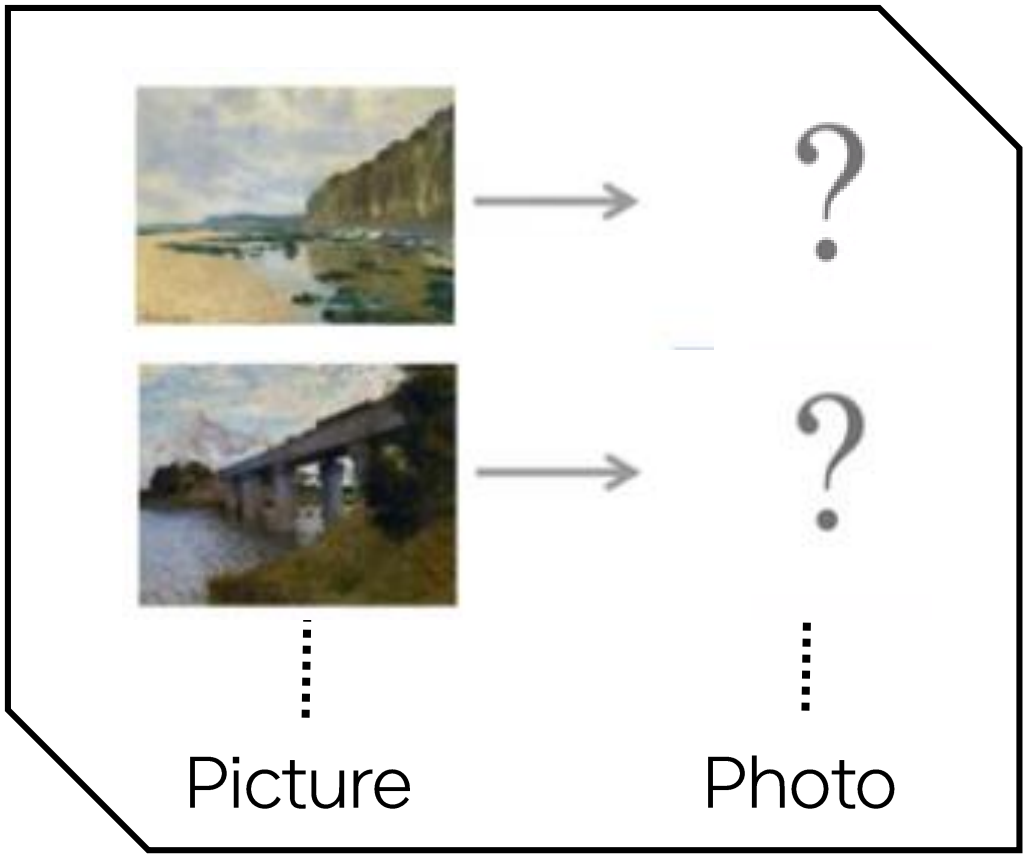
Input | Ground truth | L1 | cGAN | L1 + cGAN

Cycle GAN

Pix2pix



CycleGAN

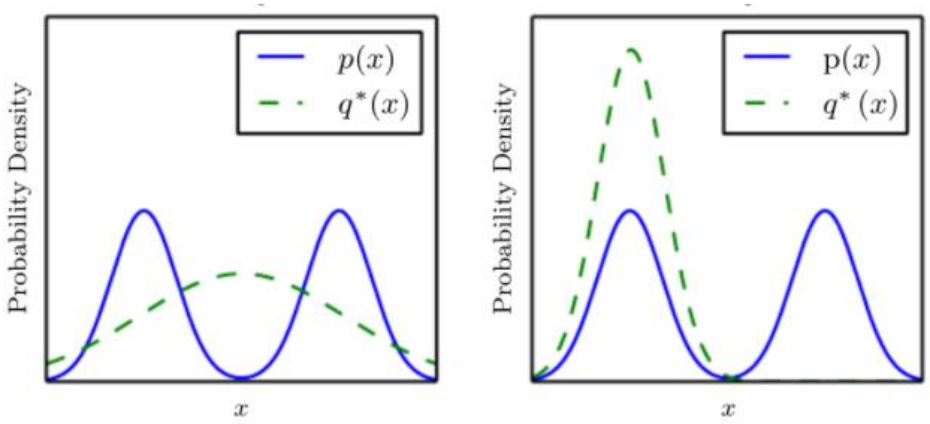


Cycle GAN

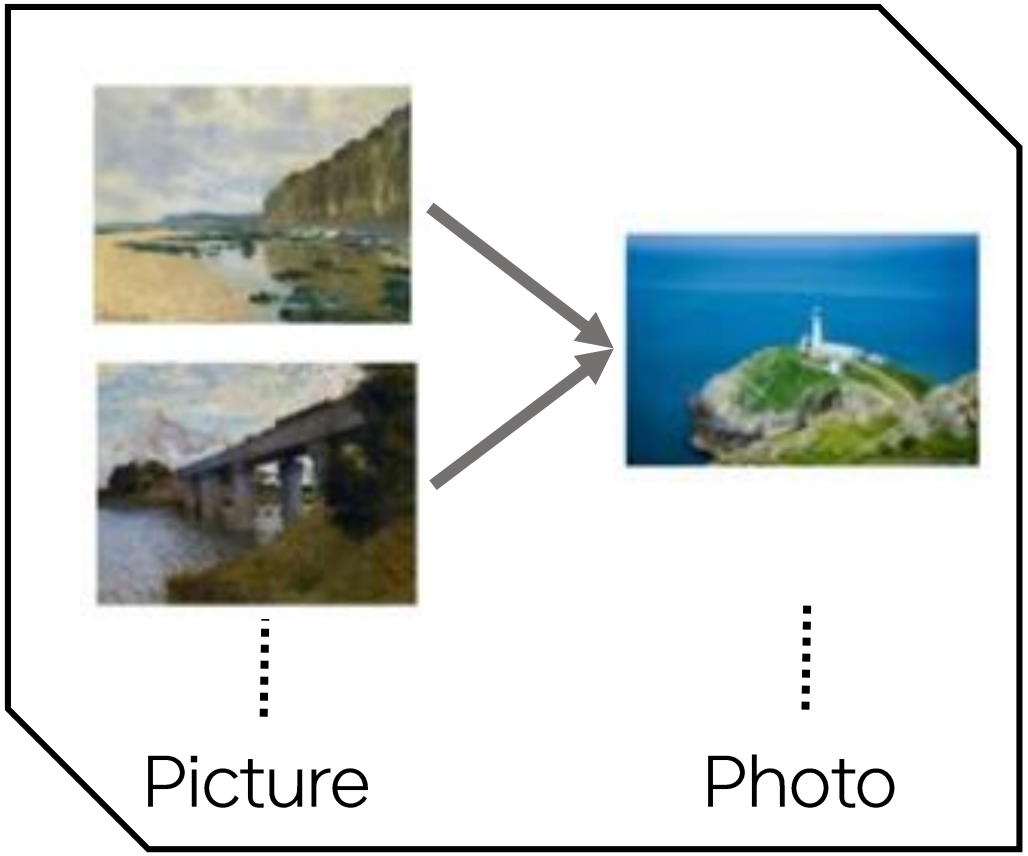
Loss 1

$$L_{GAN}(G(x), y)$$

Mode collapse 발생



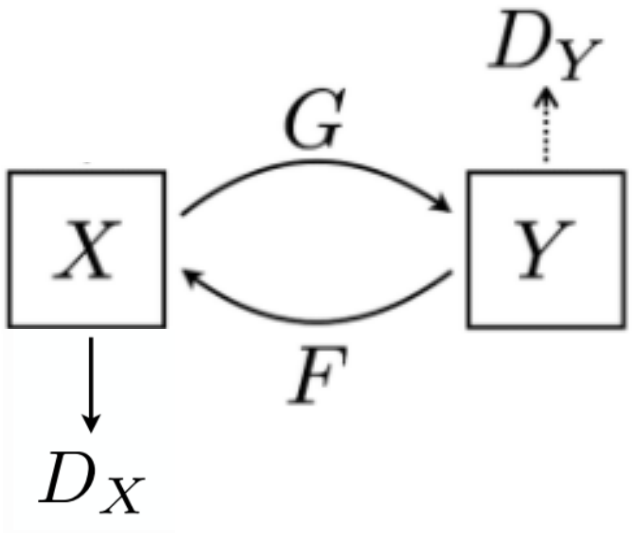
CycleGAN



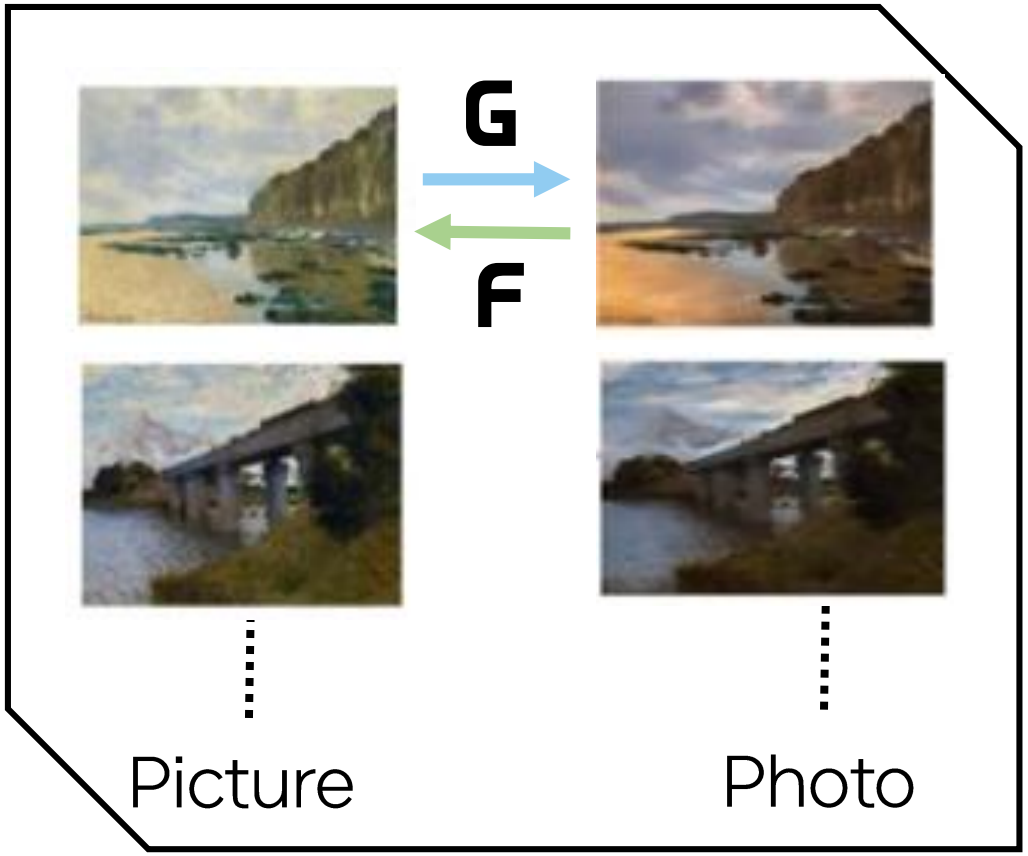
Cycle GAN

Loss 2

$$L_{GAN}(G(x), y) + \|F(G(x)) - x\|_1$$

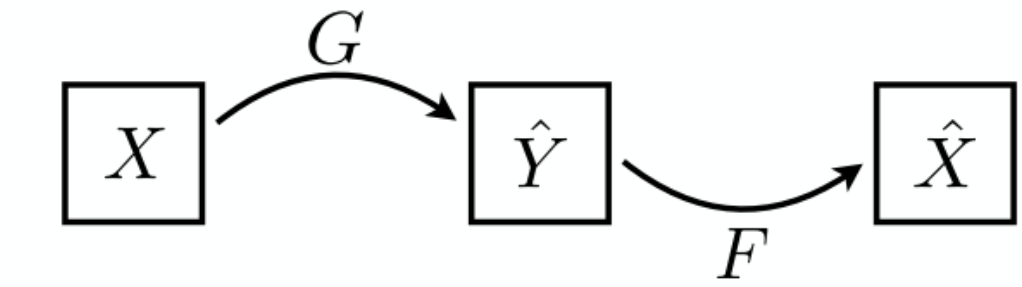


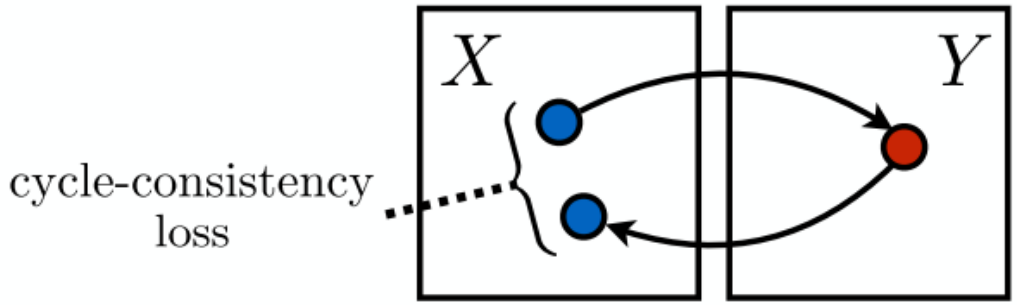
CycleGAN



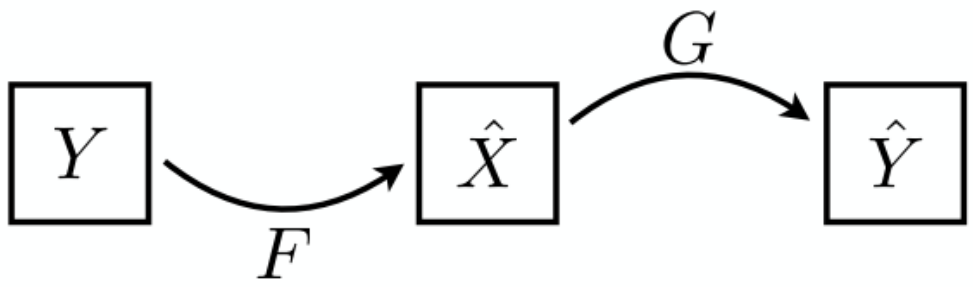
Cycle GAN

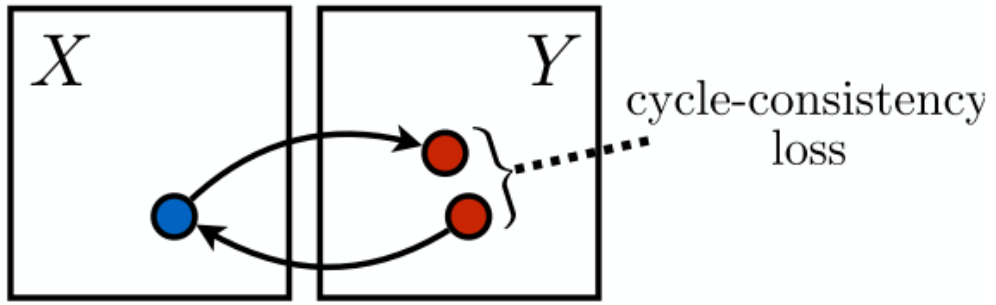
Forward Consistency





Backward Consistency





Cycle Consistency

Cycle GAN

Domain 1

Photograph

Forward

$$L_{GAN}(G(x), y) + \|F(G(x)) - x\|_1$$

$$L_{GAN}(F(y), x) + \|G(F(y)) - y\|_1$$

Backward

Domain 2

Monet

$$\boldsymbol{L_{GAN}(G(x), y) + \|F(G(x)) - x\|_1 + L_{GAN}(F(y), x) + \|G(F(y)) - y\|_1}$$

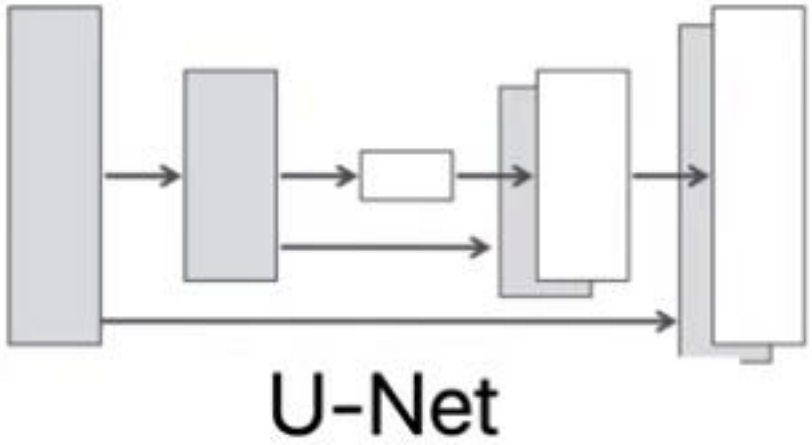
Cycle GAN

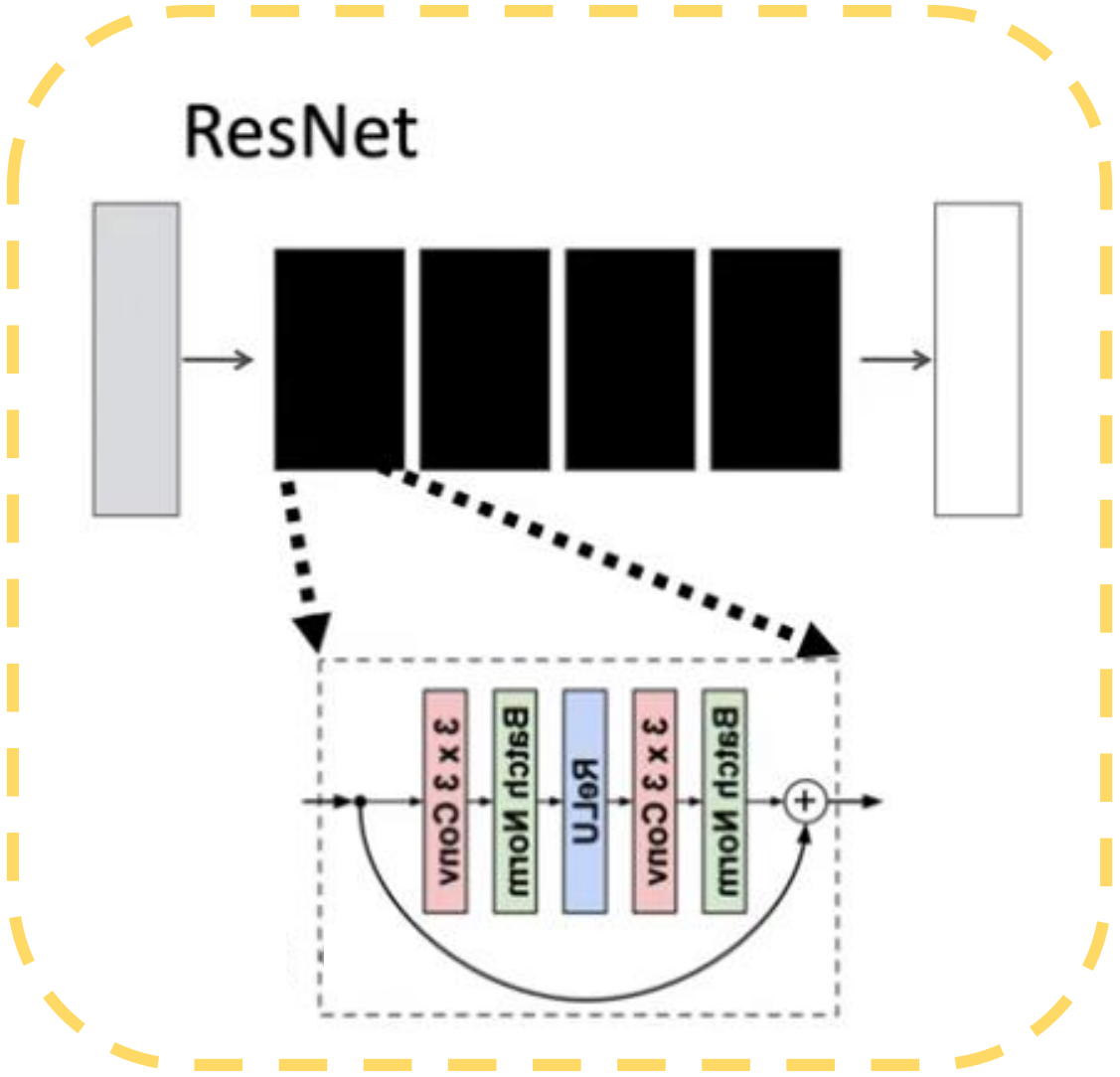
- Loss function Experiments

$$L_{GAN}(G(x), y) + \|F(G(x)) - x\|_1 + L_{GAN}(F(y), x) + \|G(F(y)) - y\|_1$$

Details

(1) Generator Architecture



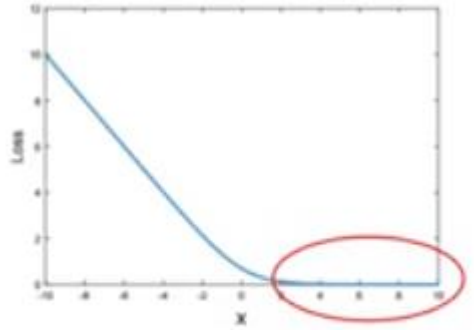


Details

(2) GAN loss function

- GANs with cross-entropy loss

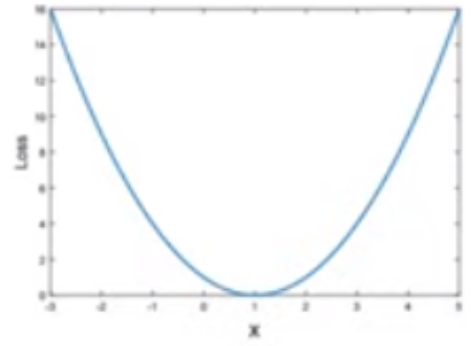
$$\mathcal{L}_{GAN}(G, D_Y, X, Y) = \mathbb{E}_{y \sim p_{data}(y)}[log D_Y(y)] + \mathbb{E}_{x \sim p_{data}(x)}[log(1 - D_Y(G(x))]$$



Vanishing gradients

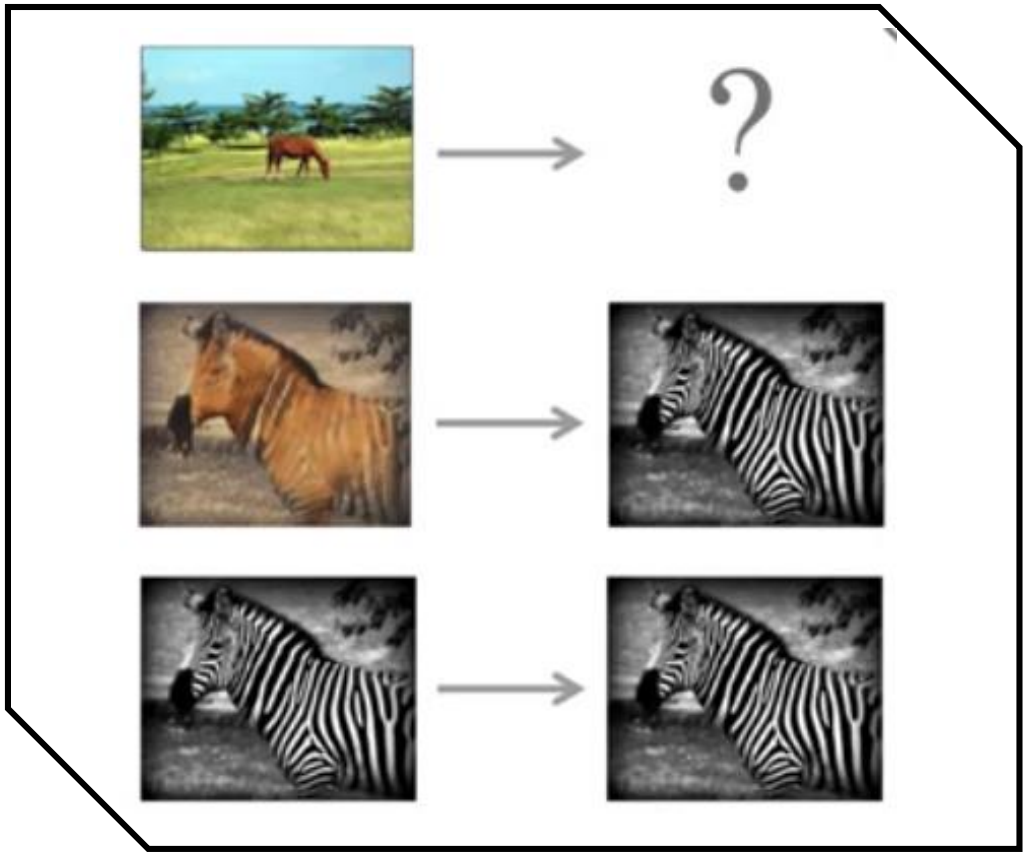
- Least square GANs

$$\mathcal{L}_{LSGAN}(G, D_Y, X, Y) = \mathbb{E}_{y \sim p_{data}(y)}[(D_Y(y) - 1)^2] + \mathbb{E}_{x \sim p_{data}(x)}[D_Y(G(x))^2]$$

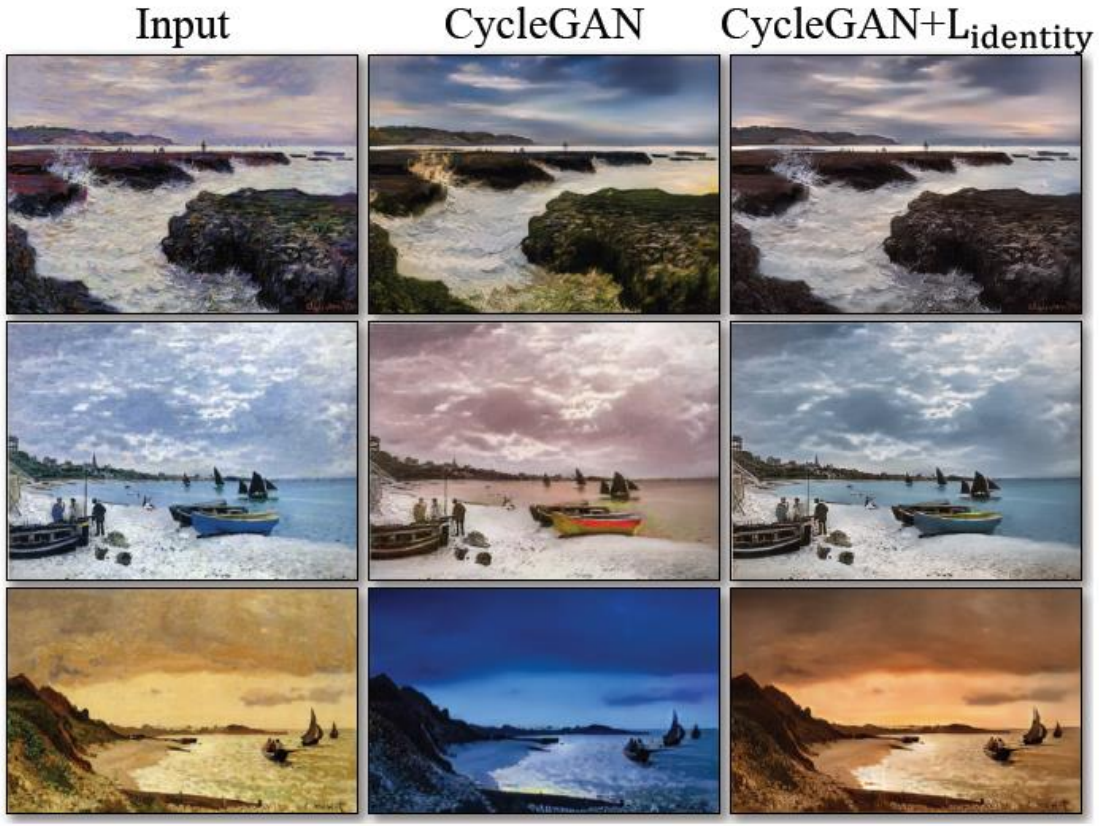


Details

(3) Identity loss function

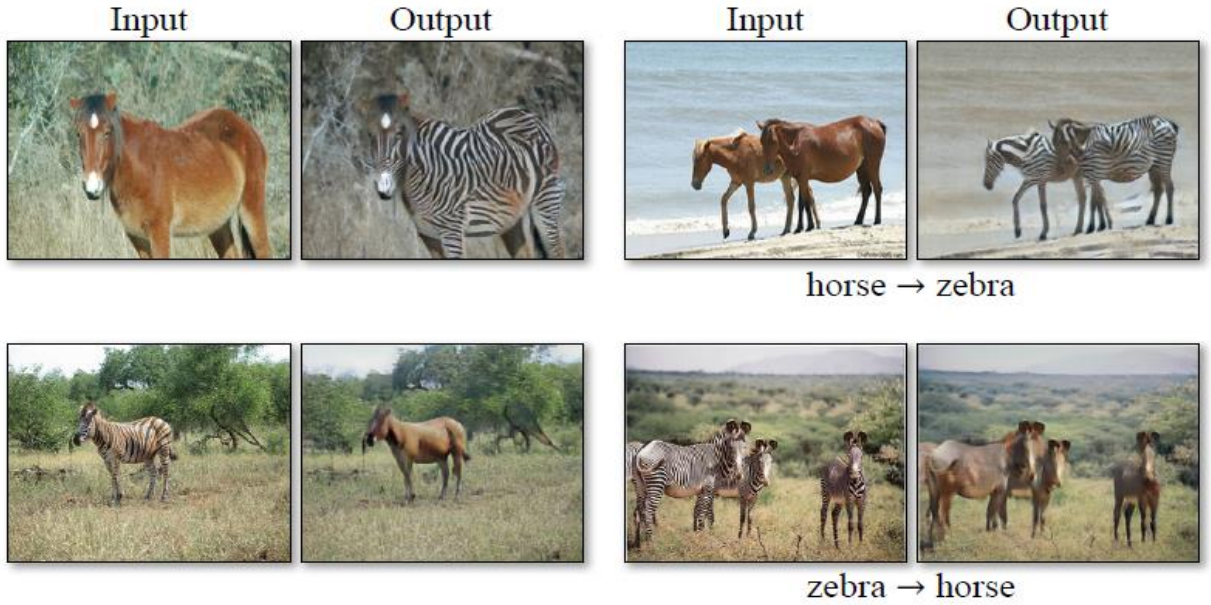


Cycle GAN



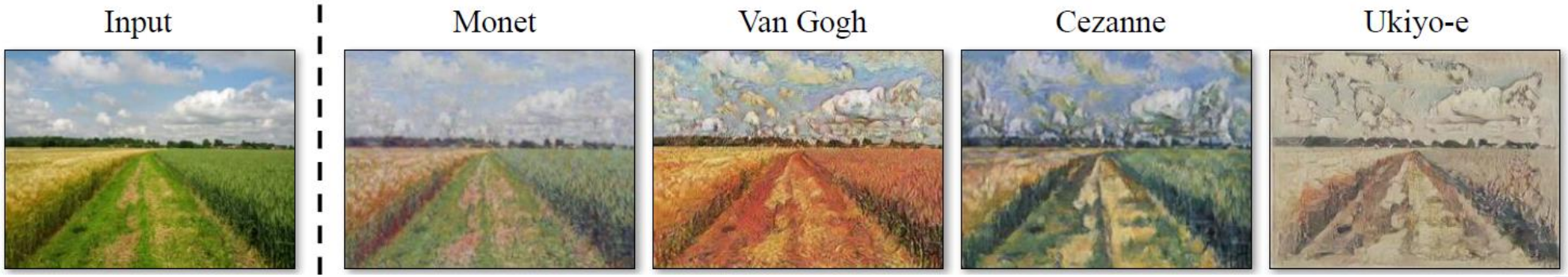
Conclusion

Zebra ↔ horse



Smart phone ↔ DSLR

Photo ↔ picture



감사합니다

IMAGE Generator 김영민 김지수 이다인