Generative Adversarial Network (Intro)

2018/05/06

강준하

Reference

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  - https://www.slideshare.net/carpedm20/pycon-korea-2016?qid=0b8383ce-826d-4451-ae10-9cf323842145&v=&b
- [Jaejun Yoo] PR12와 함께 이해하는 GANs
  - https://www.slideshare.net/thinkingfactory/pr12-intro-to-gans-jaejun-yoo
- [Yunjey Choi] 1시간만에 GAN(Generative Adversarial Network) 완전 정복하기
  - https://www.slideshare.net/NaverEngineering/1-gangenerative-adversarial-network
- 오일석, 기계학습, 2017, 한빛미디어

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1. Generative Model Introduction

Motivation

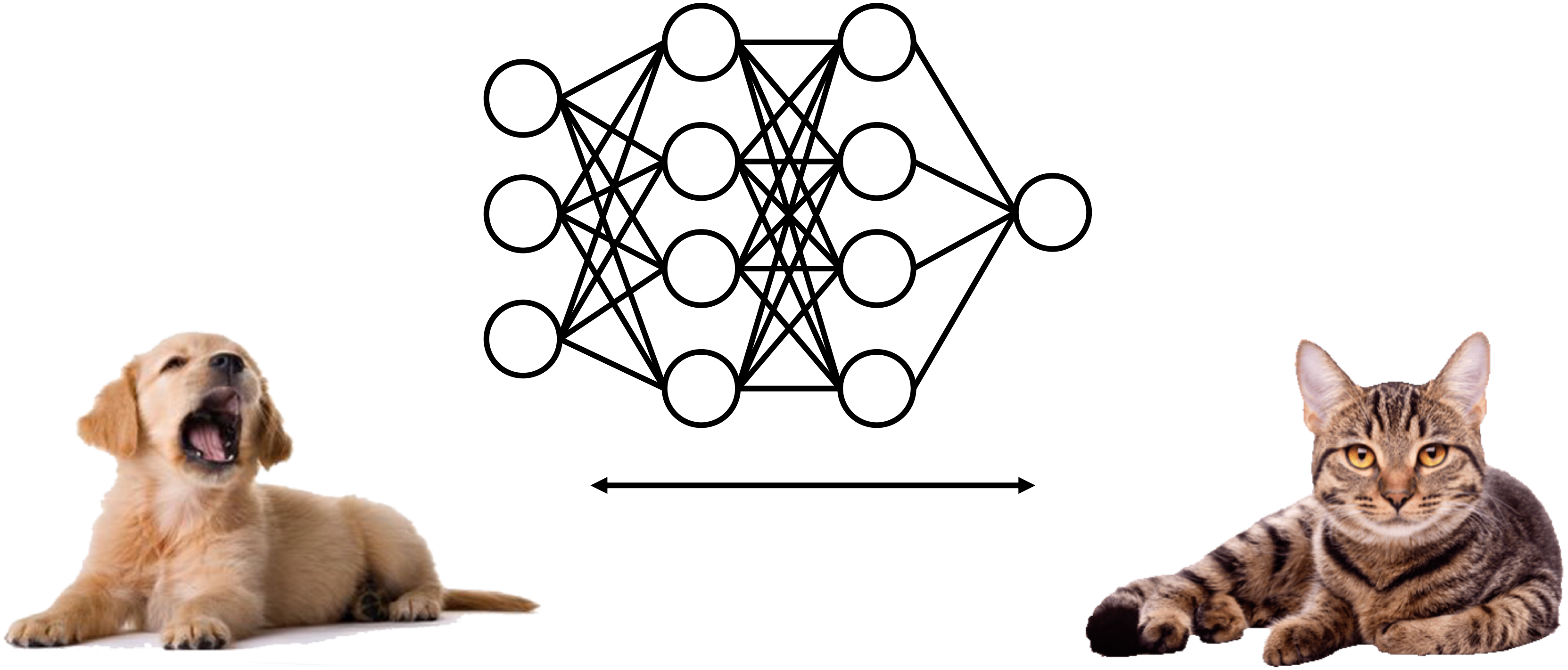
“**Generated** Images by Neural Network“
* Figure adopted from BEGAN paper released at 31. Mar. 2017 David Berthelot et al. Google (link)

What is ‘**Generative** Model’?

- Richard Feynman
  - “What I cannot create, I do not understand.”

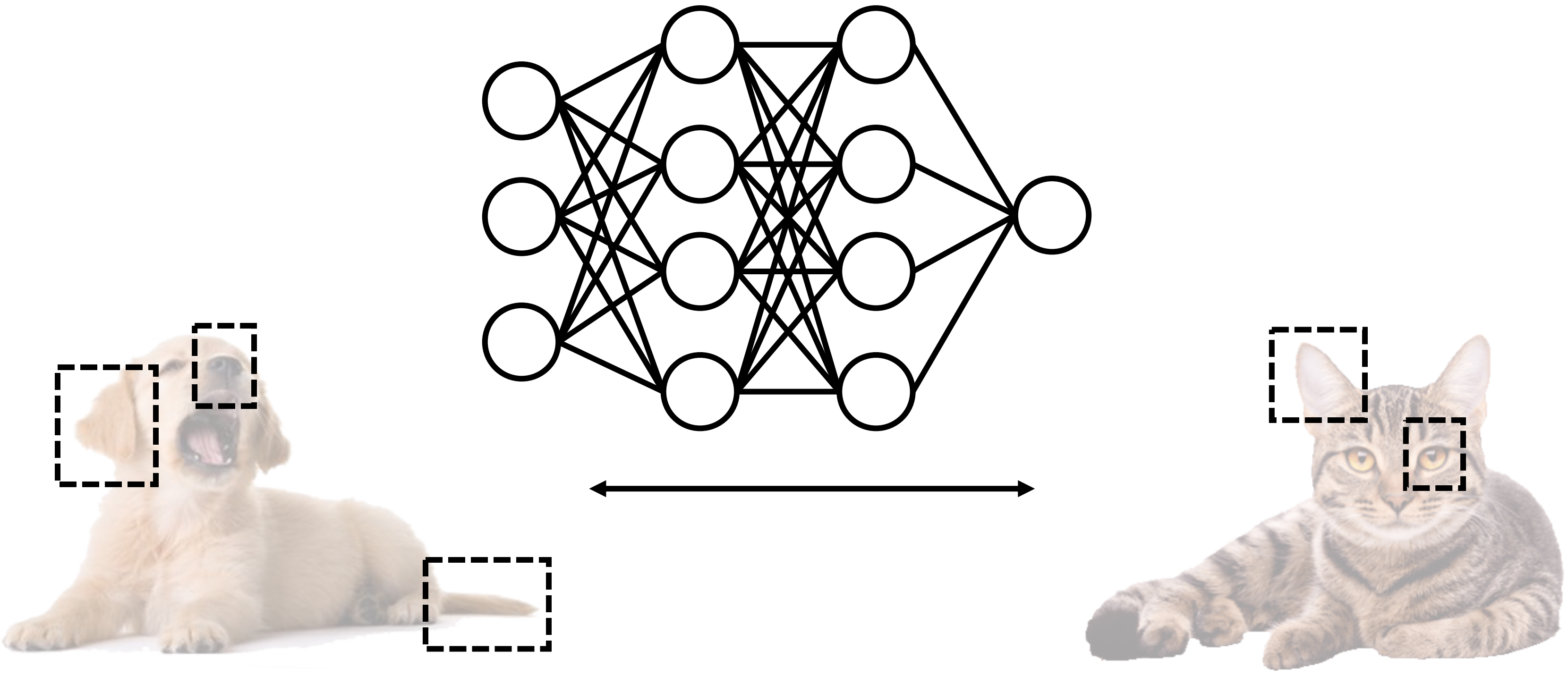
    (내가 만들어낼 수 없다면, 난 그것을 이해하지 못한 것이다.)
- 이제까지 우리가 공부해왔던 내용 : 분별 모델

Discriminative vs Generative



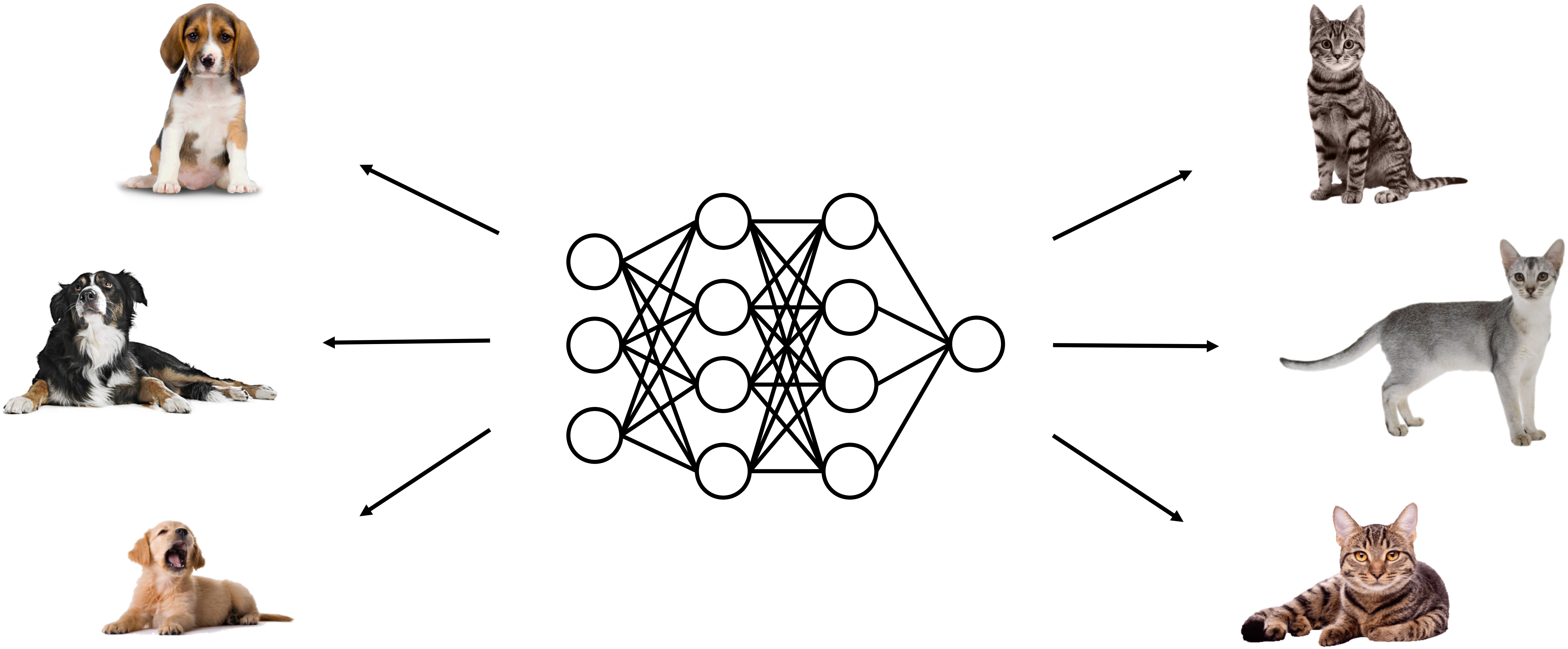
개와 고양이를 **구분하는 모델**

Discriminative vs Generative



단순히 **특징**을 배운 것에 불과

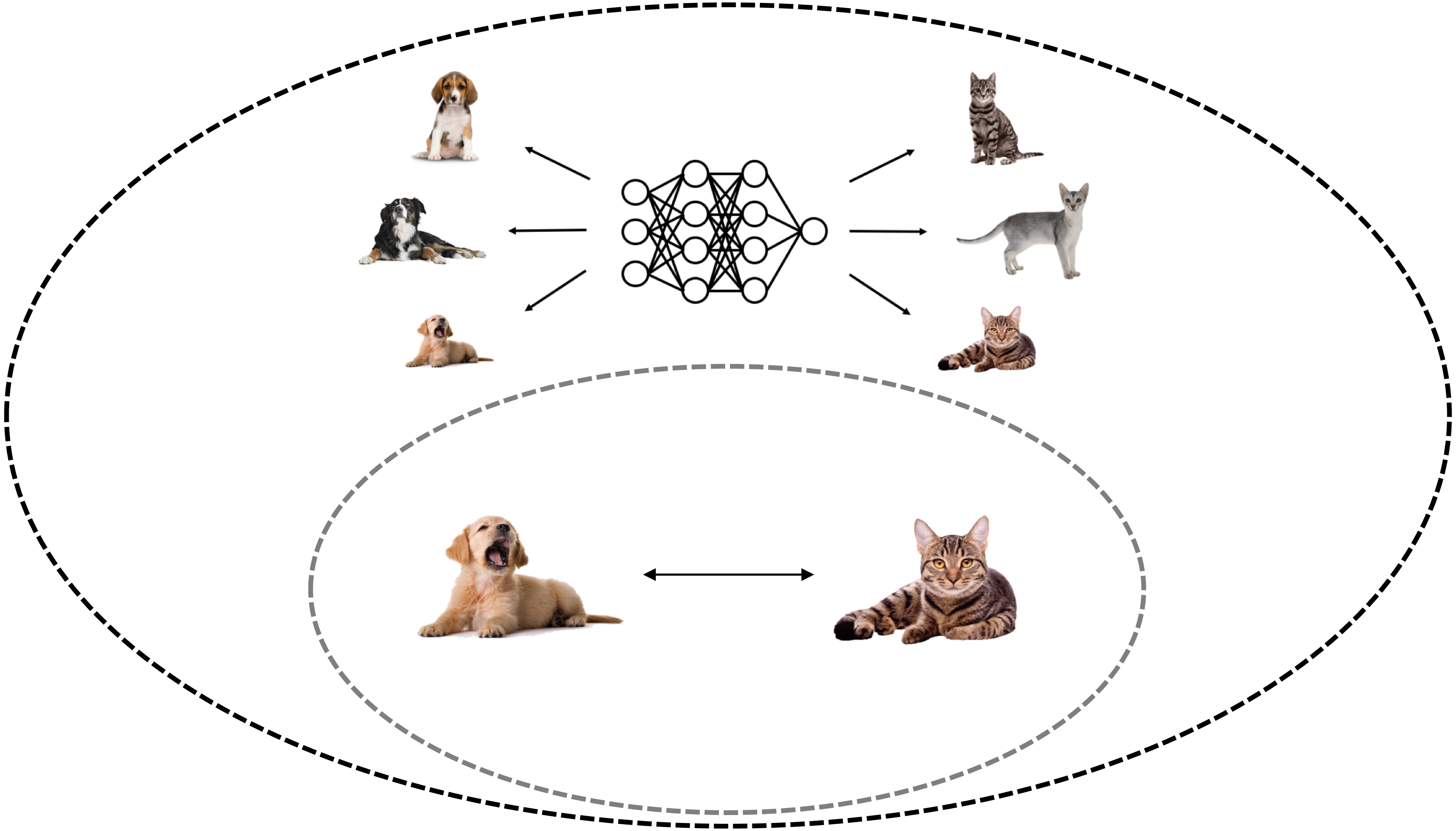
Discriminative vs **Generative**



개와 고양이 사진을 **만들 수 있는 모델**?

→ 분류 모델보다는 개와 고양이를 제대로 이해하고 있다!

Discriminative vs Generative



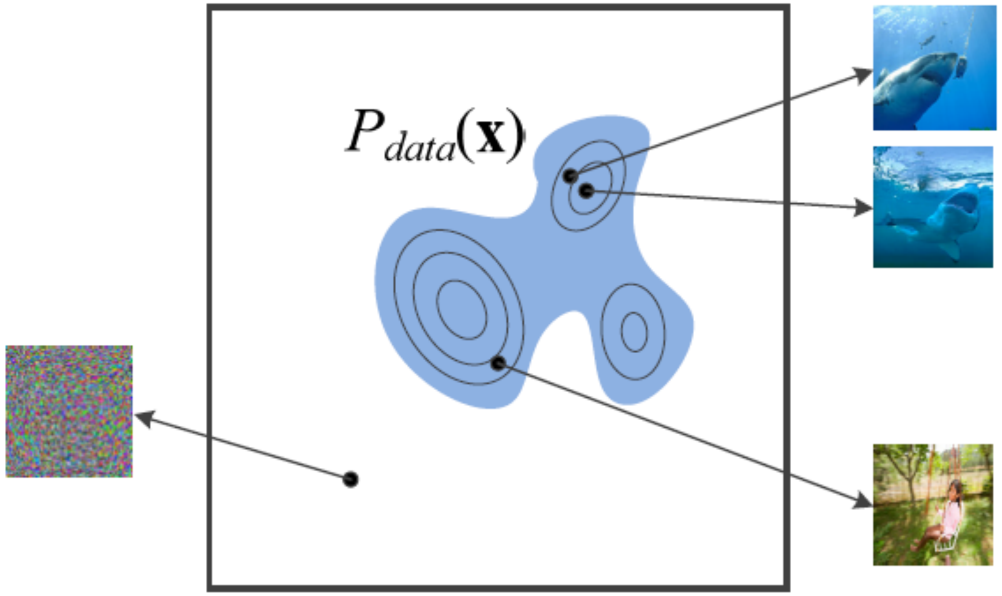
제대로 이해하고 있다면, 개와 고양이의 분류는 쉬운 문제

Discriminative vs Generative

모델	학습 단계가 할 일	예측 단계가 할 일	지도 여부
분별 모델	$P(y\|\mathbf{x})$추정	$f: \mathbf{x} \mapsto y$	지도 학습
생성 모델	$P(\mathbf{x})$ 또는 $P(\mathbf{x}\|y)$, $P(\mathbf{x}, y)$ 추정	f: 씨앗$\mapsto \mathbf{x}$ 또는 f: 씨앗, $y \mapsto \mathbf{x}$, f: 씨앗$\mapsto \mathbf{x}, y$	비지도 학습

Generative model

- 자연의 사진 data 또한 어떤 probability distribution model에 의해 생긴 결과일 것이라고 가정
- 그렇다면 이 probability distribution을 알아낼 수 있다면 인위적으로 샘플을 생성 가능
- 진짜처럼 보이는 ‘가짜’ 자료 생성 가능!



Generative model

- GAN (Generative Adversarial Network)
- VAE (Variational AutoEncoder)
- RNN
- RBM
- 등의 모델들…

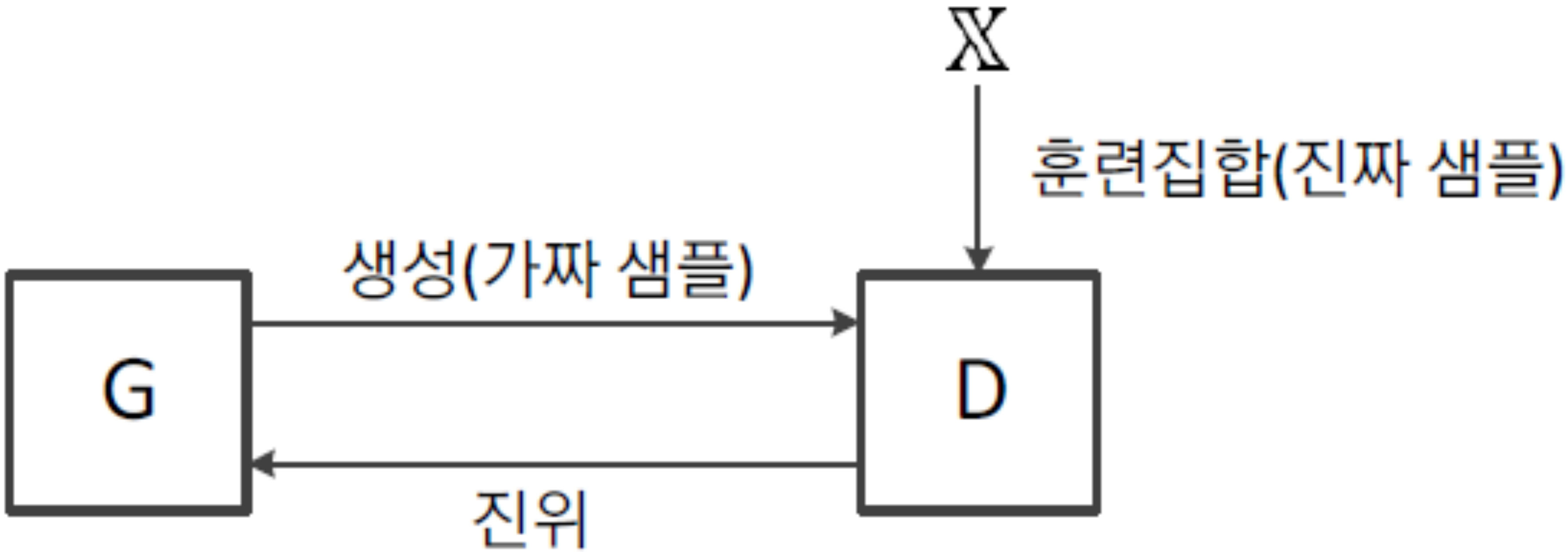
- 현재 GAN이 가장 우월한 성능 보이는 중!

2. About GAN(Generative Adversarial Network)

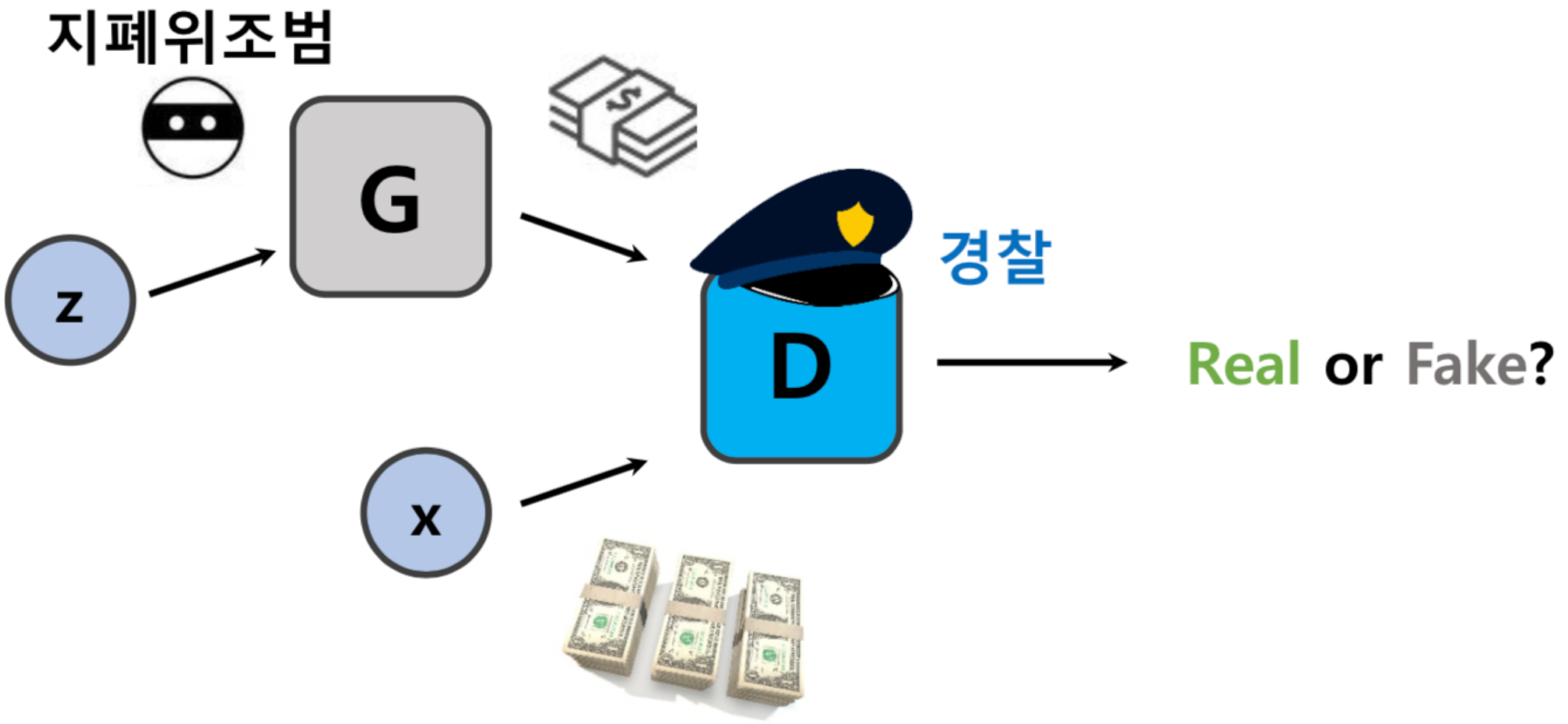
GAN(Generative Adversarial Network)

- Generative
  - 생성 모델
- Adversarial
  - 서로 대립 관계에 있는, 대립적인
- Network
  - Neural Network 이용해서 구현

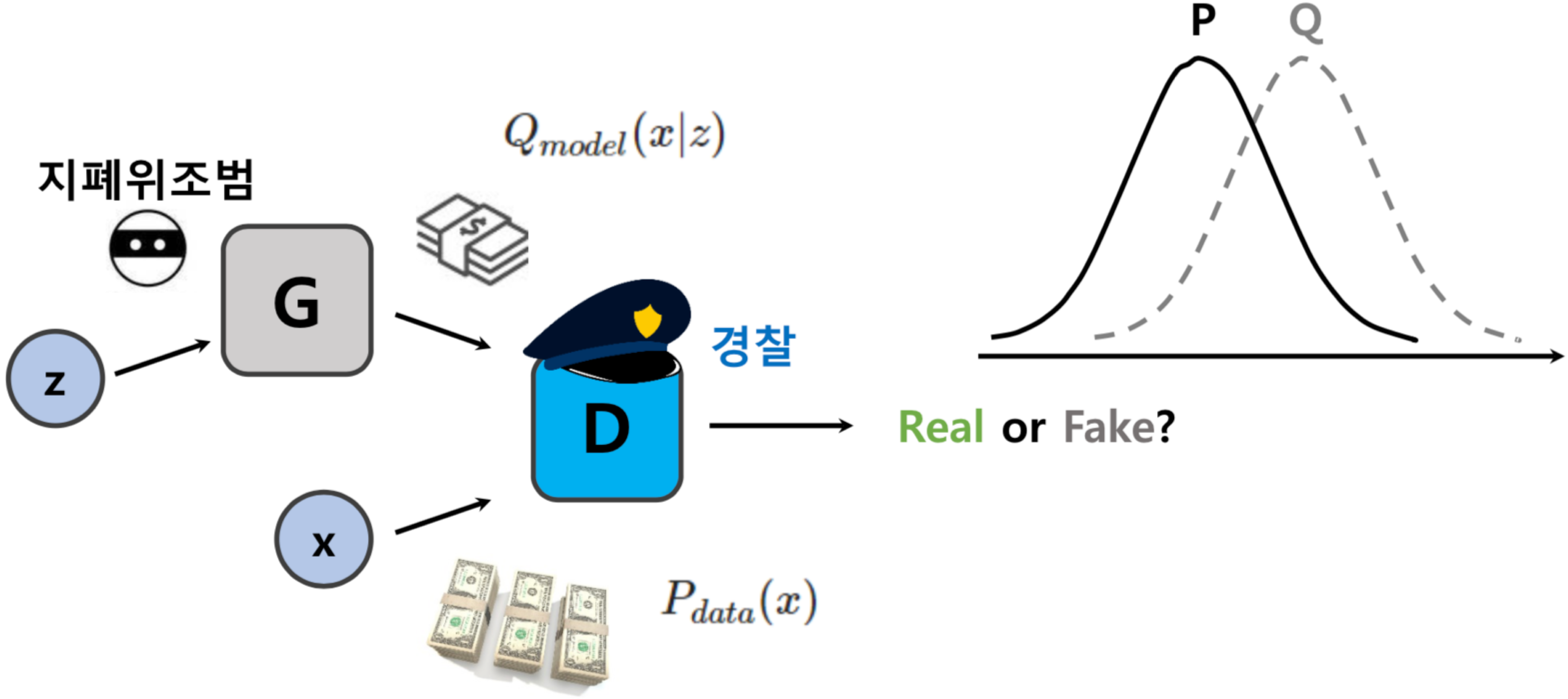
GAN(Generative **Adversarial** Network)



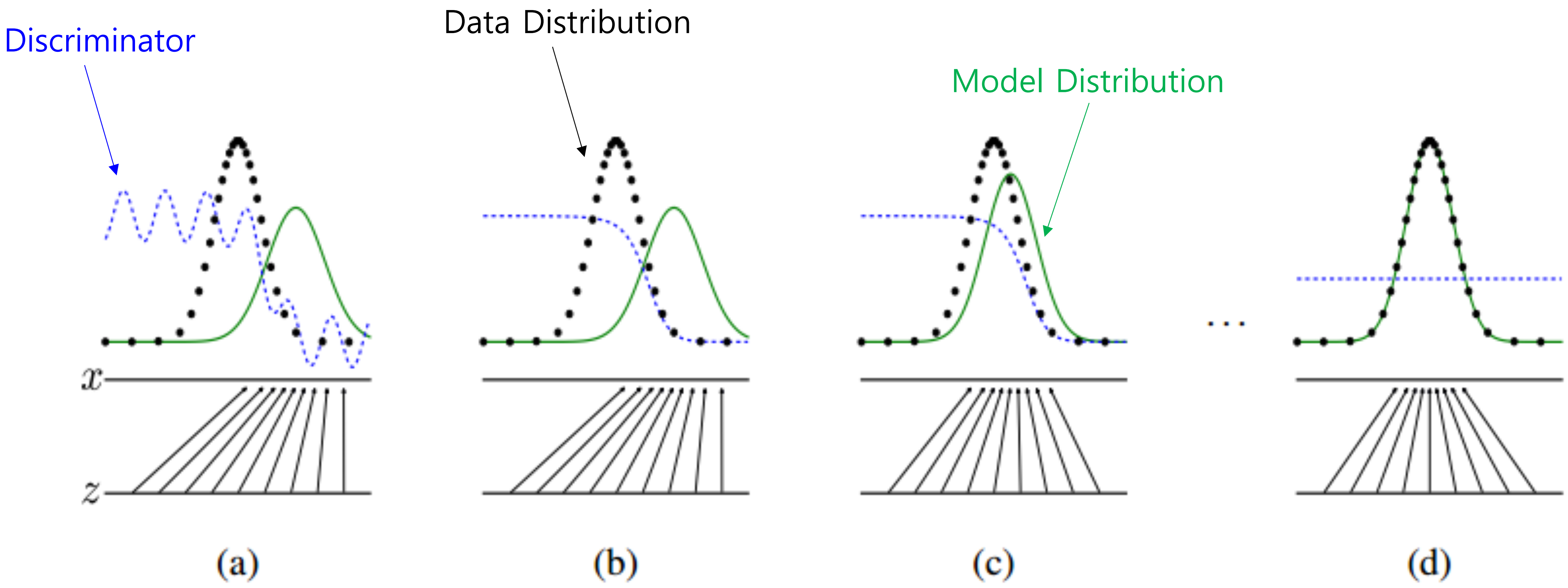
GAN(Generative **Adversarial** Network)



GAN(Generative **Adversarial** Network)

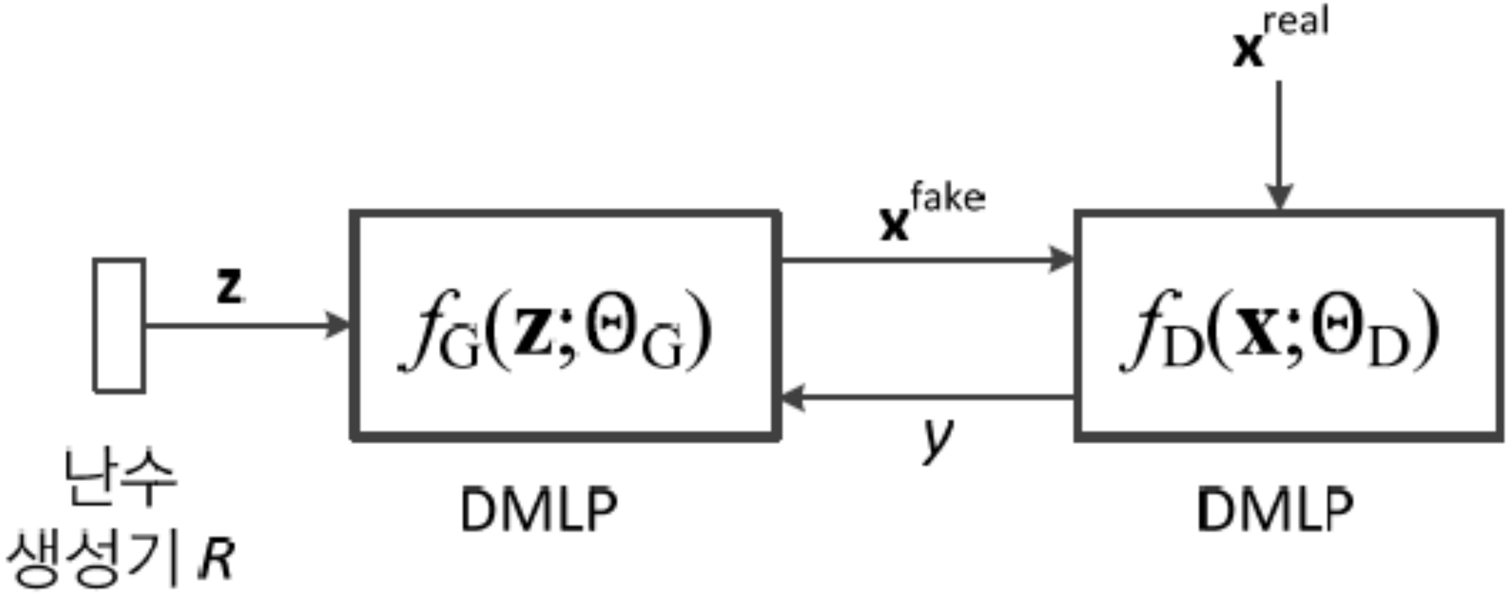


GAN(Generative Adversarial Network)

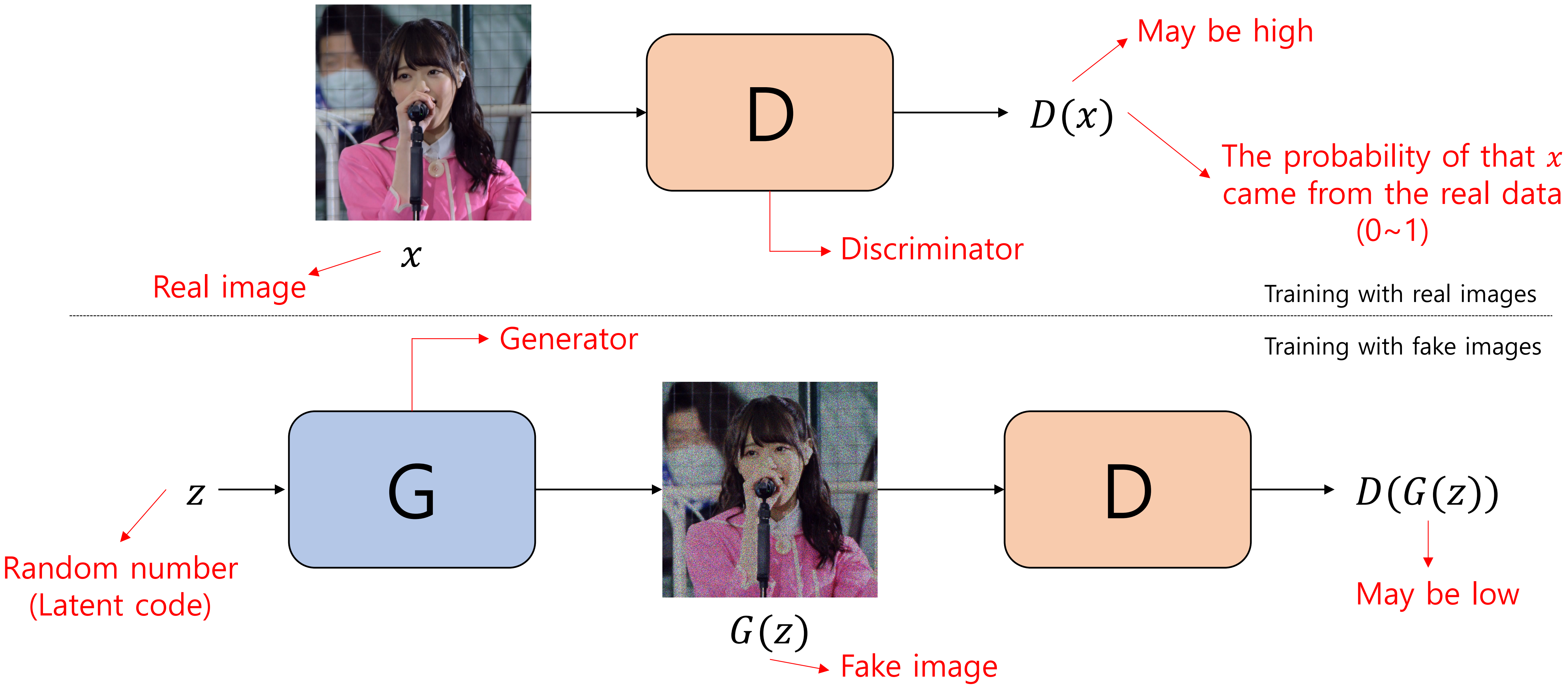


Structure of GAN

- Generator와 Discriminator를 DMLP(Deep Multi-Layer Perceptron)로 구성



Intuition in GAN



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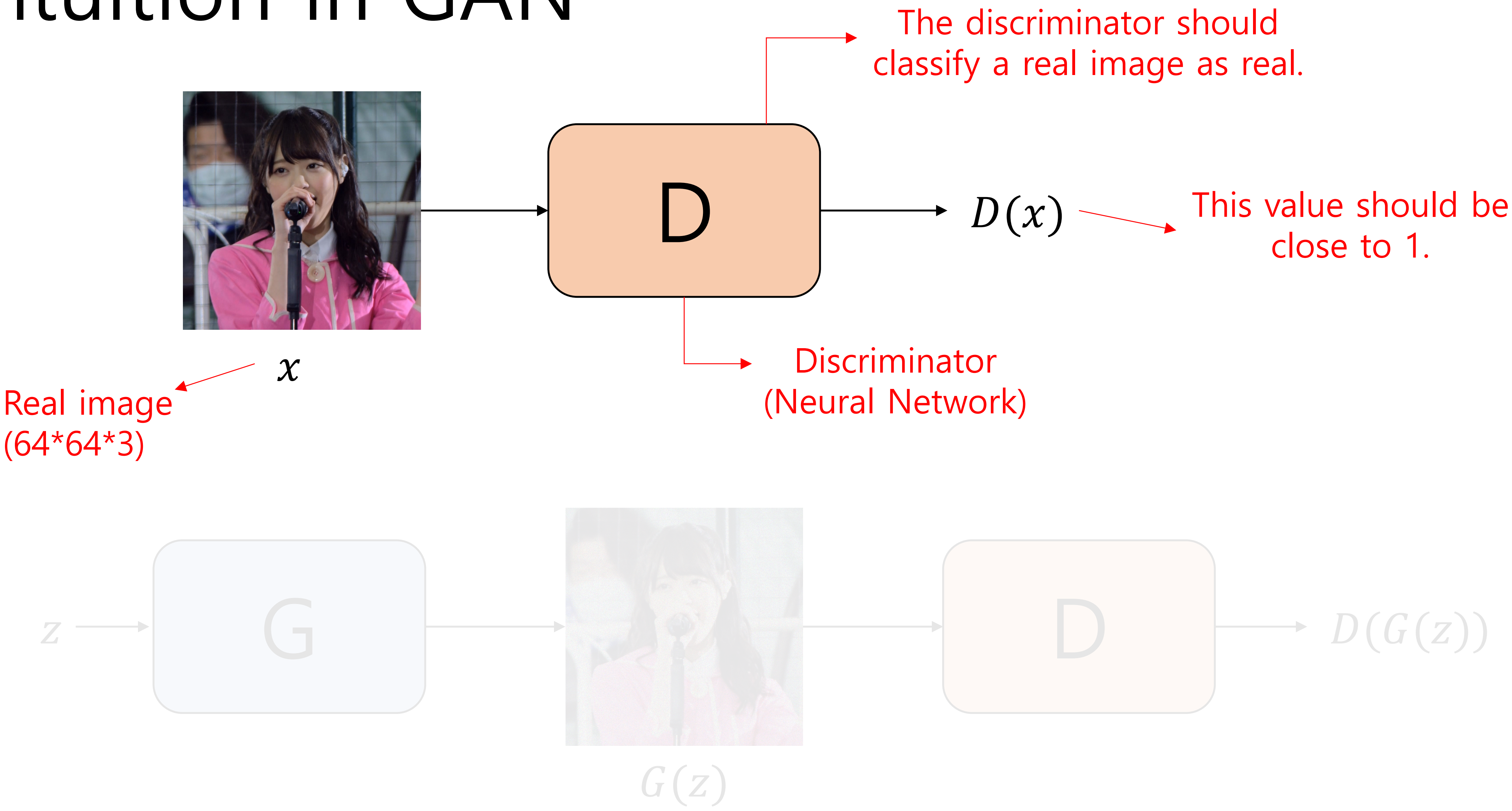

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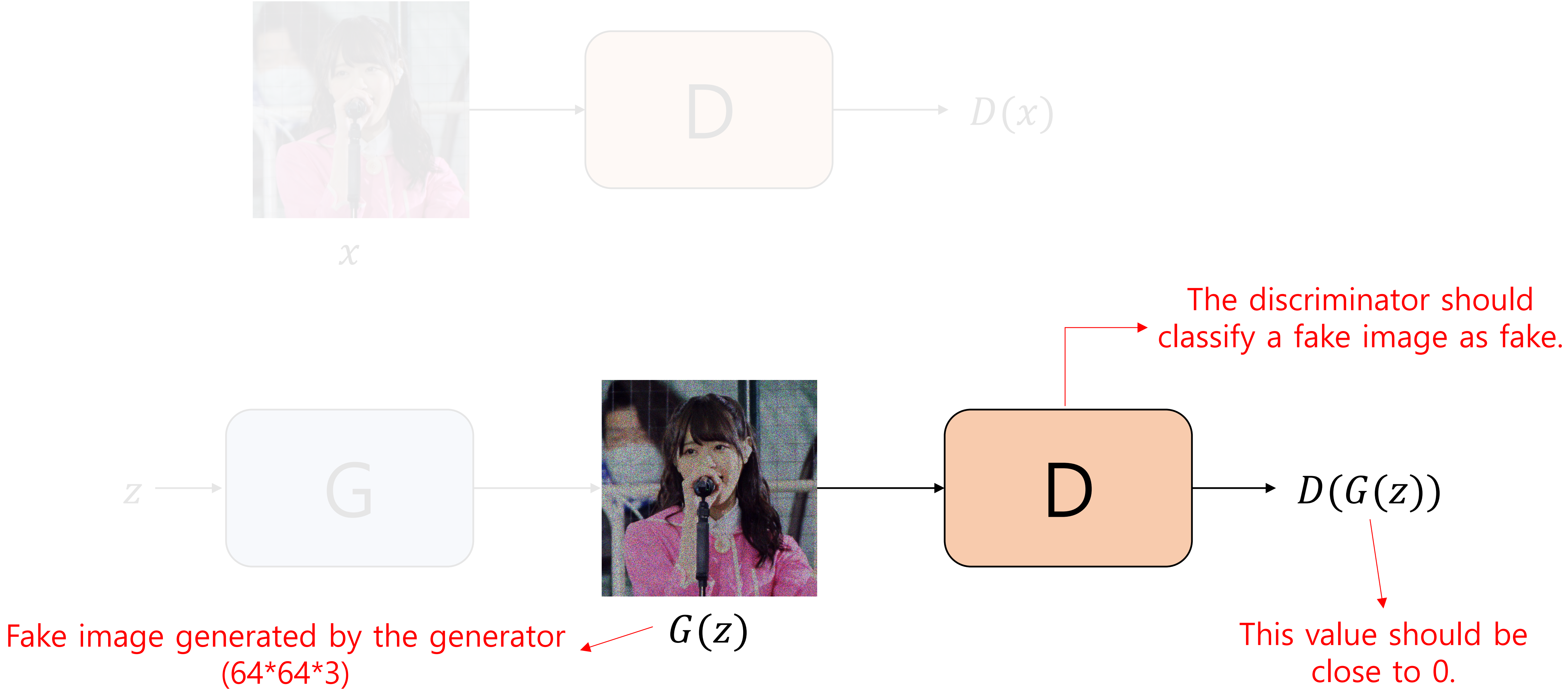

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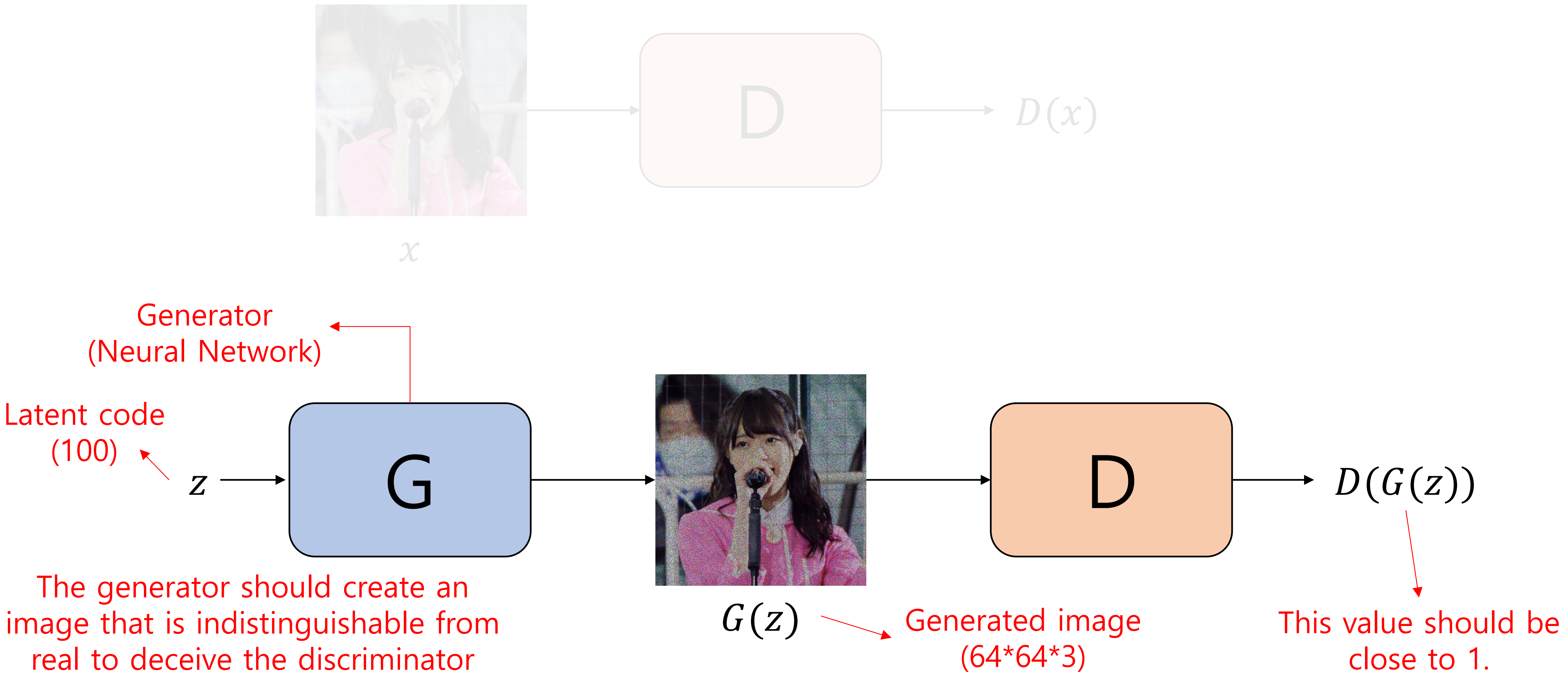


Objective Function of GAN

Sample x from real data distribution

Sample latent code z from Gaussian distribution

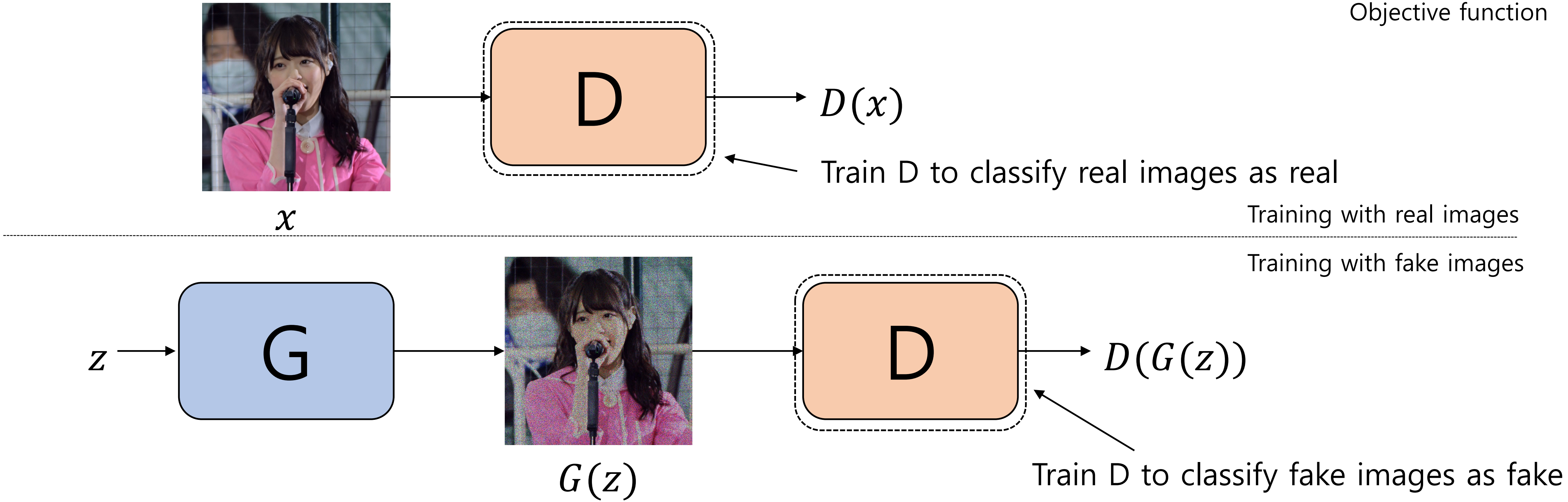
$$\min_G \max_D V(D,G) = E_{x\sim p_{data}(x)}[\log D(x)] + E_{z\sim p_z(z)}[\log(1-D(G(z)))]$$

D should maximize $V(D,G)$

Maximum when $D(x)=1$

Maximum when $D(G(z))=0$

Objective function



Objective Function of GAN

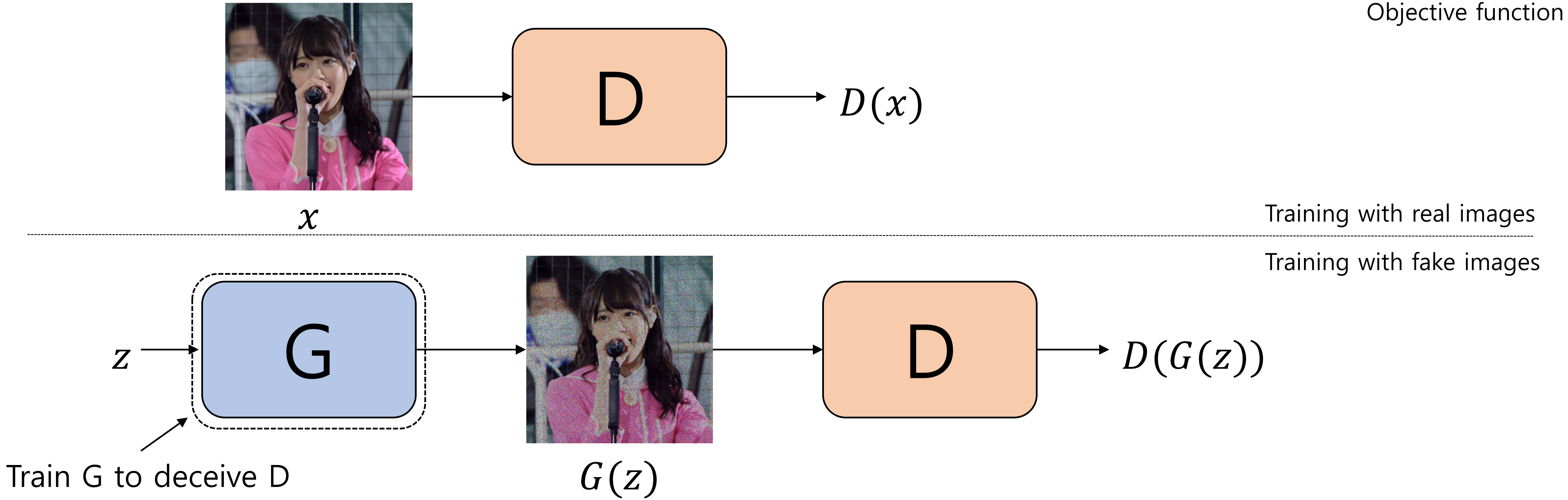
G is independent of this part

$$\min_G \max_D V(D,G) = \cancel{E_{x\sim p_{data}(x)}[\log D(x)]} + E_{z\sim p_z(z)}[\log(1 - D(G(z)))]$$

G should minimize $V(D,G)$

Minimum when $D(G(z)) = 1$

Objective function



Maybe Next?

- Theory in GAN
- GAN Tensorflow implementation
- Variants of GAN