

[Deep Learning Seminar]
Season 3 : Deep Learning Paper Review

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

By Jun-Yan Zhu et al.

Hanyang University
Artificial Intelligence Lab.
Gunhee Cho

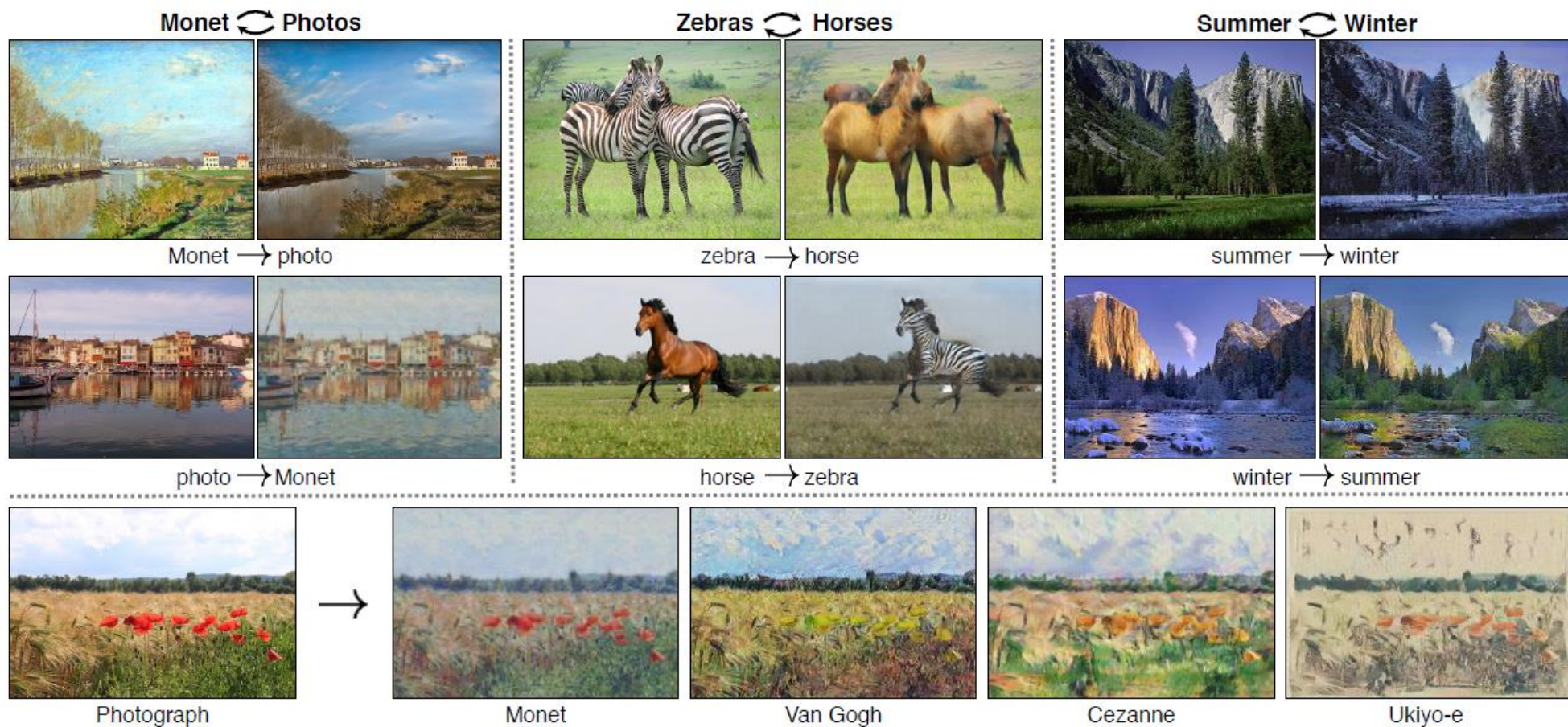
DiscoGAN 발표를 준비하던 어느 날..



“CycleGAN”

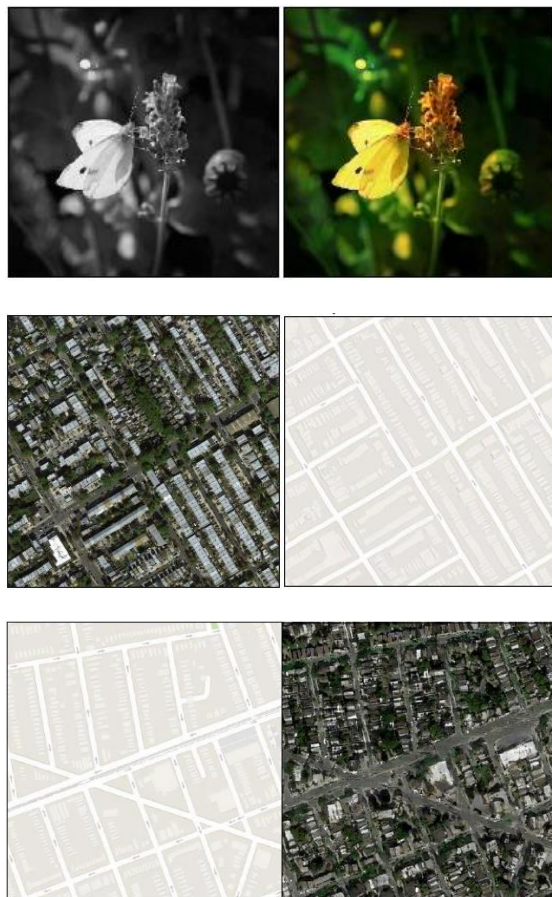
띠용 ㅈㄴ 신기하네..

이걸로 뭘 할 수 있을까?



pix2pix랑 뭐가 달라?

pix2pix



CycleGAN



멍청한 G와 D

$$\text{Loss} : L_{GAN}(G(x), y)$$

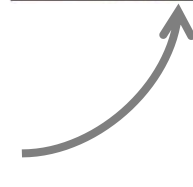
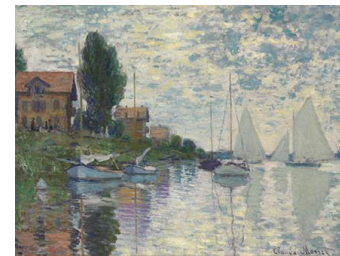
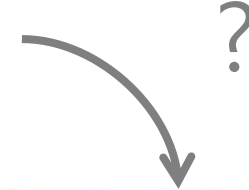
G

그림을
"사진"처럼만
만들면 되는 거지?

○○ "사진"은
맞네

D

CycleGAN



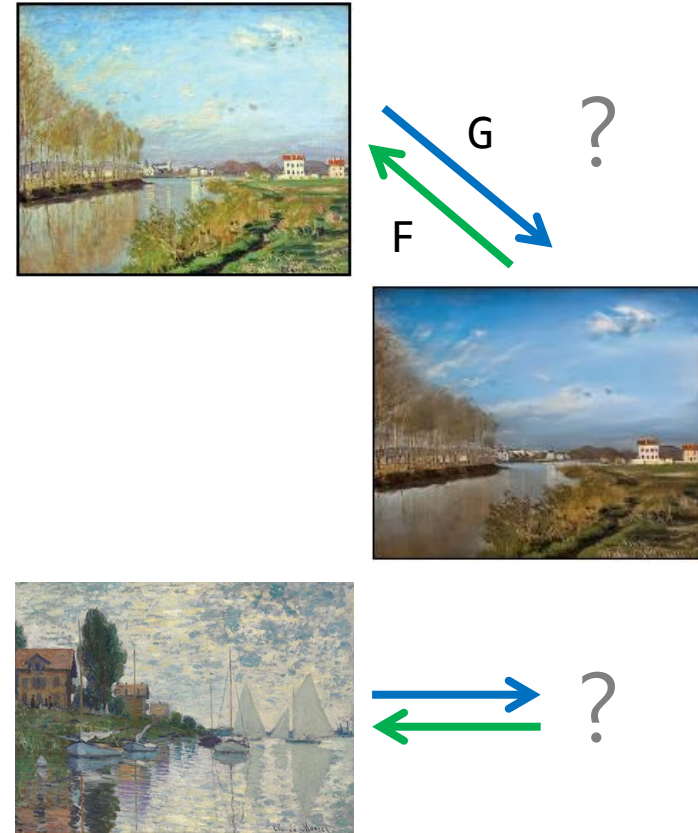
요렇게 해결!!

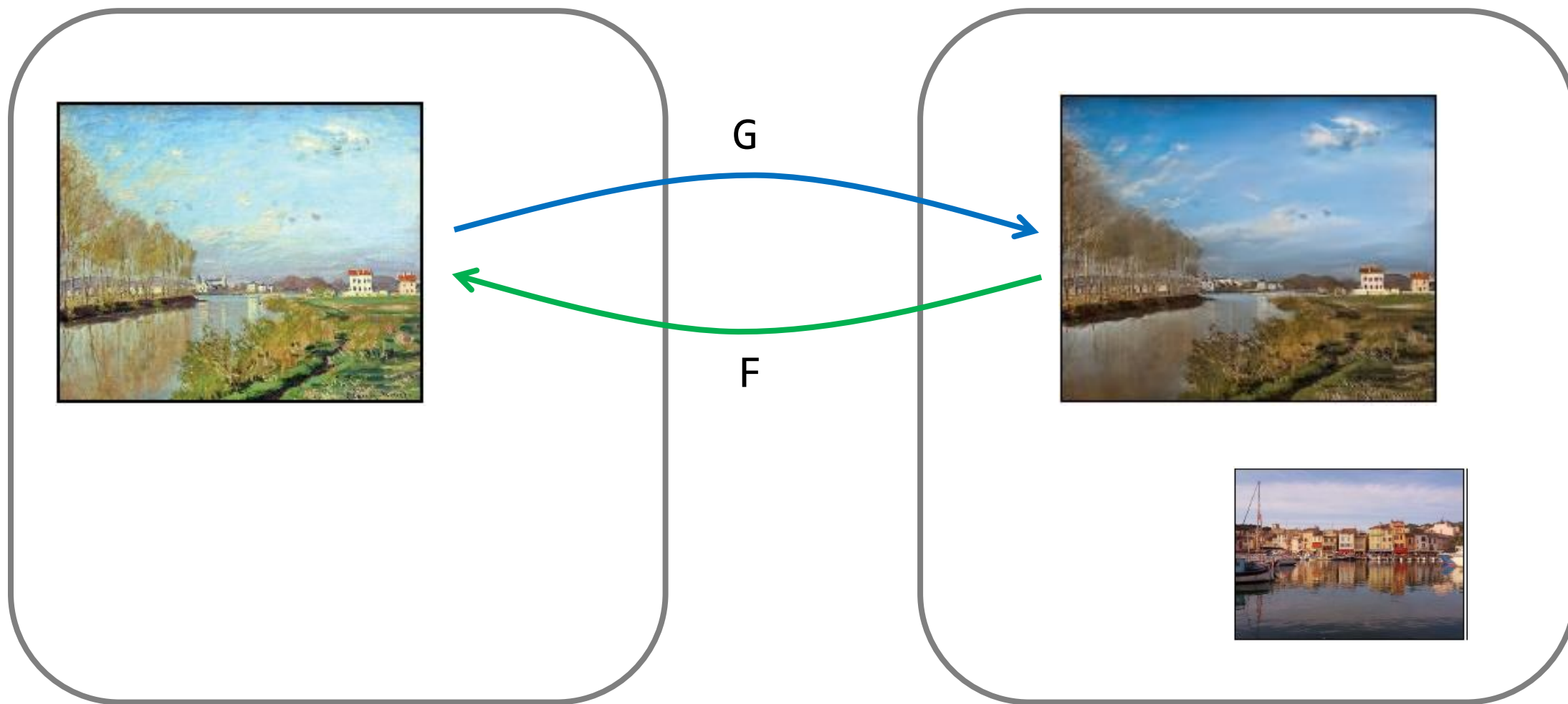
$$\text{Loss} : L_{GAN}(G(x), y) + \|F(G(x)) - x\|_1$$

F

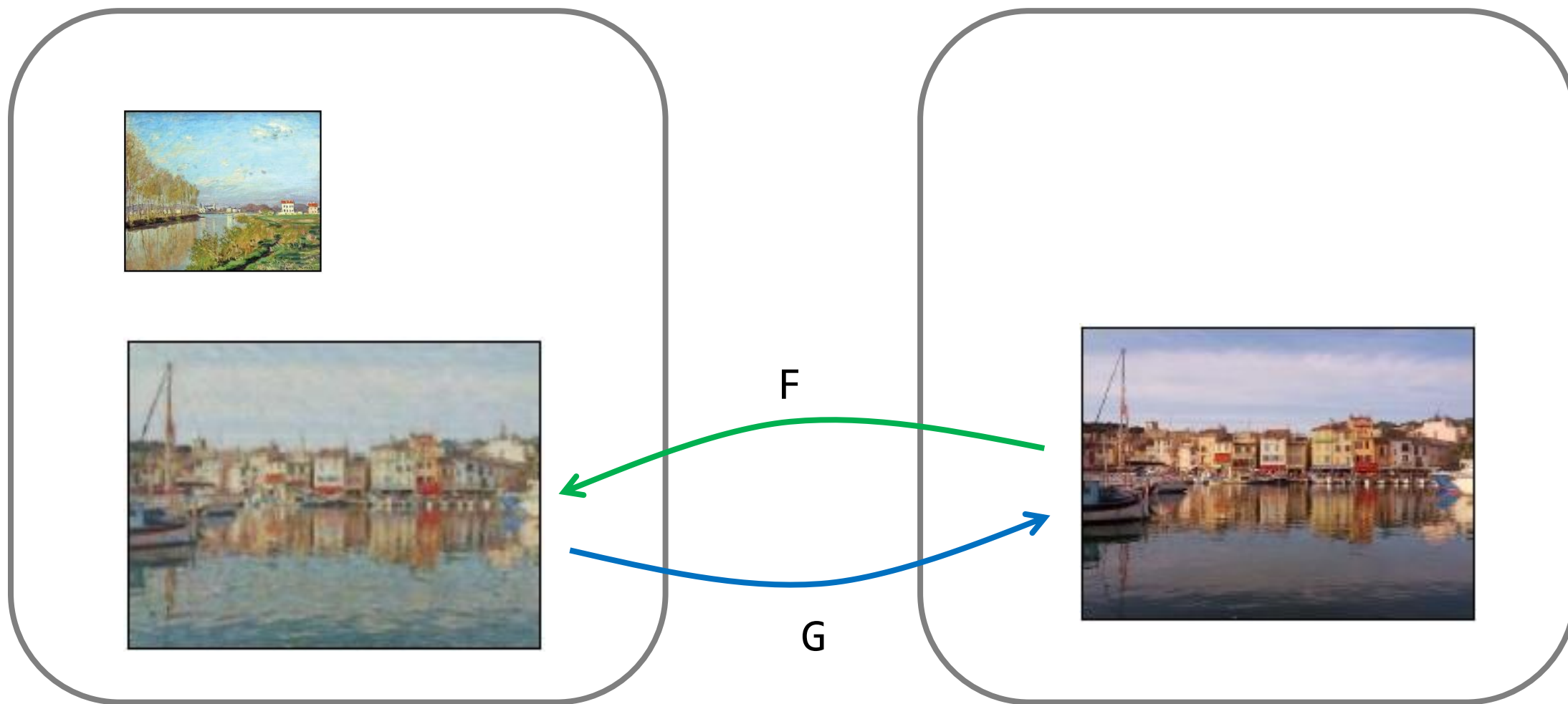
내가 복원 해줄게!

CycleGAN

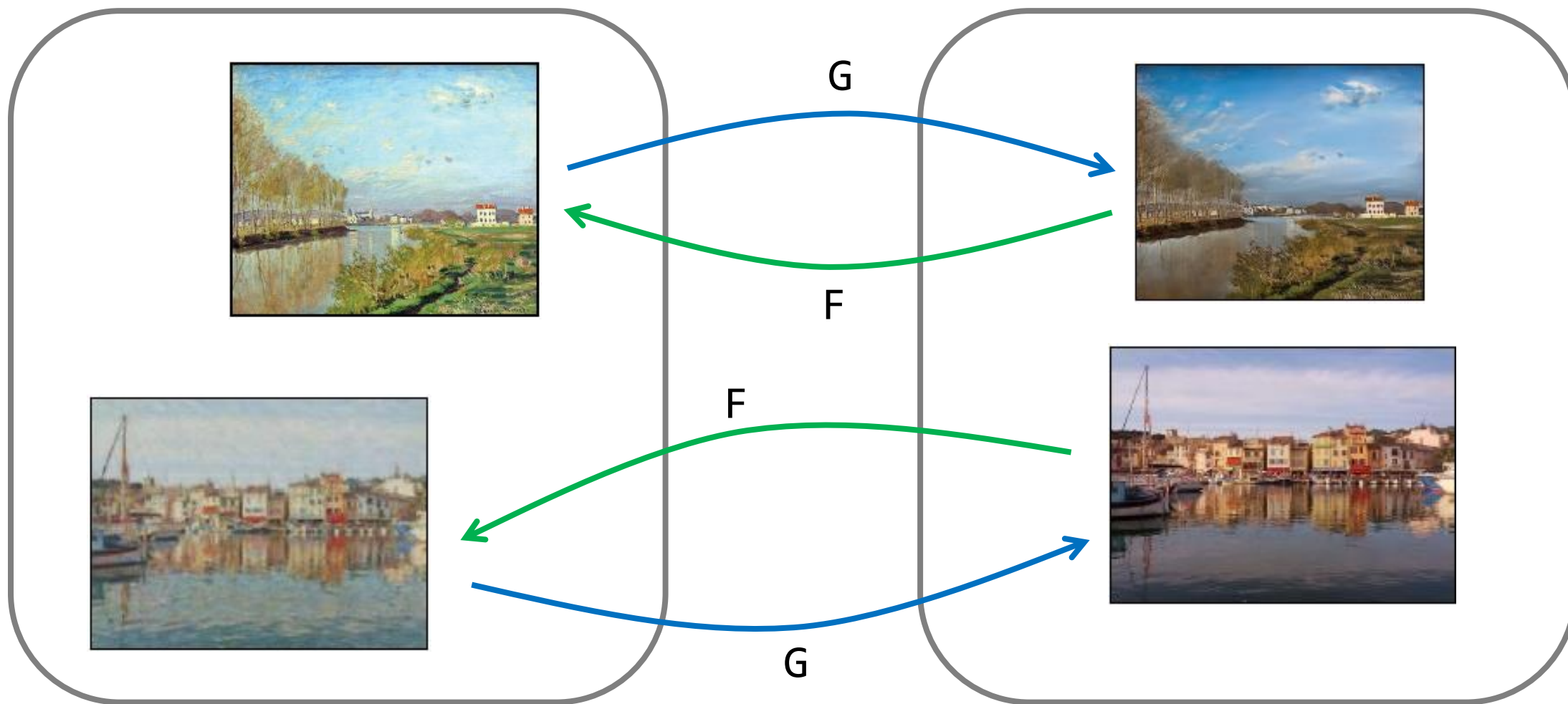




$$L_{GAN}(G(x), y) + \|F(G(x)) - x\|_1$$

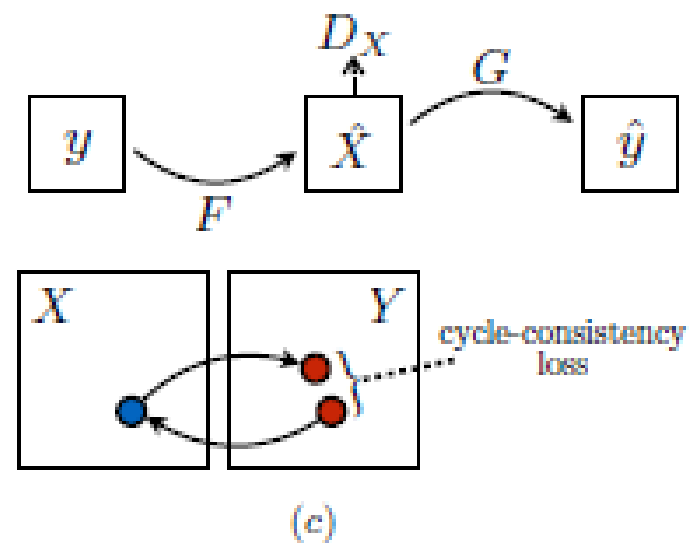
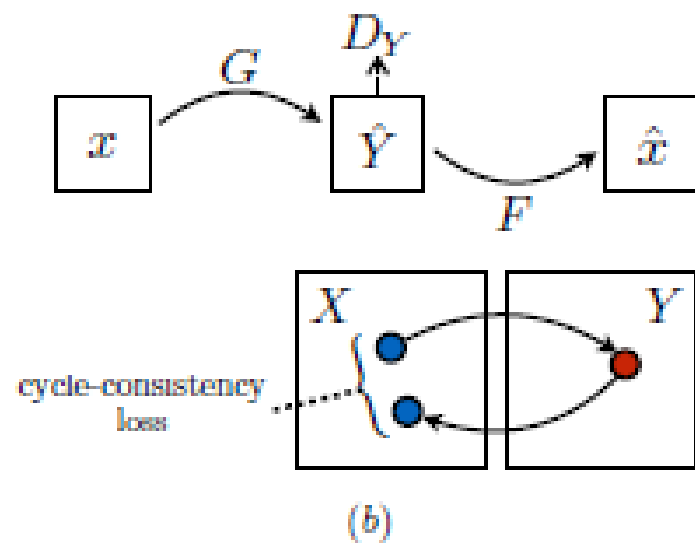
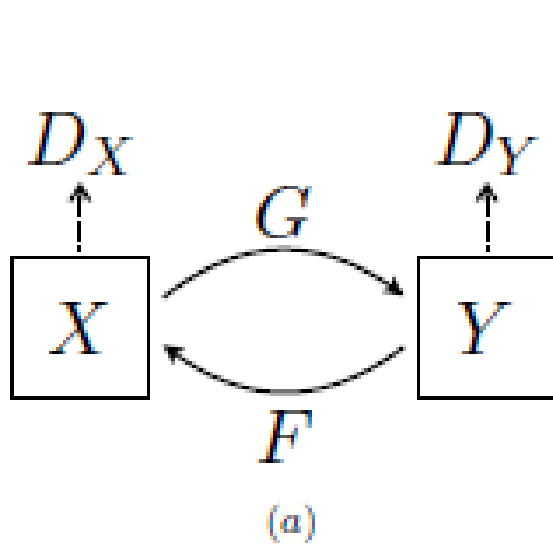


$$L_{GAN}(F(y), x) + \|G(F(y)) - y\|_1$$



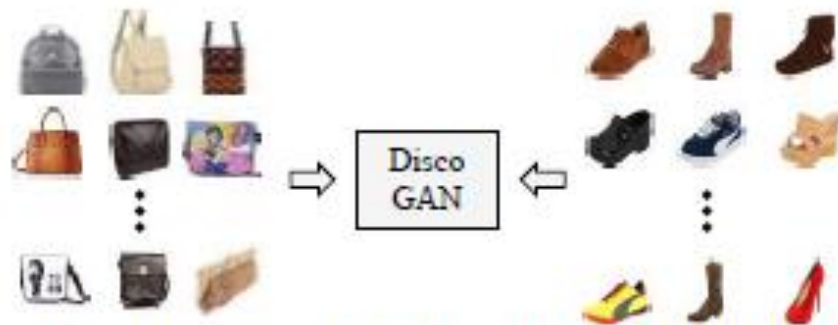
$$L_{GAN}(G(x), y) + \|F(G(x)) - x\|_1 + L_{GAN}(F(y), x) + \|G(F(y)) - y\|_1$$

짜잔~



아니....

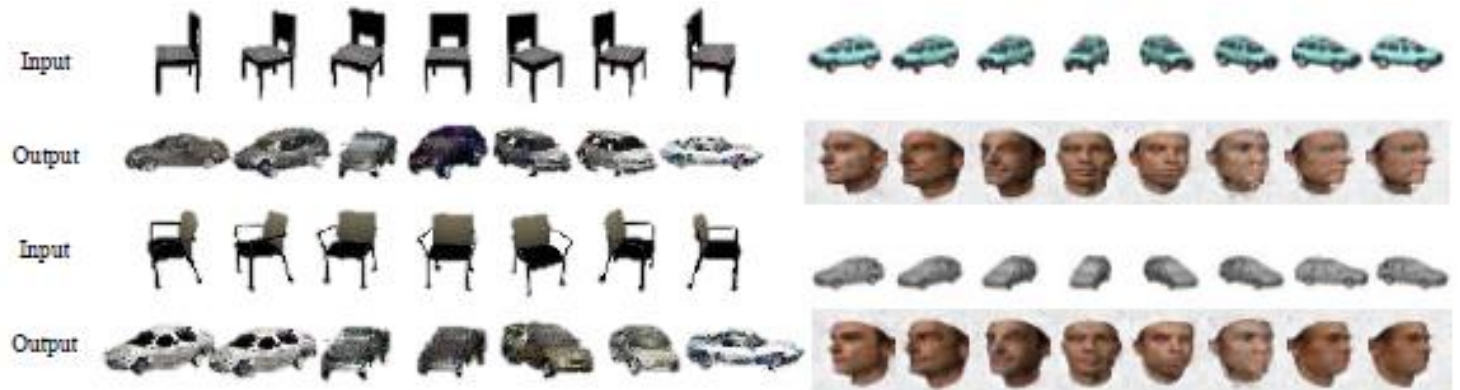
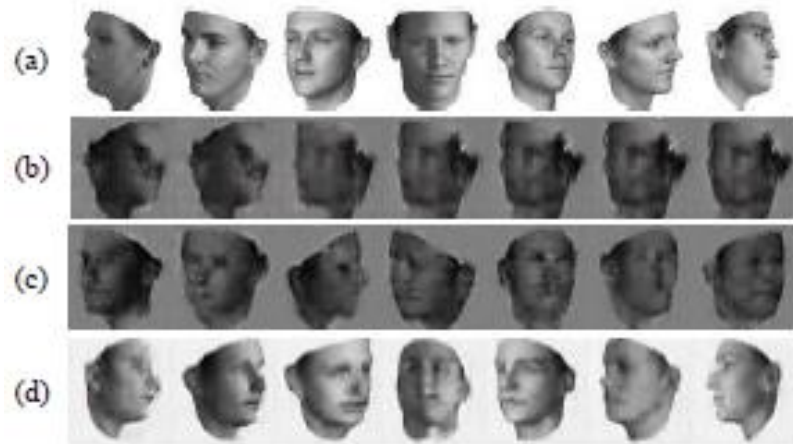
근데 이거 DiscoGAN이랑 똑같은 거 아님?



(a) Learning cross-domain relations **without** any extra label

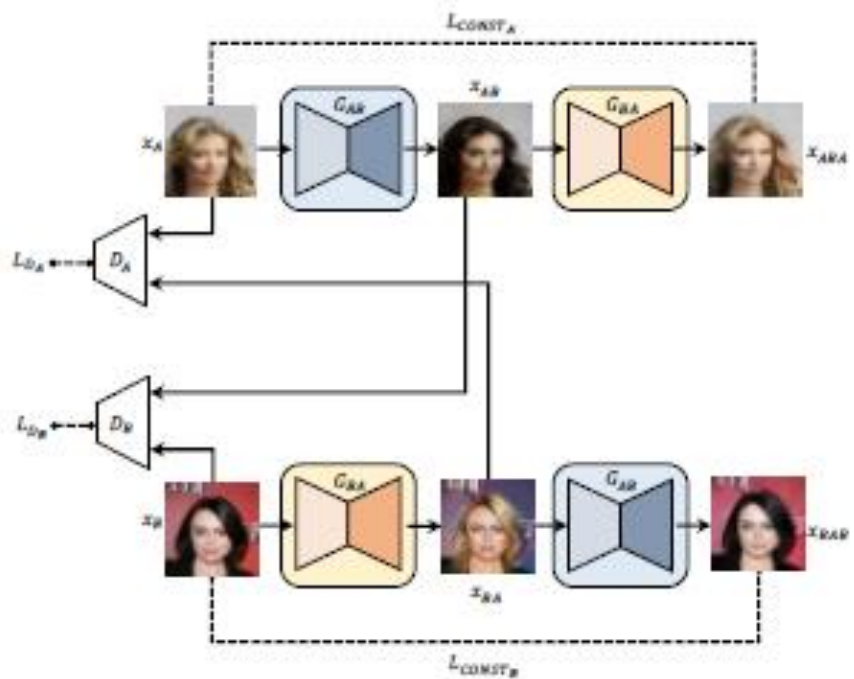


(b) Handbag images (input) & Generated shoe images (output)

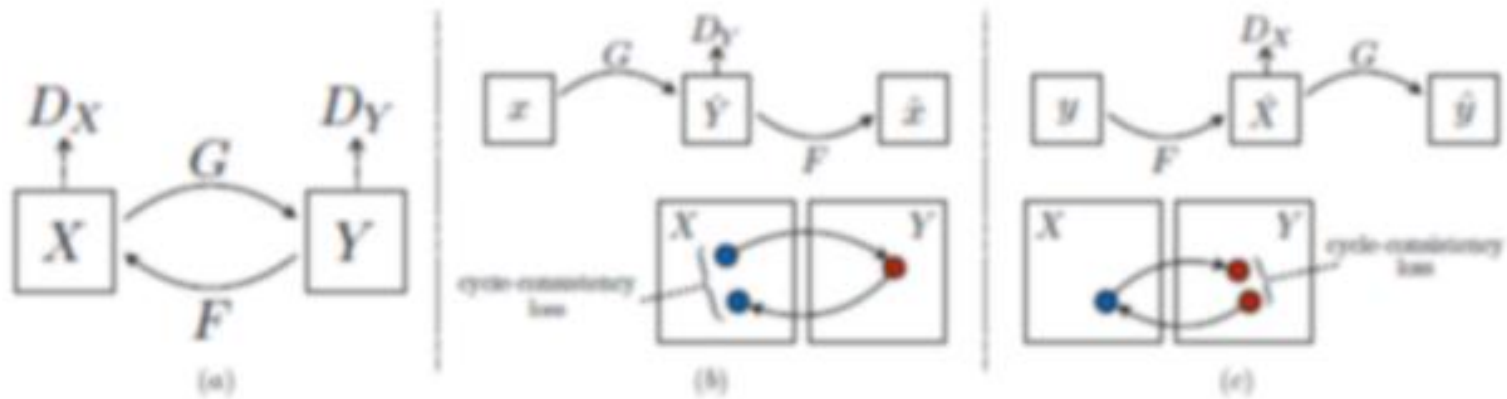


(a) Chair to Car

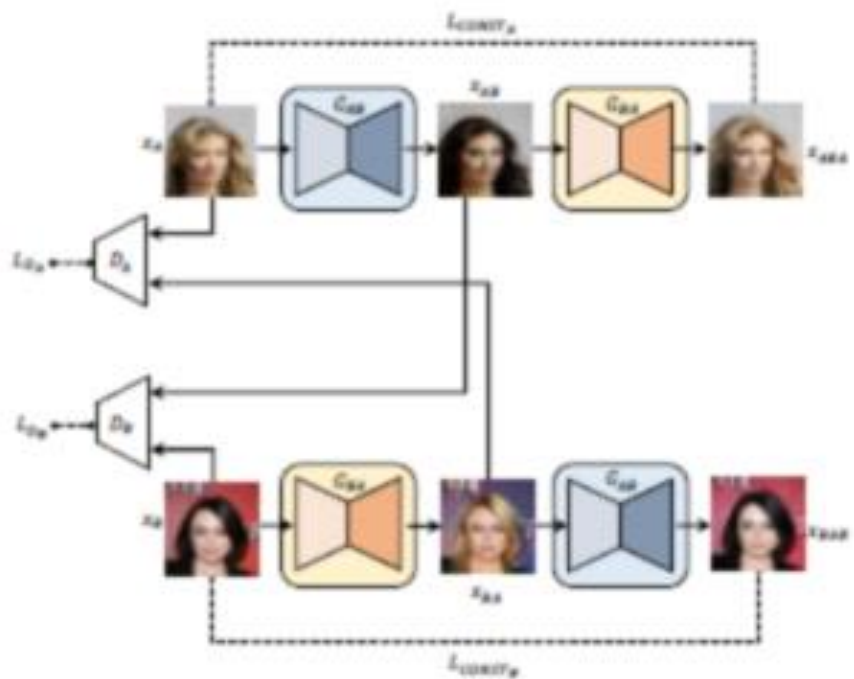
(b) Car to Face



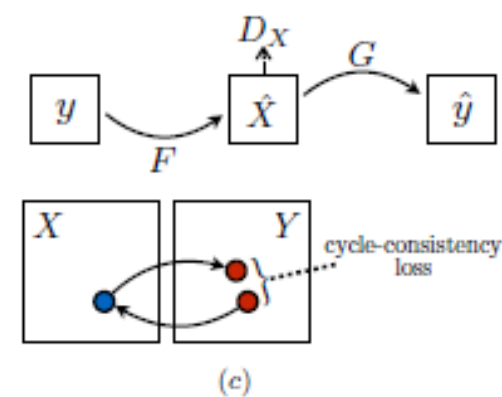
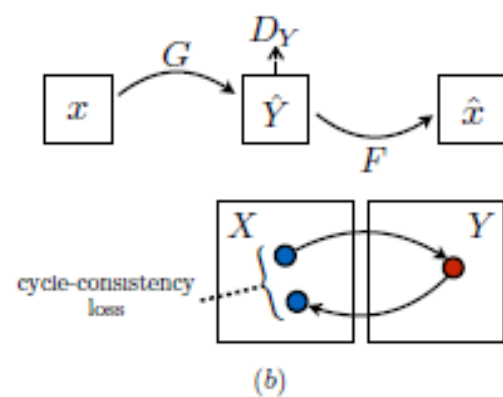
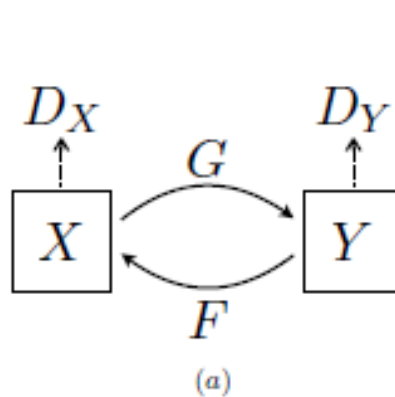
DiscoGAN



CycleGAN



DiscoGAN



CycleGAN

전체 동작원리는 동일!

전체 동작원리는 동일!

그럼 뭐가 다른거야?

CycleGAN 만든 사람이 알려줌!



저는 다른데여?

Finding connections among images using CycleGAN

조회수 2,632회

40 0 공유 ...

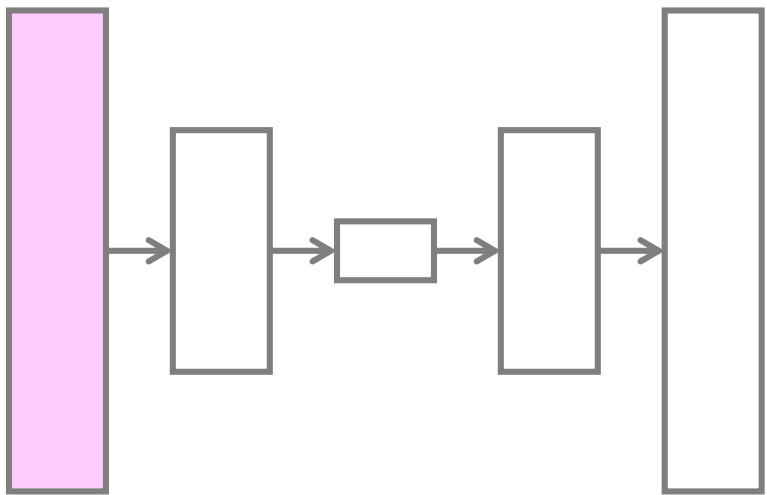
NAVER naver d2
게시일: 2017. 10. 23.

구독 2.3천

발표자: 박태성 (UC Berkeley 박사과정)
발표일: 2017.6.

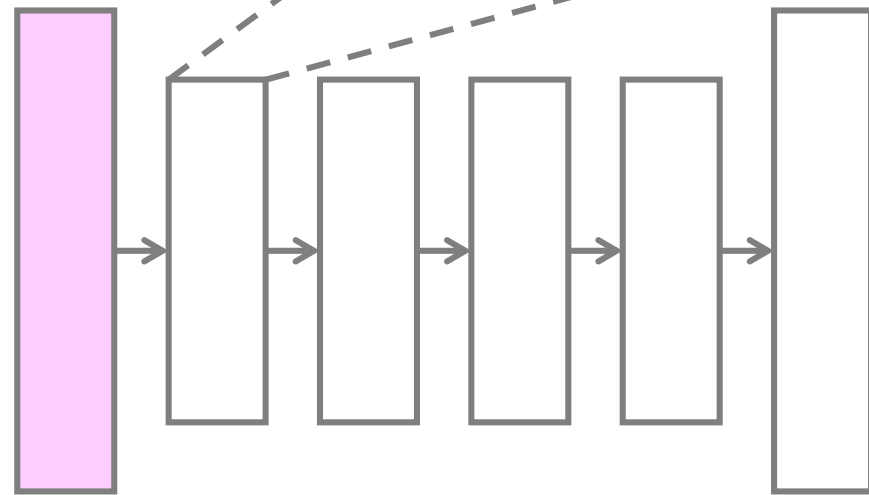
G 구조가 다름

DiscoGAN

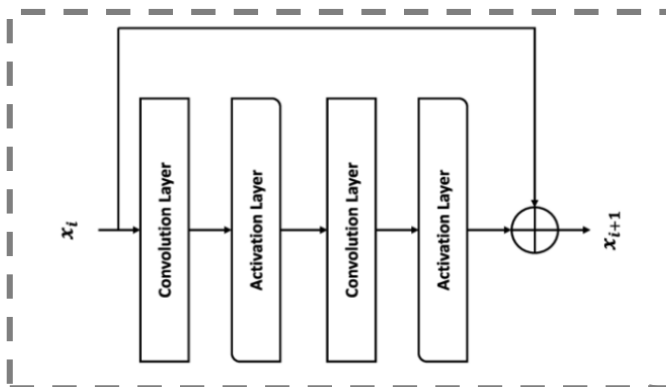


Encoder-decoder

CycleGAN



ResNet
[He et al.]



왜 다른거야?

목적이 다름

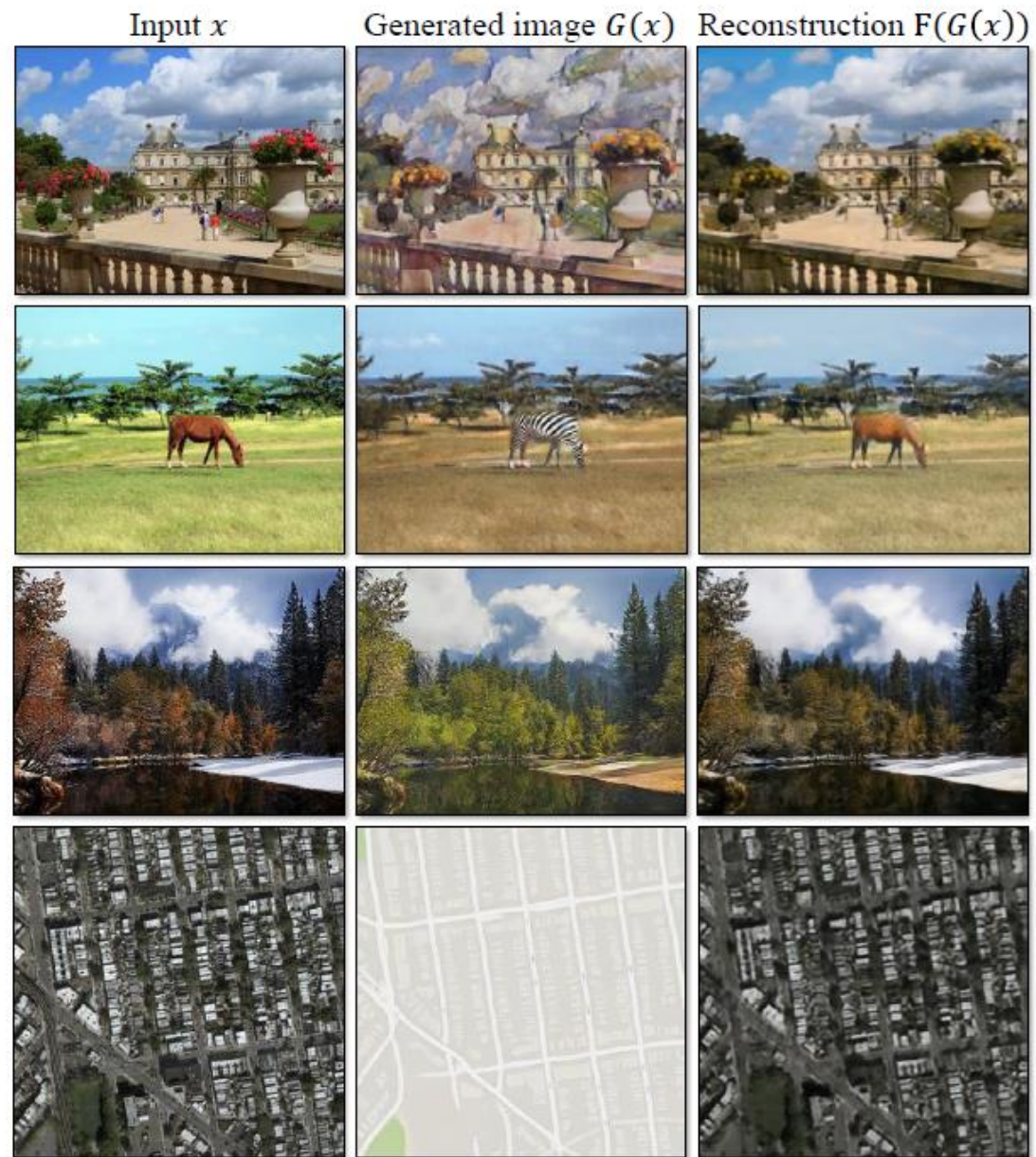
DiscoGAN

- 두 이미지 간 관계를 파악해보자!
- 디테일보다는 전체적인 변화에 집중!
즉, 높은 해상도는 바라지 않아!
- 물체 특성(방향 등)을 유지시키면서 물체 형태를 바꿔보자!

CycleGAN

- 컴퓨터 그래픽을 사진처럼 만들어 보자!
- 지금까지의 GAN은 32픽셀짜리 이미지를 생성하는 수준이었는데 고해상도 이미지를 생성해보자!
- 실제 사진처럼 보이는 게 목적이니까 오버피팅 일어나게 하는 것도 나쁘지 않아!

잘 됨?



잘 됨?



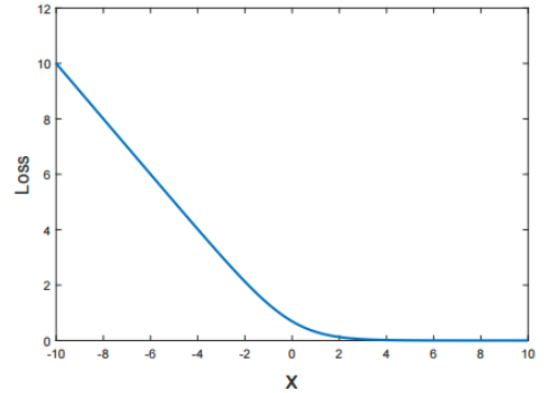
$$L_{GAN}(G(x), y) + \|F(G(x)) - x\|_1 + L_{GAN}(F(y), x) + \|G(F(y)) - y\|_1$$

CycleGAN의 특징이 있다면?

Least Square GAN [Mao et al.]

$$\mathcal{L}_{GAN}(G, D_y, X, Y)$$

$$= \mathbb{E}_{y \sim p_{data}(y)} [\log D_Y(y)] + \mathbb{E}_{x \sim p_{data}(x)} [\log(1 - D_Y(G(x)))]$$

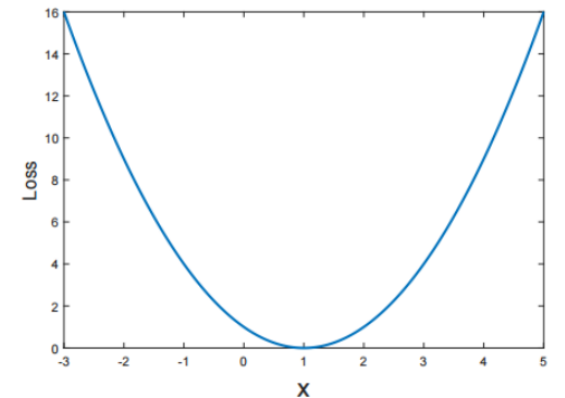


$$\mathcal{L}_{LSGAN}(D, X, Y)$$

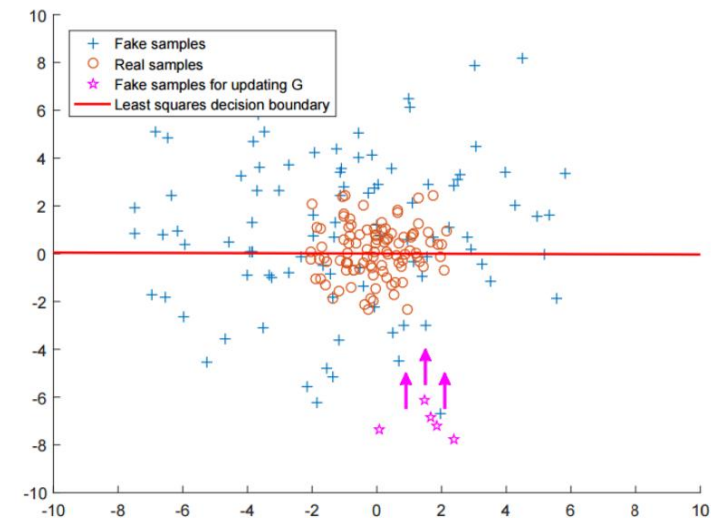
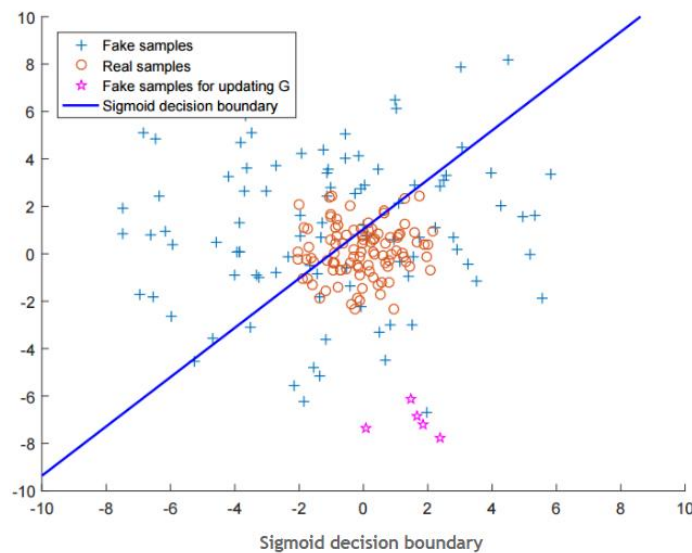
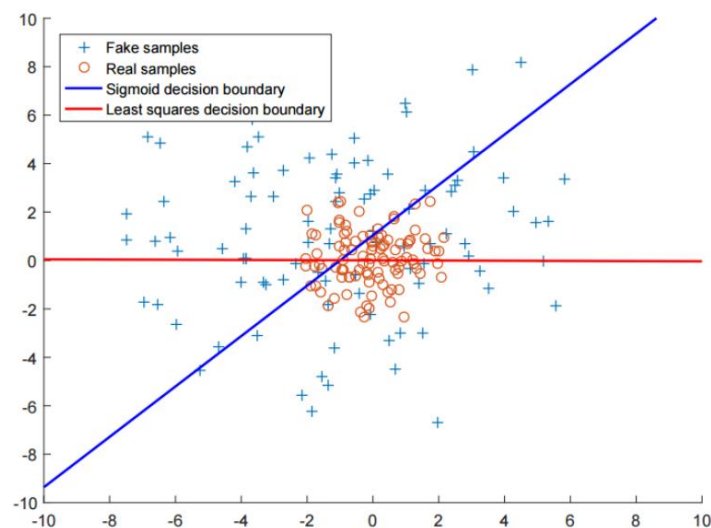
$$= \mathbb{E}_{y \sim p_{data}(y)} [(D(y) - 1)^2] + \mathbb{E}_{x \sim p_{data}(x)} [(D(G(x)))^2]$$

$$\mathcal{L}_{LSGAN}(G, X, Y)$$

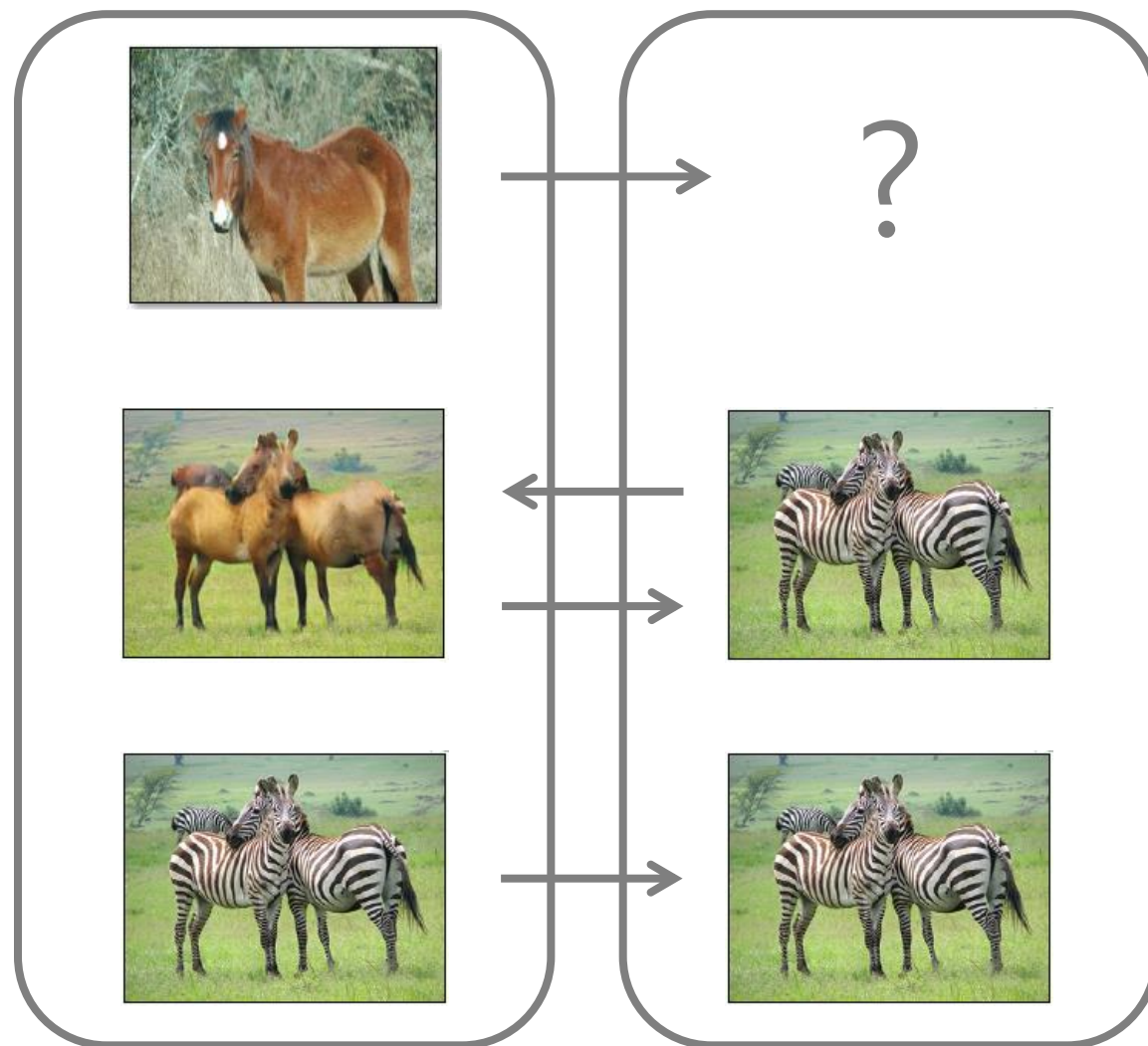
$$= \mathbb{E}_{x \sim p_{data}(x)} [(D(G(x)) - 1)^2]$$



Least Square GAN [Mao et al.]

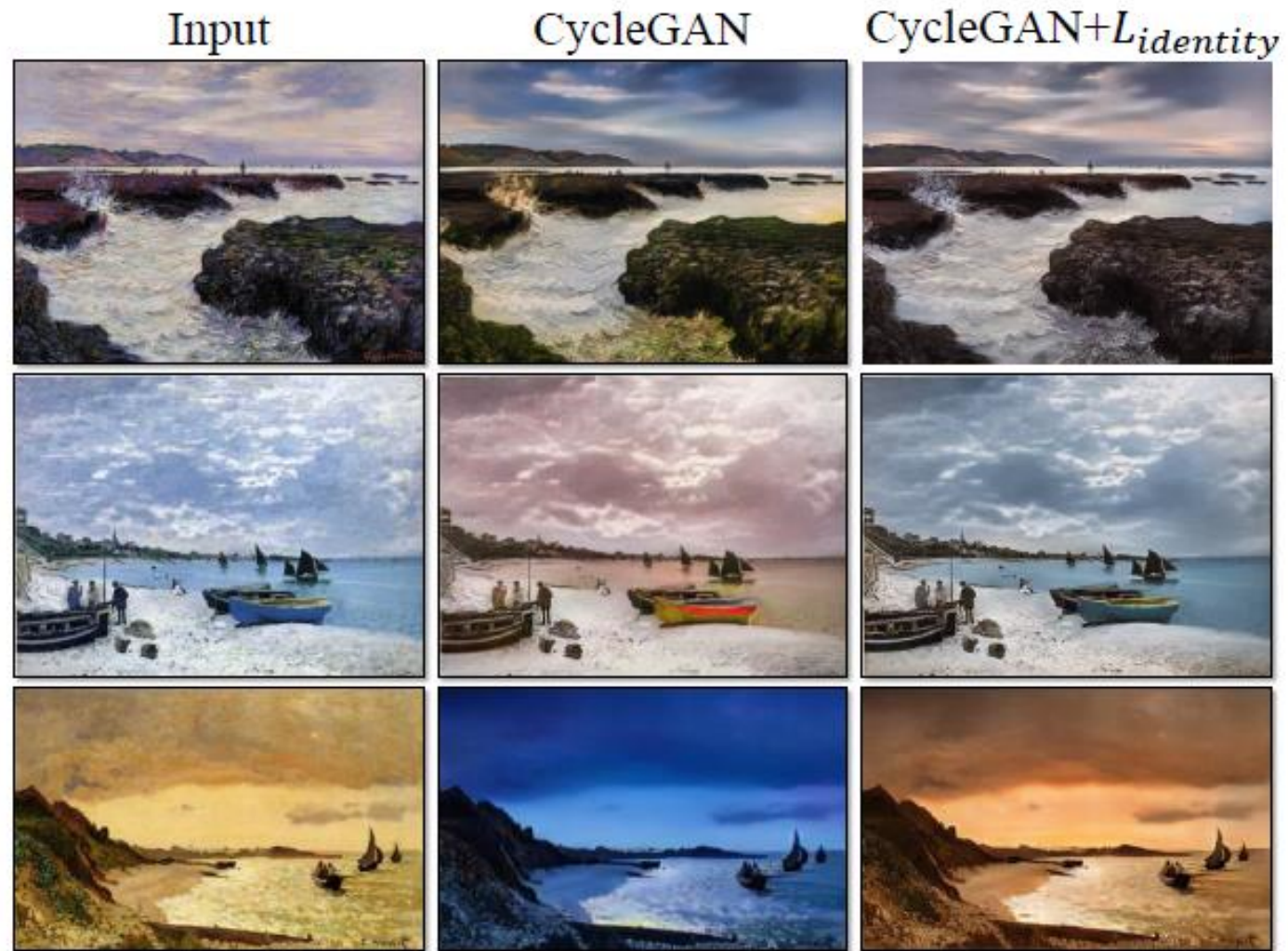


L1 Loss



*stable
guiding
force*

L1 Loss

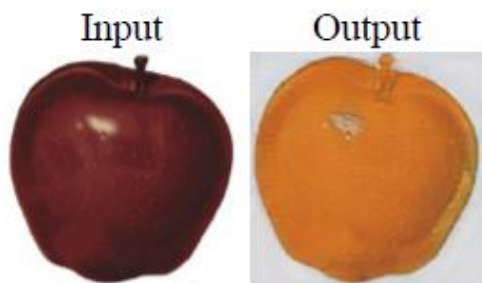


Replay buffer!

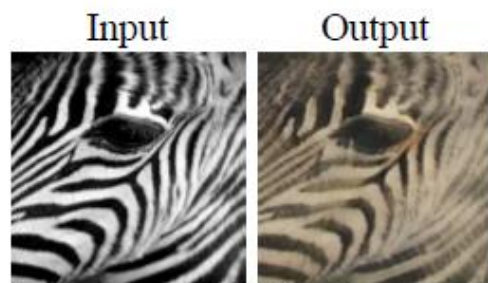
Replay buffer!

G가 전에 만든 50개 갖고 D 복습!

이런 것들은 잘 안됨...



apple → orange



zebra → horse



winter → summer



dog → cat



cat → dog



Monet → photo



photo → Ukiyo-e



photo → Van Gogh



iPhone photo → DSLR photo



Horse → Zebra



ImageNet “wild horse” training images

그래서 이걸 어디에 쓰면 됨?

CG2Real : GTA 게임화면을 실제처럼!



GTA → Cityscapes

게임할라고 만든거임?

게임할라고 만든거임?

ㄴ ㄴ 이거로 무인자동차 만들거임!







게임하라고 산 거 아님! 연구할거임!

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1



Intelligent Machines

Self-Driving Cars Can Learn a Lot by Playing Grand Theft Auto

Hyper-realistic computer games may offer an efficient way to teach AI algorithms about the real world.

by Will Knight September 12, 2016

Spending thousands of hours playing Grand Theft Auto might have questionable benefits for humans, but it could help make computers significantly more intelligent.

Domain Adaption with CycleGAN



Train on CycleGAN data



Test on real images

		Per-class accuracy	Per-pixel accuracy
Oracle (Train and test on Real)	실제 학습	60.3	93.1
Train on CG, test on Real	GTA 학습	17.9	54.0
FCN in the wild [Hoffman et al.]	잘 학습	27.1 (+6.0)	-
Train on CycleGAN, test on Real	GTA + CycleGAN 학습	34.8 (+16.9)	82.8

질문 있음?

감사리

<https://youtu.be/Fkqf3dS9Cqw>

https://youtu.be/odpjk7_tGY0

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

<https://mikigom.github.io/jekyll/update/2017/07/11/cyclegan.html>

<https://taeoh-kim.github.io/blog/gan%EC%9D%84-%EC%9D%B4%EC%9A%A9%ED%95%9C-image-to-image-translation-pix2pix-cyclegan-discogan/>

<https://www.youtube.com/watch?v=Fkqf3dS9Cqw&t=2799s>

<https://ratsgo.github.io/blog/>

<https://www.slideshare.net/ssuser77ee21/generative-adversarial-networks-70896091>

https://www.youtube.com/watch?v=odpjk7_tGY0&feature=youtu.be&t=3m7s

<https://www.slideshare.net/carpedm20/ss-63116251>