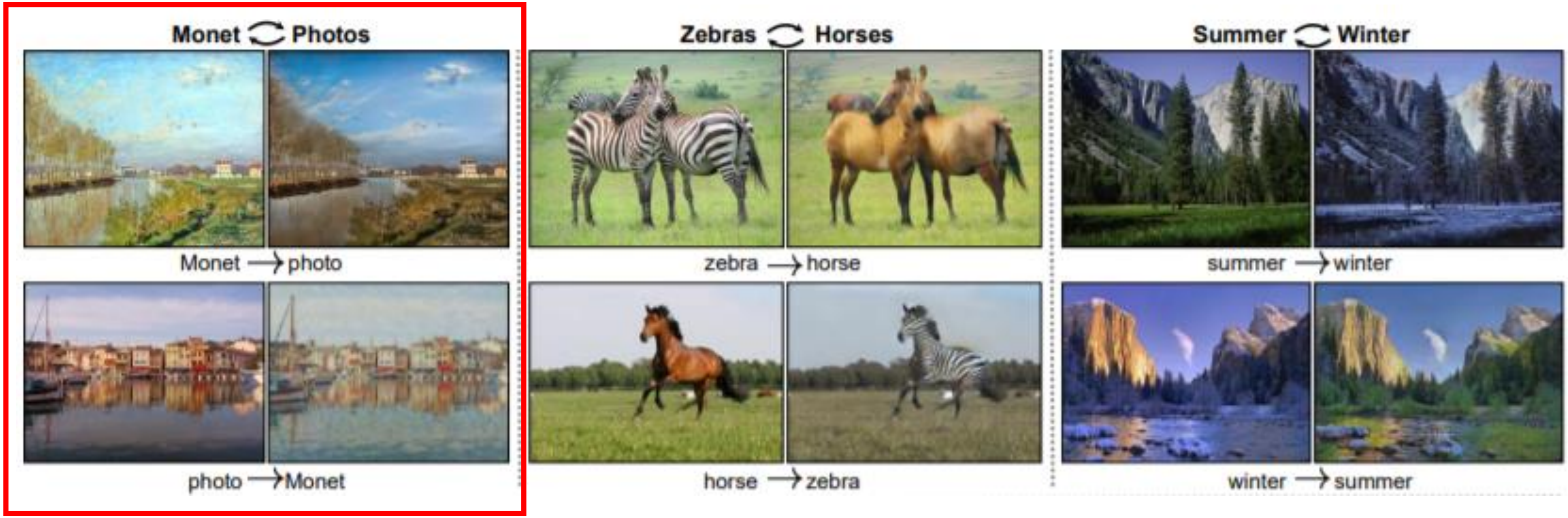
Cycle
Generative
Adversarial
Networks

CycleGAN

SMARCLE 신도현

Contents

1. CycleGAN ?

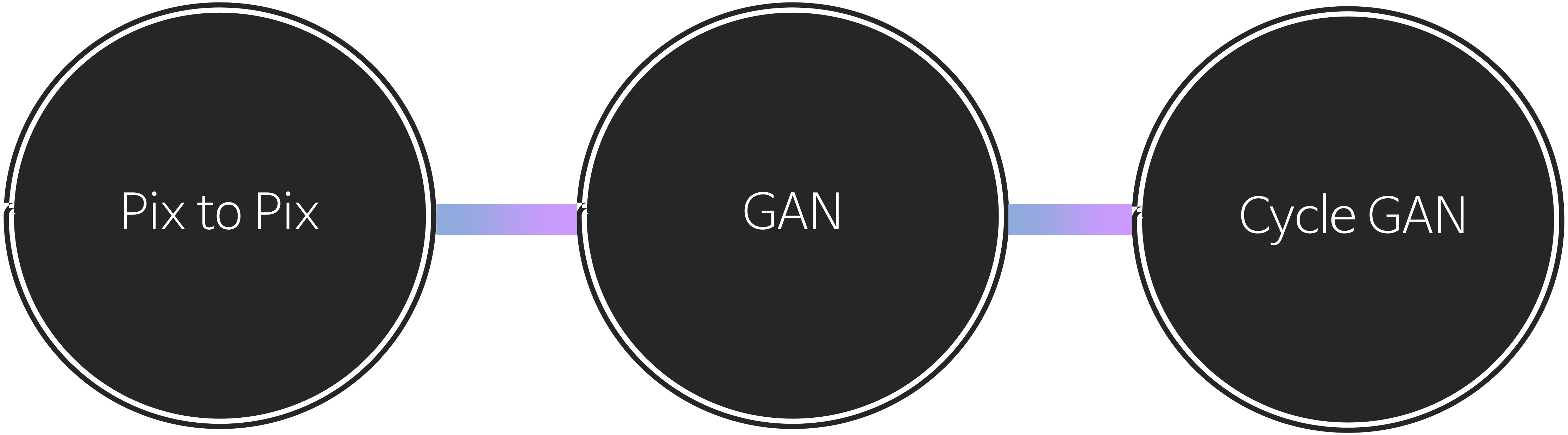

Monet Photos
Monet → photo
photo → Monet
Zebras Horses
zebra → horse
horse → zebra
Summer Winter
summer → winter
winter → summer

Face to Ramen?

Figure 1: Given any two unordered image collections X and Y, our algorithm learns to automatically "translate" an image from one into the other and vice versa: *(left)* Monet paintings and landscape photos from Flickr; *(center)* zebras and horses from ImageNet; *(right)* summer and winter Yosemite photos from Flickr. Example application *(bottom)*: using a collection of paintings of famous artists, our method learns to render natural photographs into the respective styles.

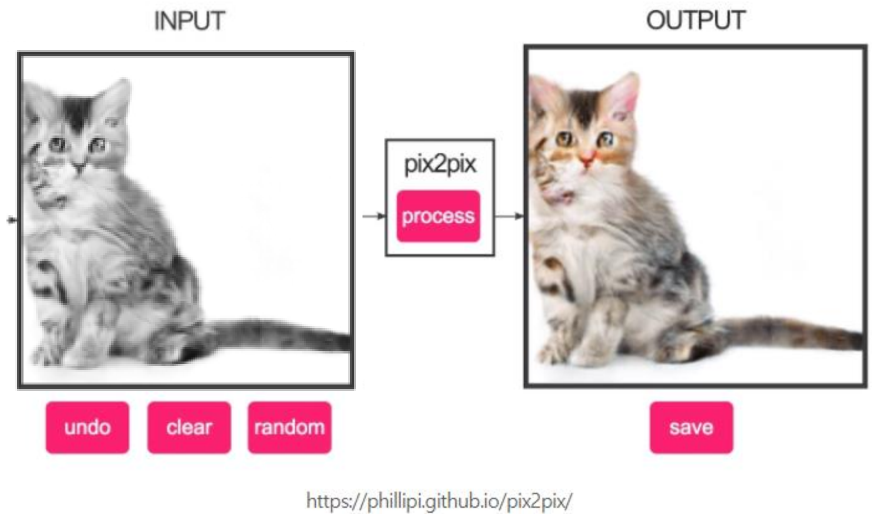
1. CycleGAN ?

2. Process

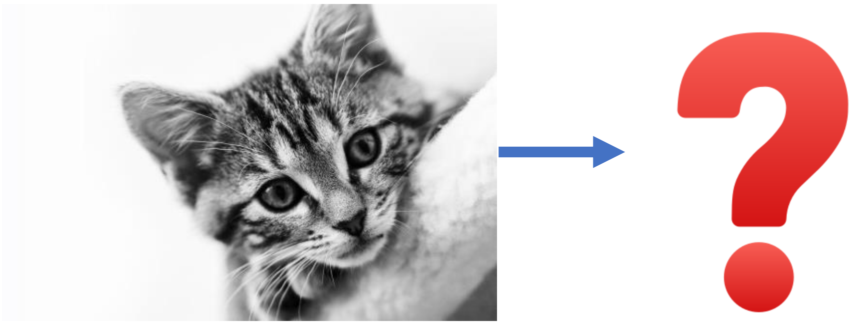


Pix to Pix

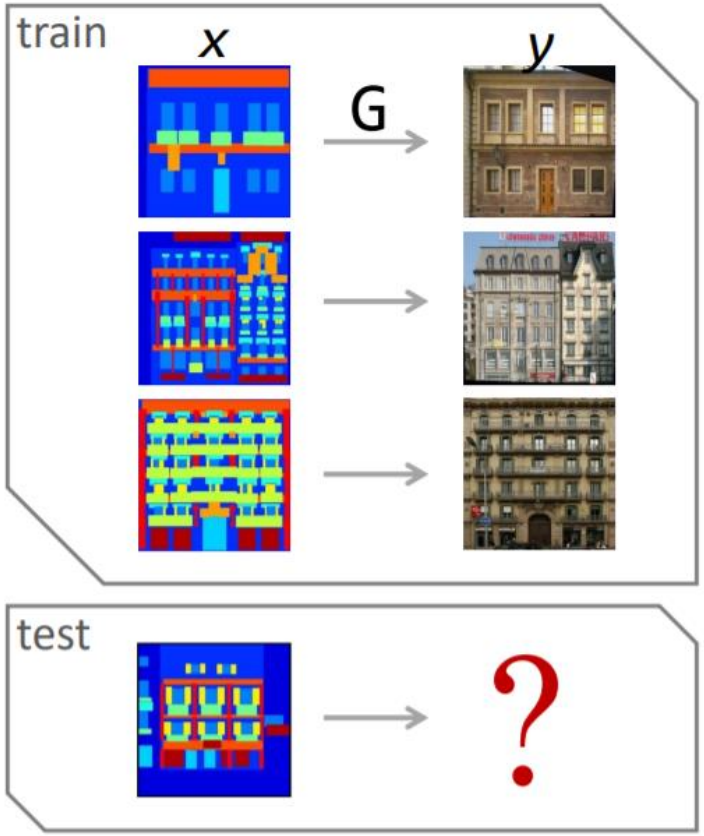
- Image-to-Image Translation with Conditional Adversarial Networks
- Supervised learning
- Train data



- Test data



Pix to Pix



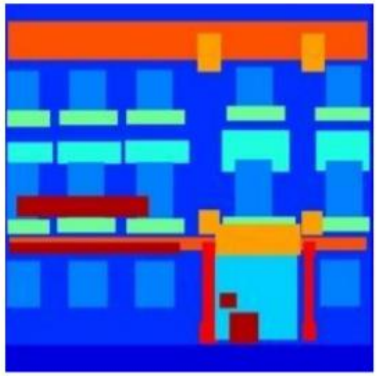
- Supervised
- loss: Minimize the difference between output *G(x)* and ground truth *y*

Data from [Tylecek, 2013]

Pix to Pix

Loss: Minimize the difference between output *G(x) and the ground truth y*

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



Input

Output

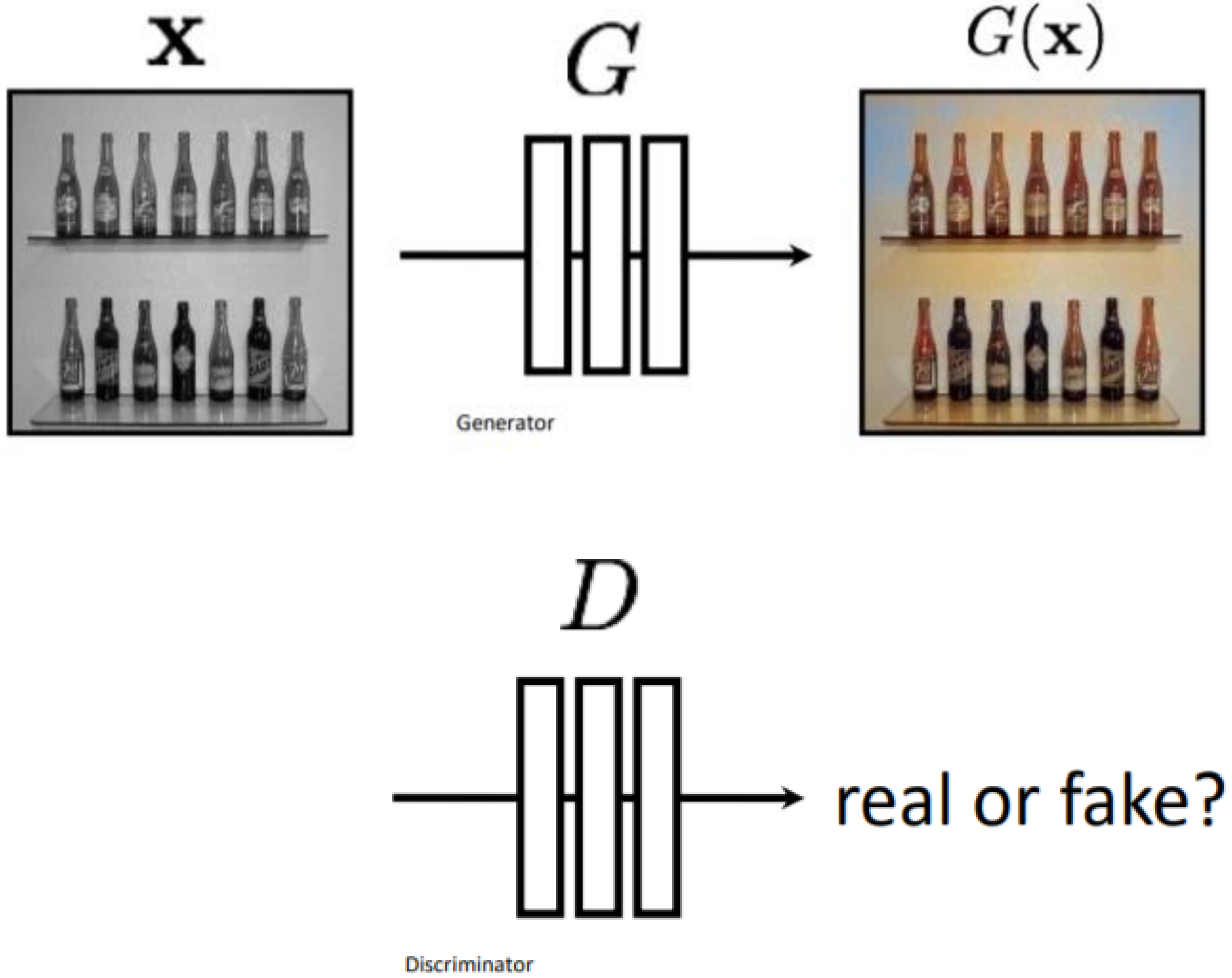
Ground Truth

Input

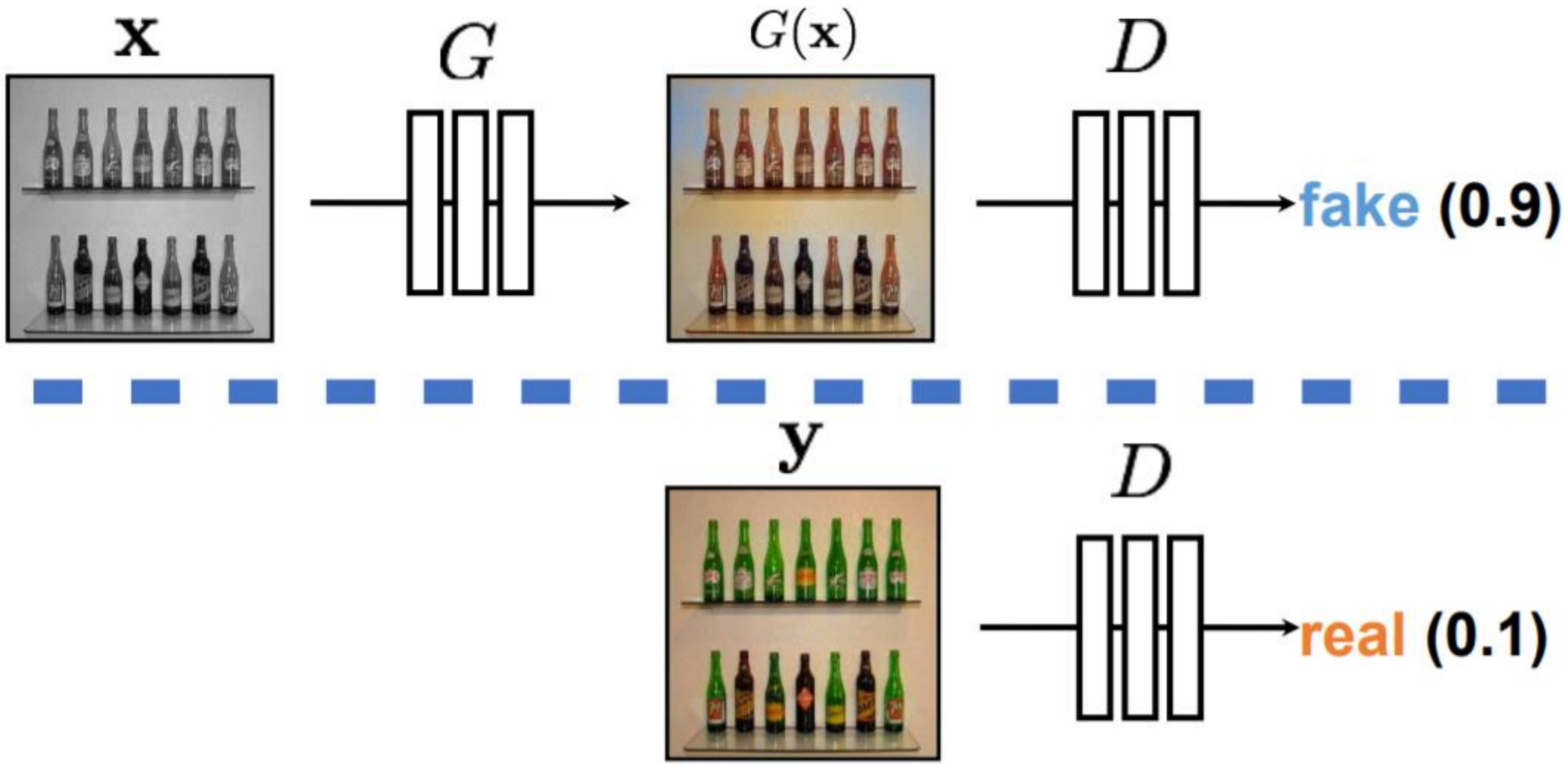
Output

Ground Truth

GAN



GAN



G tries to synthesize fake images that *fool* the *best* D:

$$\arg \boxed{\min_{G}} \boxed{\max_{D}} \mathbb{E}_{\mathbf{x},\mathbf{y}}[\ \log D(G(\mathbf{x})) \ + \ \log(1 - D(\mathbf{y}))\ ]$$

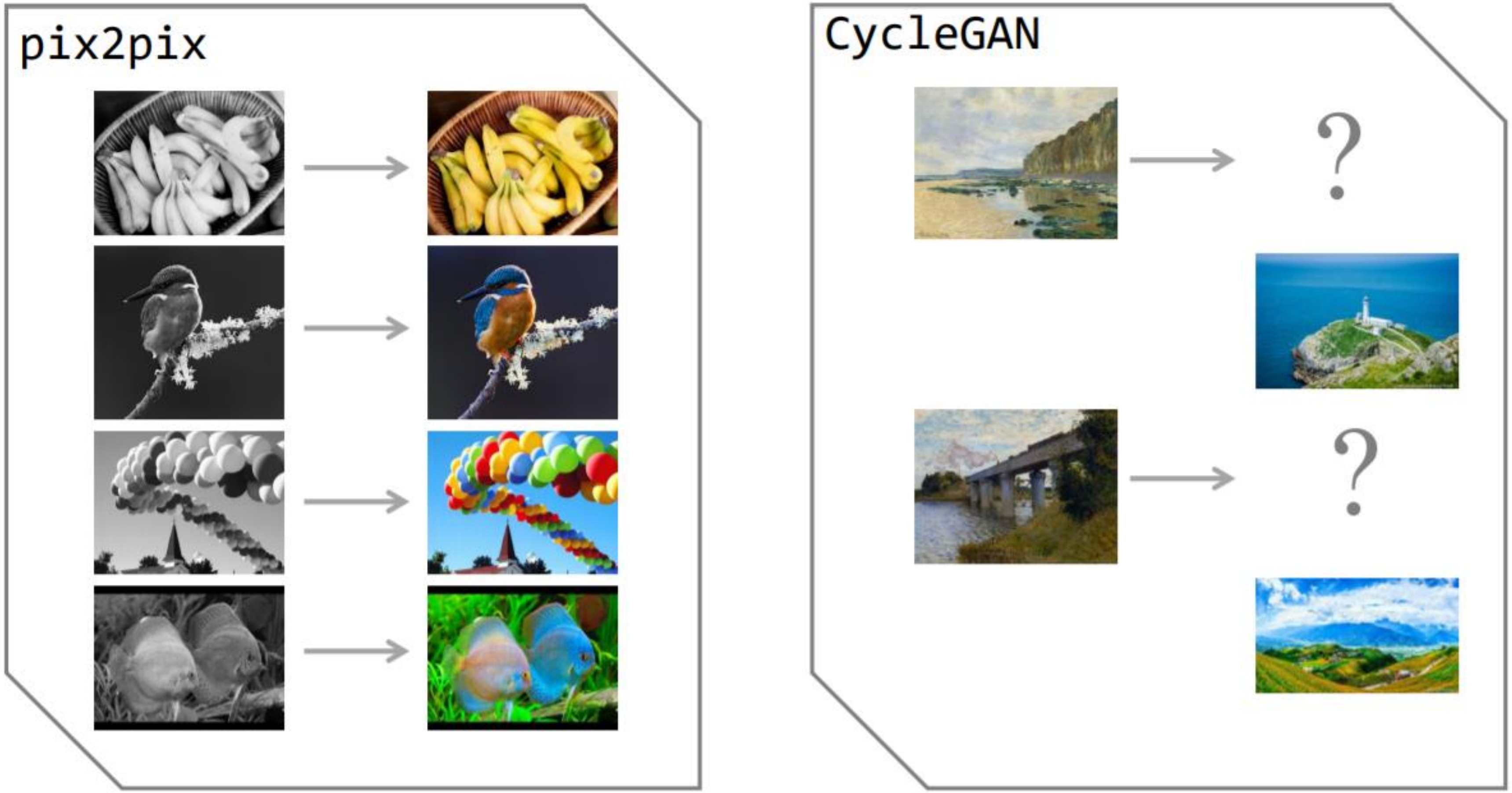
GAN

Loss: Minimize the difference between and output *G(x)* and ground truth *y*

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

Input Ground Truth L1 loss only L1+GAN loss

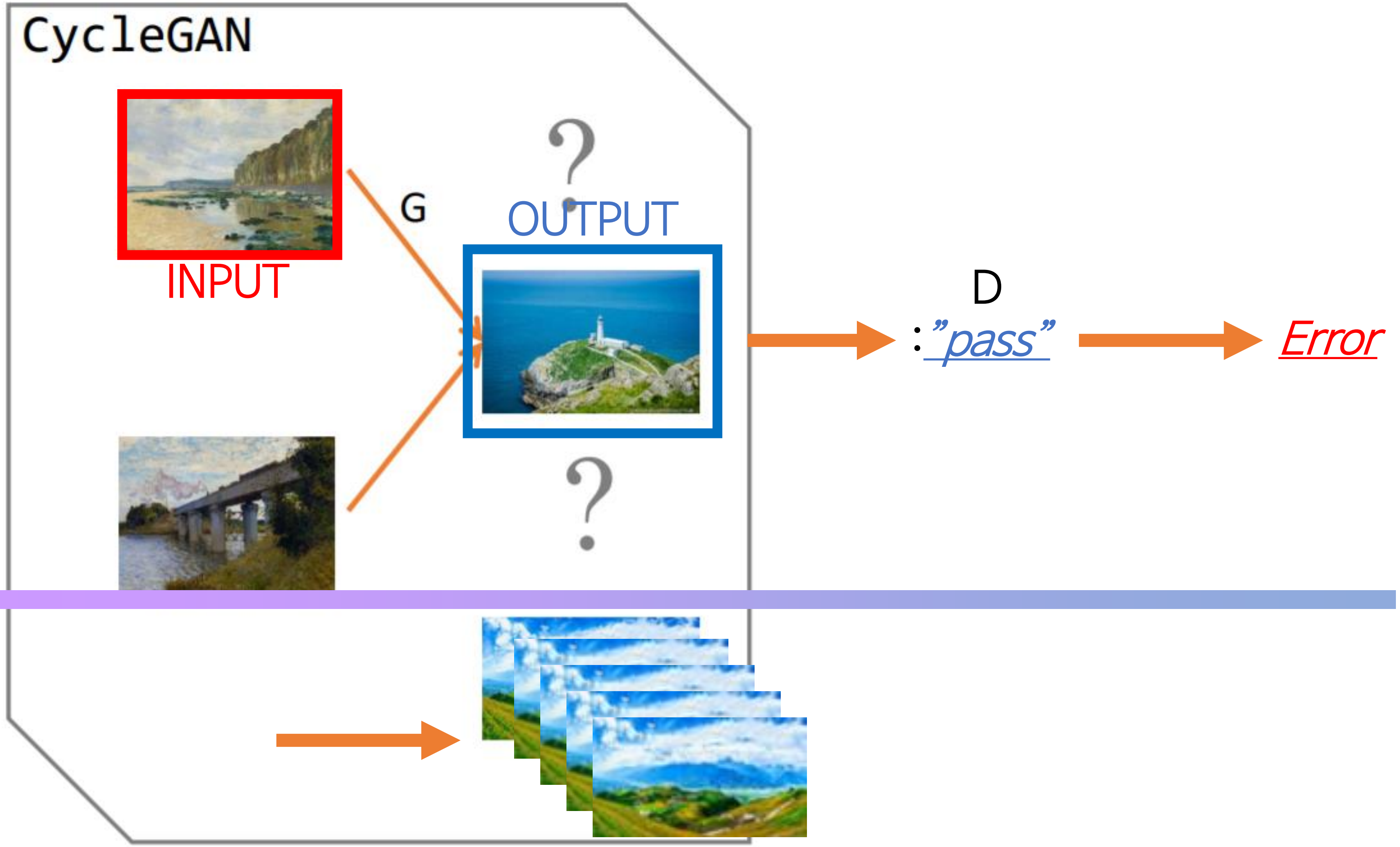
Cycle GAN



automatically “translate” an image

Cycle

GAN

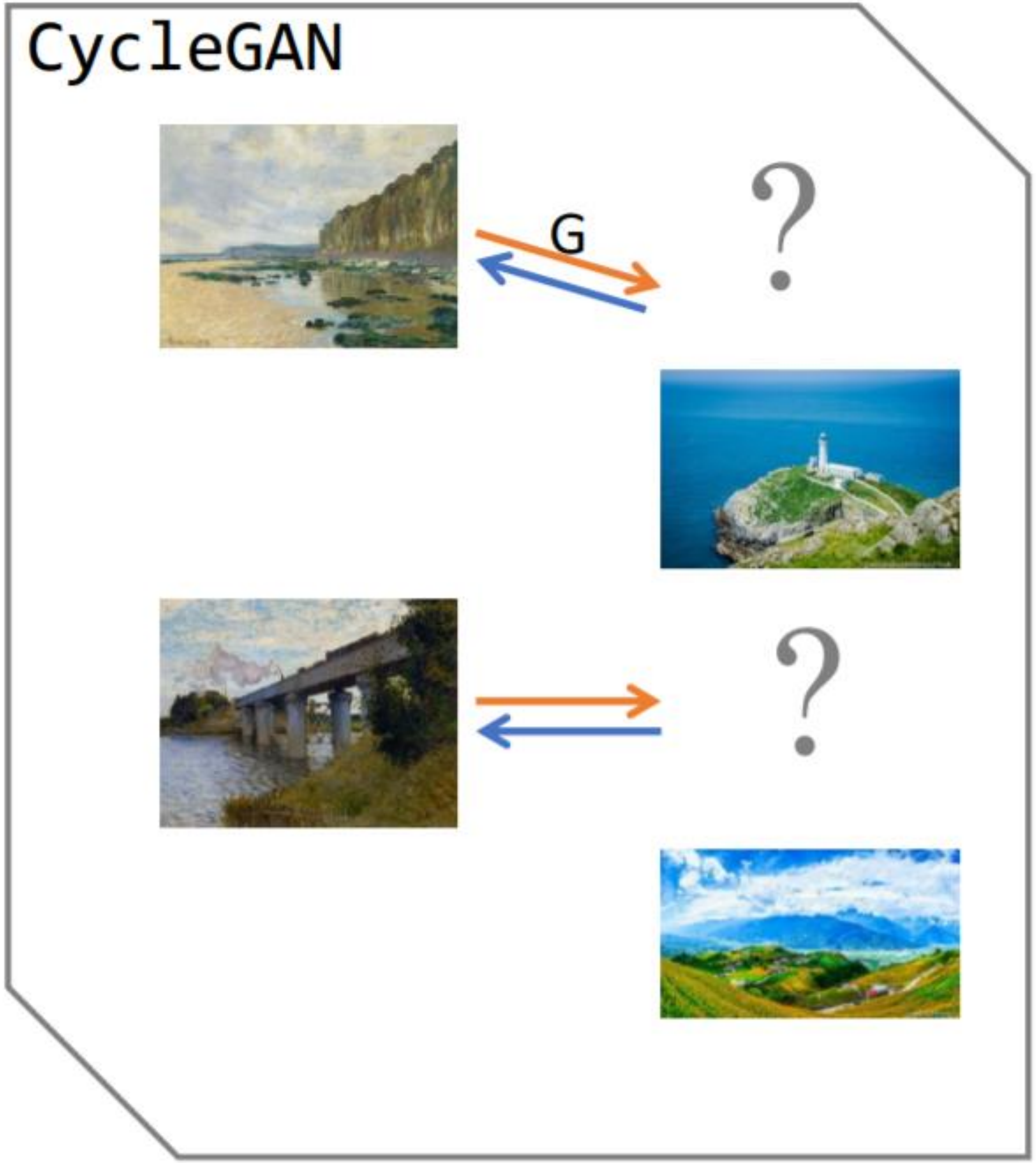


[기존 GAN loss 적용시]

1. G가 input (1)을 무시하고 output(2)을 만들 수 있다.
2. input에 관계없는 똑같은 output만 생성될 수 있다.

Cycle

GAN



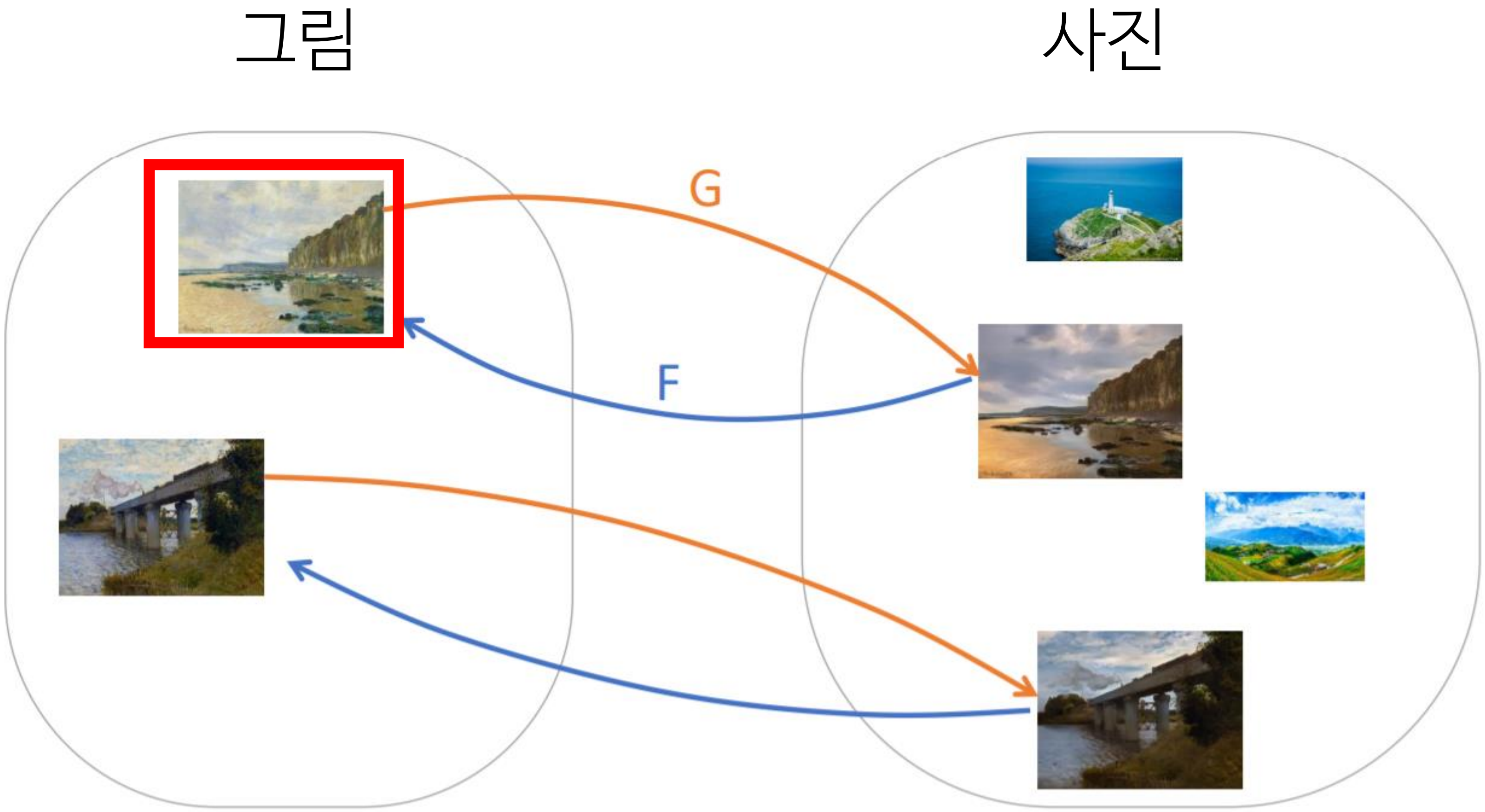
Key Object :

Cycle

GAN

G: 그림 → 사진

F: 사진 → 그림

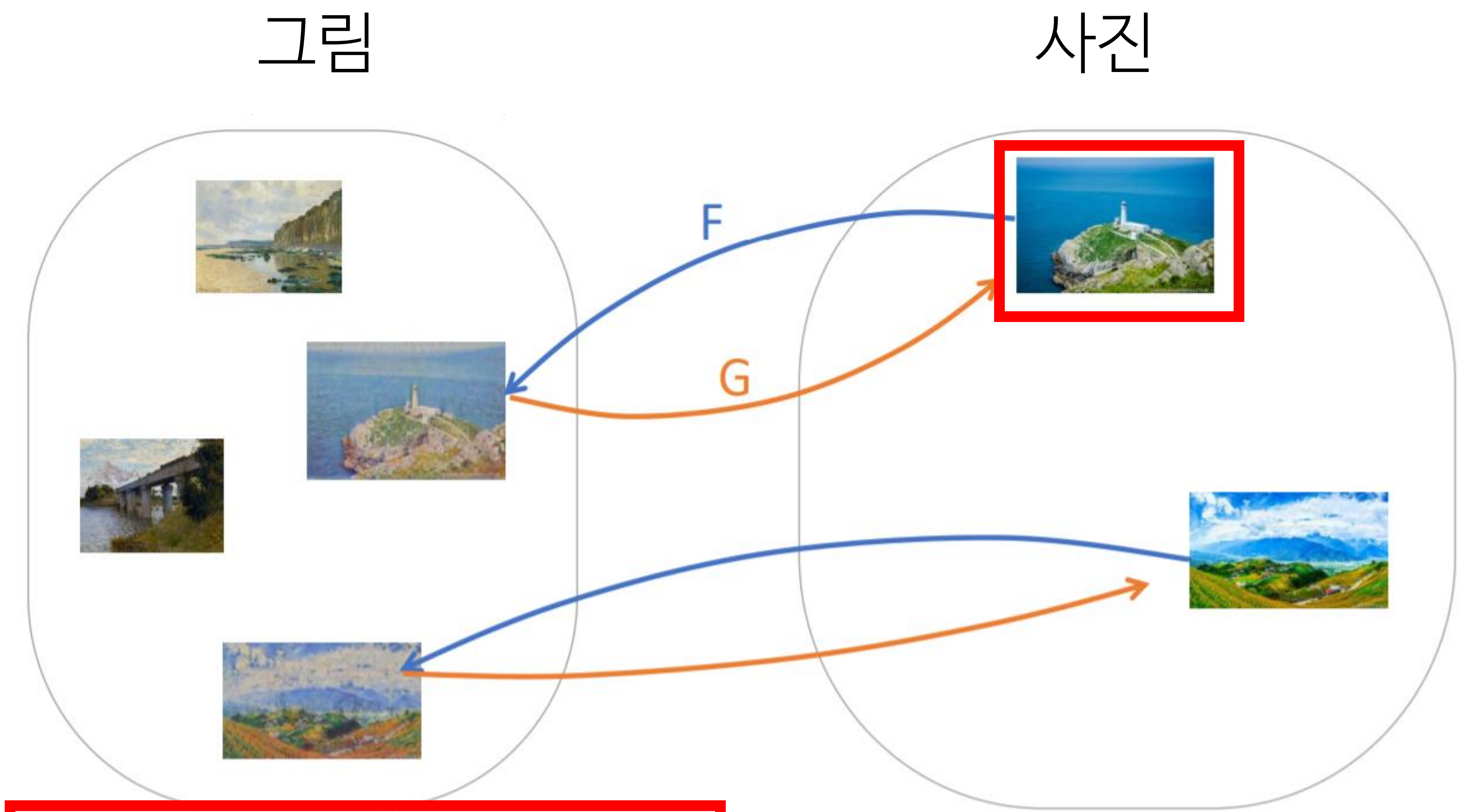


$$\boxed{L_{GAN}(G(x),y)+\|F(G(x))-x\|_1}$$

(그림->사진->그림) == 원래 그림

Cycle

GAN

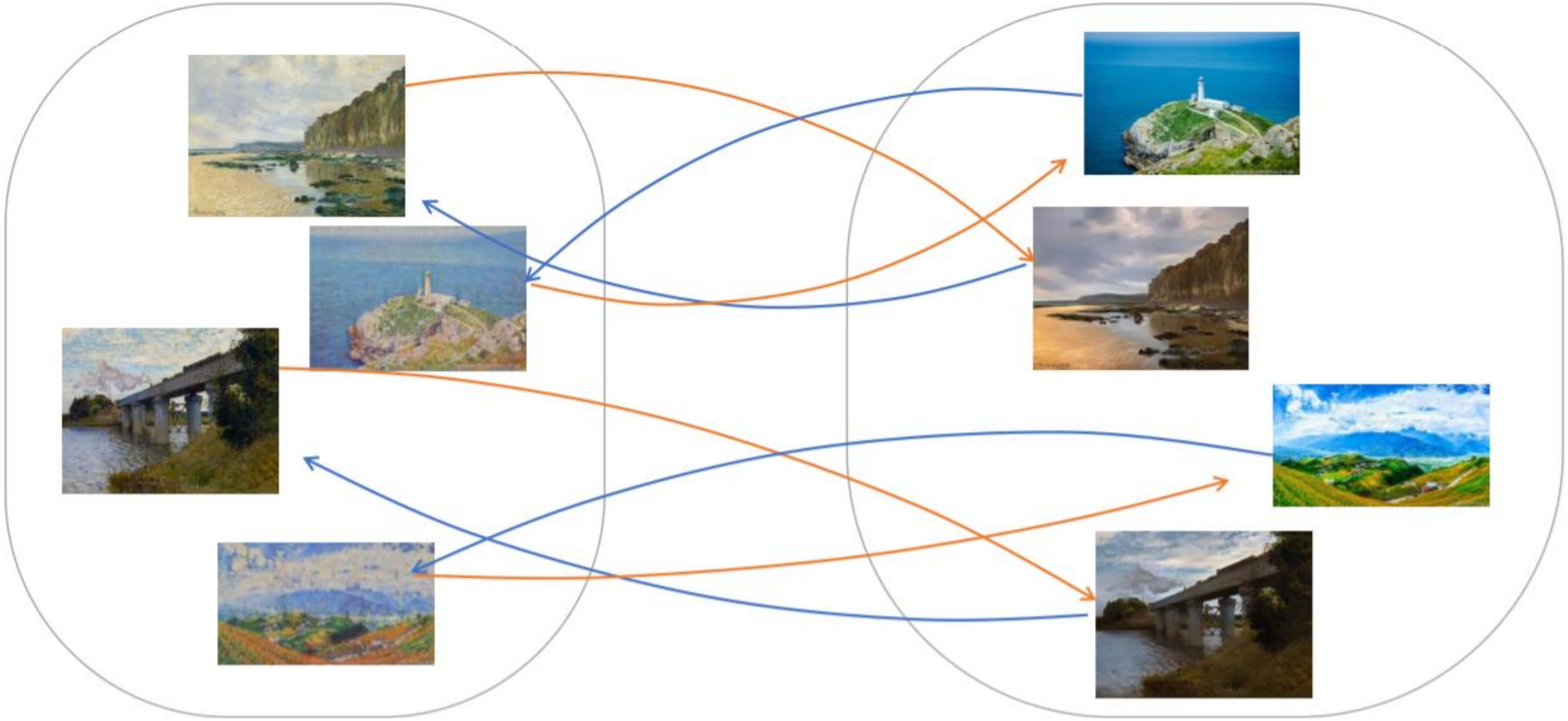


$$L_{GAN}(F(y),x)+\|G(F(y))-y\|_1$$

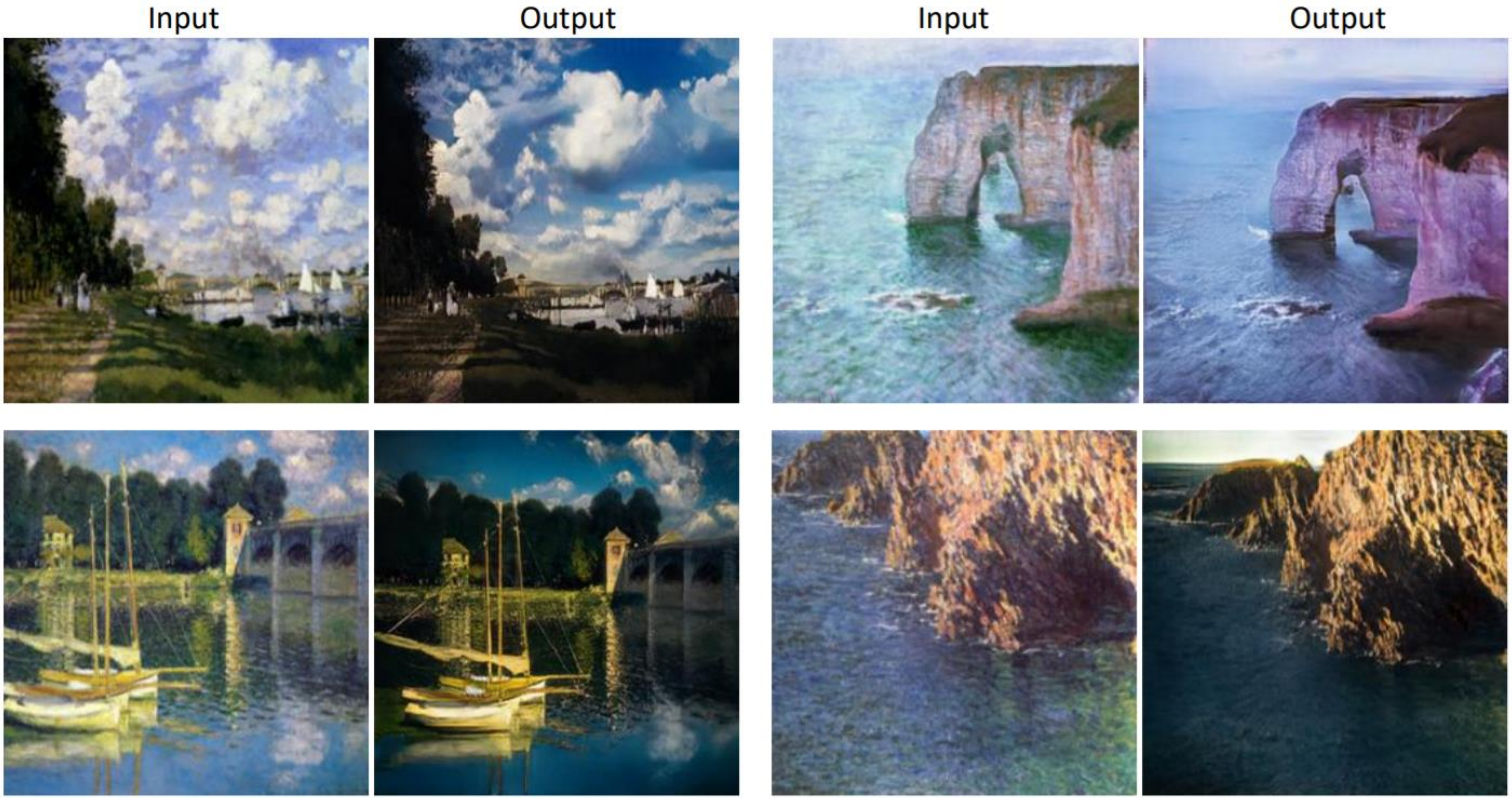
F: 사진 → 그림

G: 그림 → 사진

Cycle GAN



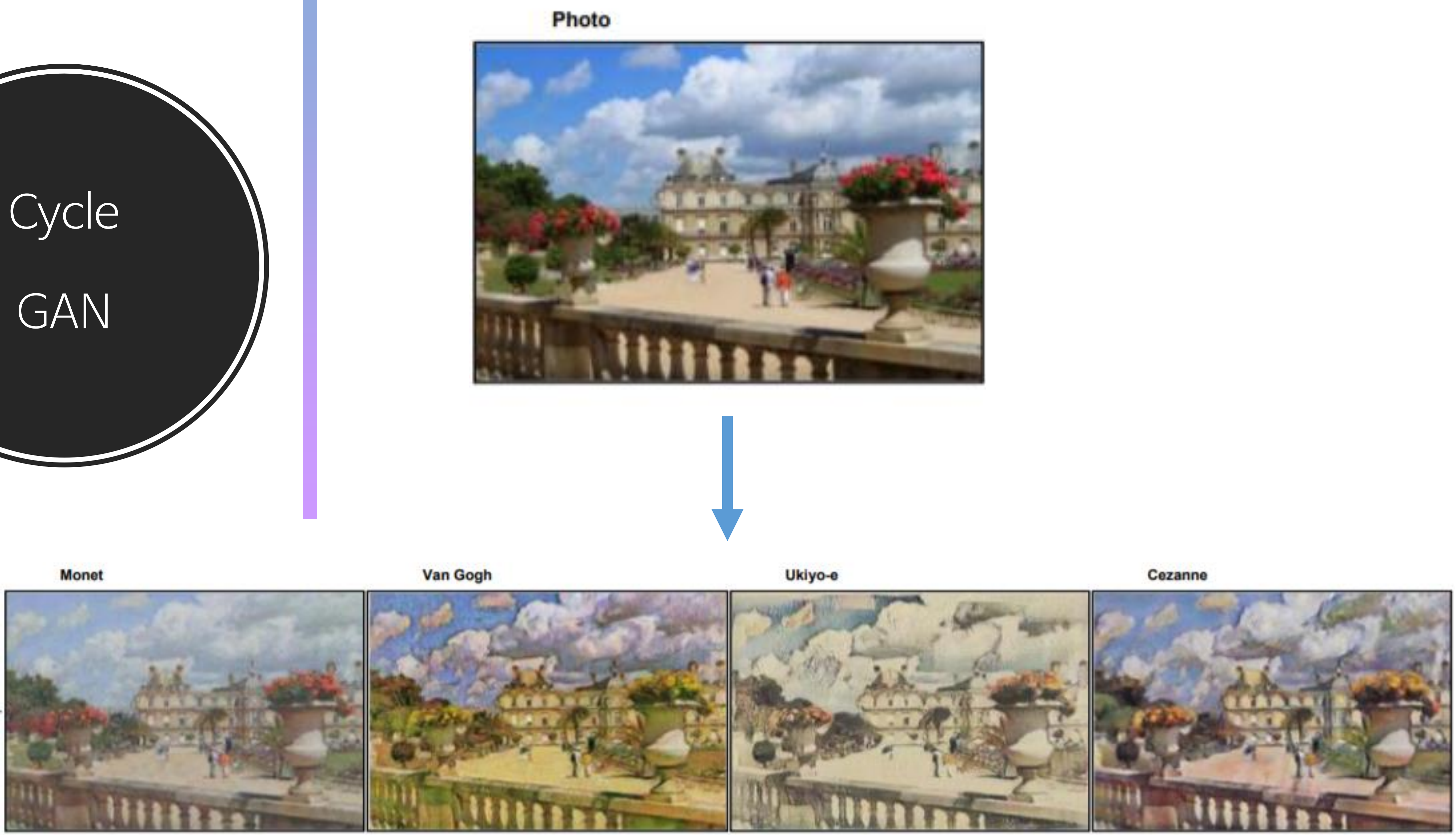
$$L_{GAN}(G(x),y)+\left\|F(G(x))-x\right\|_1 \quad + \quad L_{GAN}(F(y),x)+\left\|G(F(y))-y\right\|_1$$



(slides credit: Phillip Isola) [Zhu, Park, Isola, Efros, submitted]

Cycle

GAN



Ablation Study on Cityscapes dataset

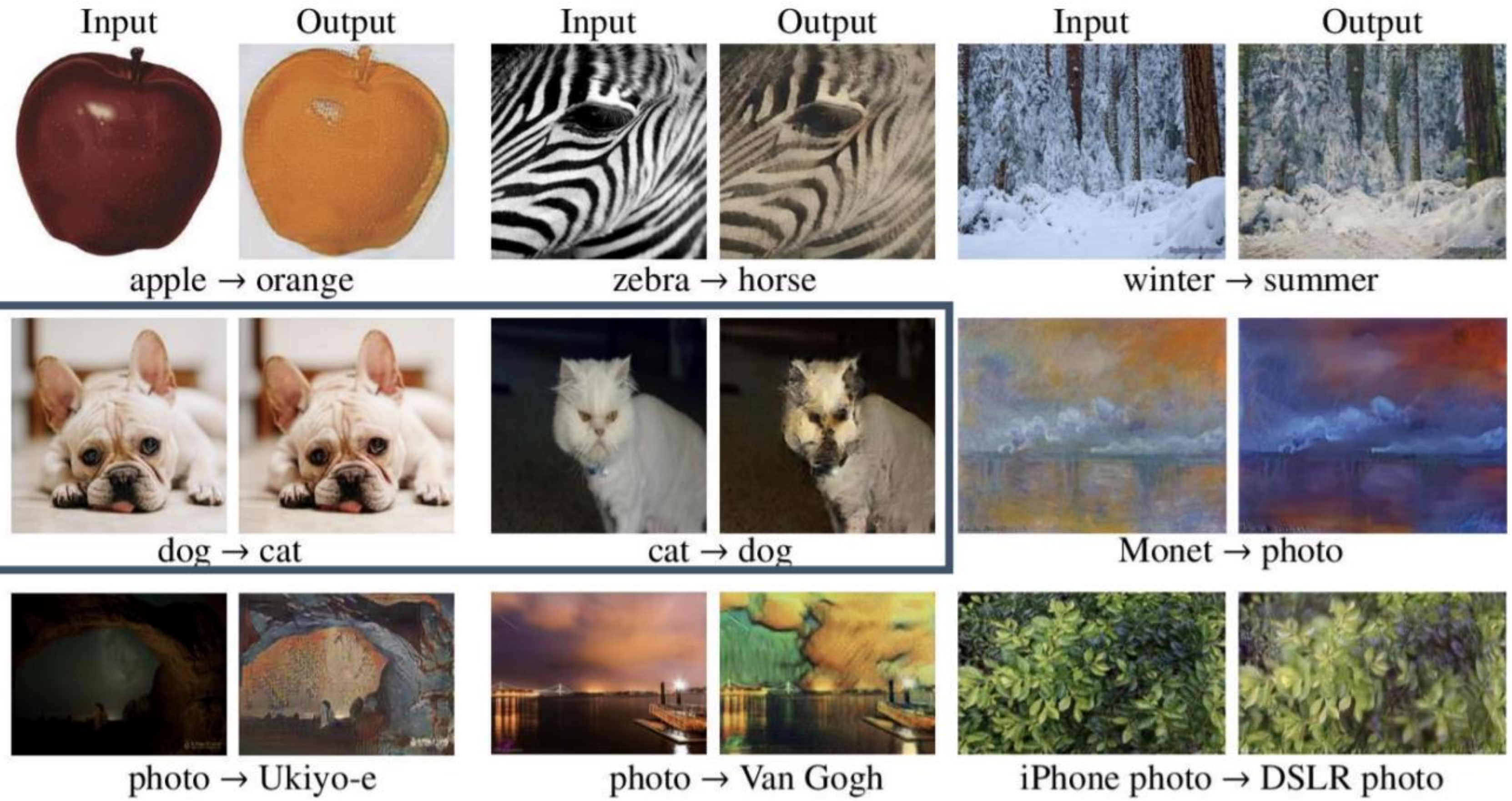
$$L_{GAN}(G(x),y) + \|F(G(x)) - x\|_1 + L_{GAN}(F(y),x) + \|G(F(y)) - y\|_1$$

Cycle

GAN

Limitation

Failure cases



Cycle

GAN

Limitation

1 / 100 data

Thank you

- [참고]

- - Unpaired Image-to-Image Translation using Cycle-Consistent Adversarial Networks [Jun-Yan Zhu* Taesung Park* Phillip Isola Alexei A. Efros Berkeley AI Research (BAIR) laboratory, UC Berkeley]

https://arxiv.org/pdf/1703.10593v6.pdf

- - Finding connections among images using CycleGAN[Taesung Park, Naver D2, 2017]

https://www.slideshare.net/NaverEngineering/finding-connections-among-images-using-cyclegan