

# Generative Adversarial Networks

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*GAN*

# Generative Adversarial Networks

생성의

# Generative Adversarial Networks

생성의

적대적인

# Generative Adversarial Networks

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적대적 생성 신경망

**“What I cannot create,  
I do not understand.”**



*Richard Feynman*



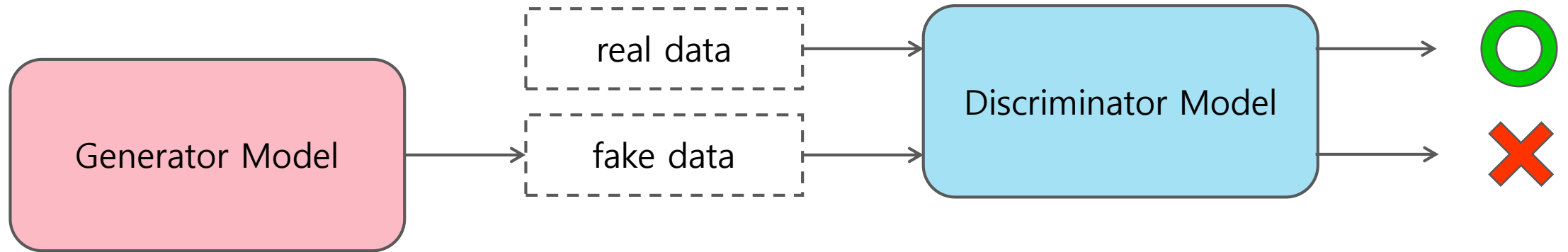
Model



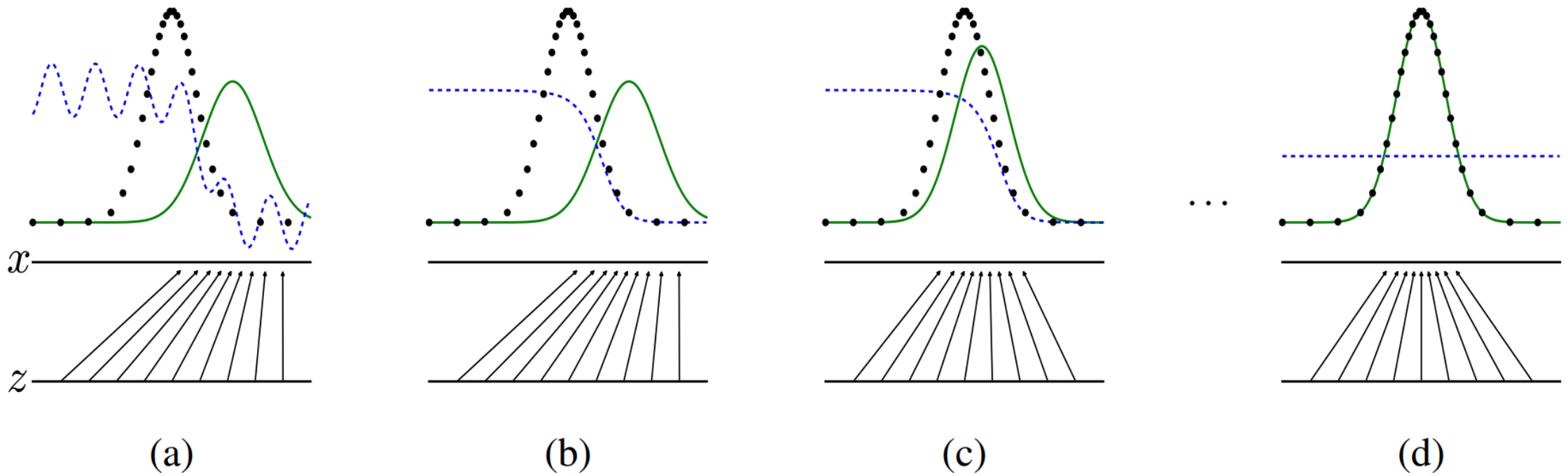
Model



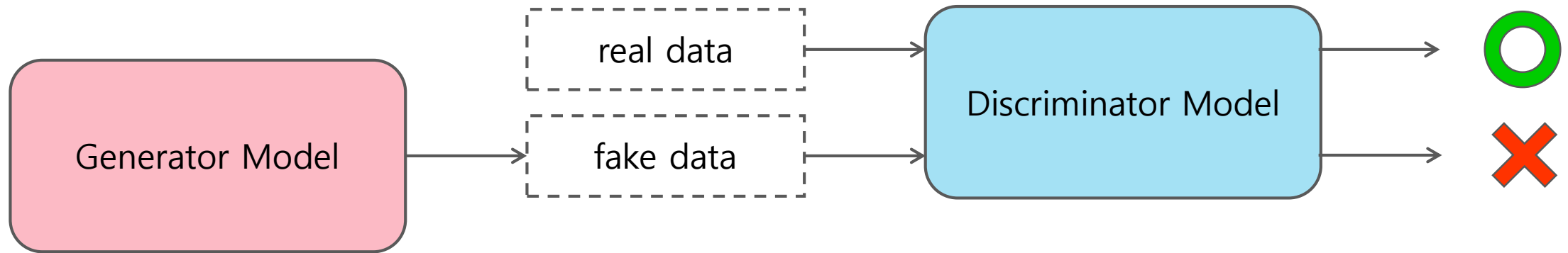
# Generative Adversarial Networks



# Generative Adversarial Networks

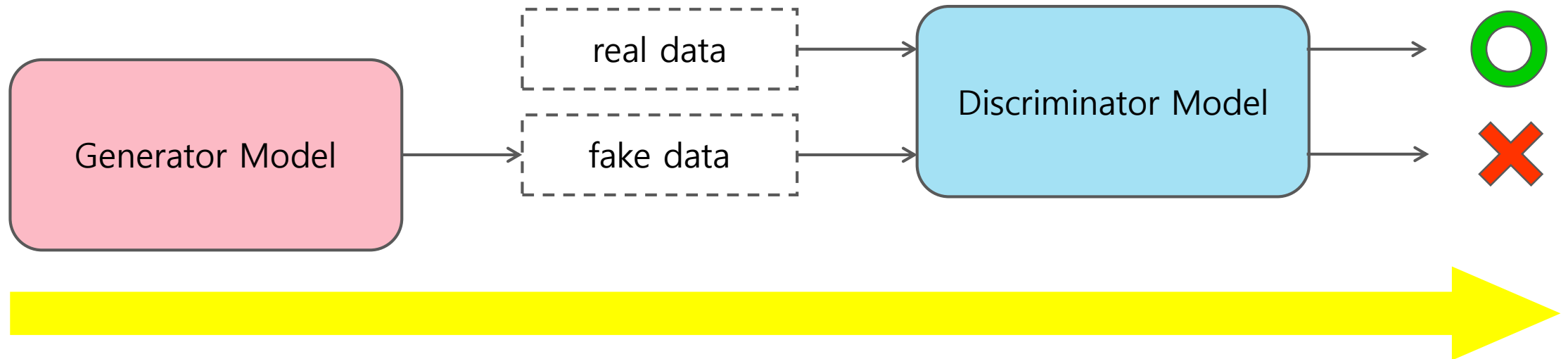


# Generative Adversarial Networks



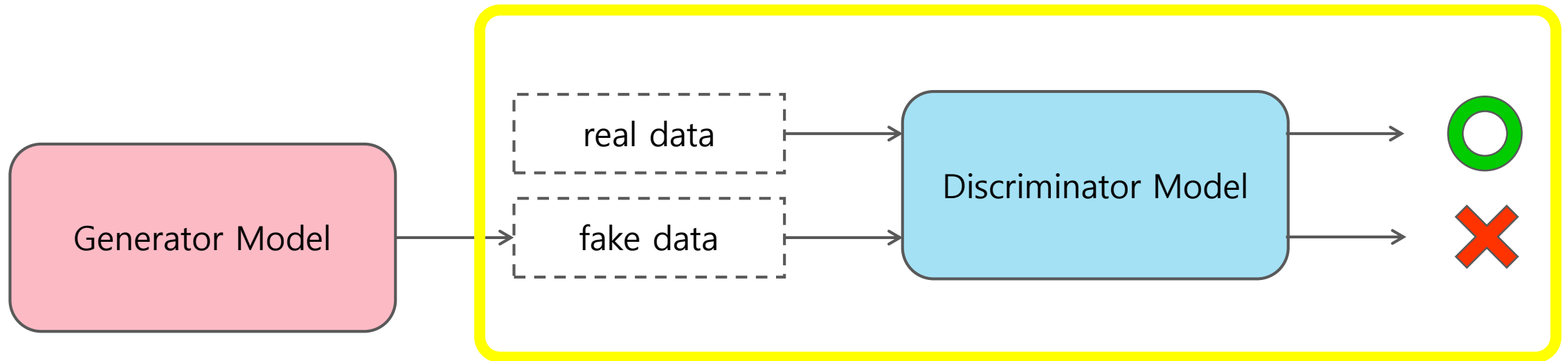
$$\min_G \max_D V(D, G) = \mathbb{E}_{\mathbf{x} \sim p_{\text{data}}(\mathbf{x})} [\log D(\mathbf{x})] + \mathbb{E}_{\mathbf{z} \sim p_{\mathbf{z}}(\mathbf{z})} [\log(1 - D(G(\mathbf{z})))]$$

# Generative Adversarial Networks



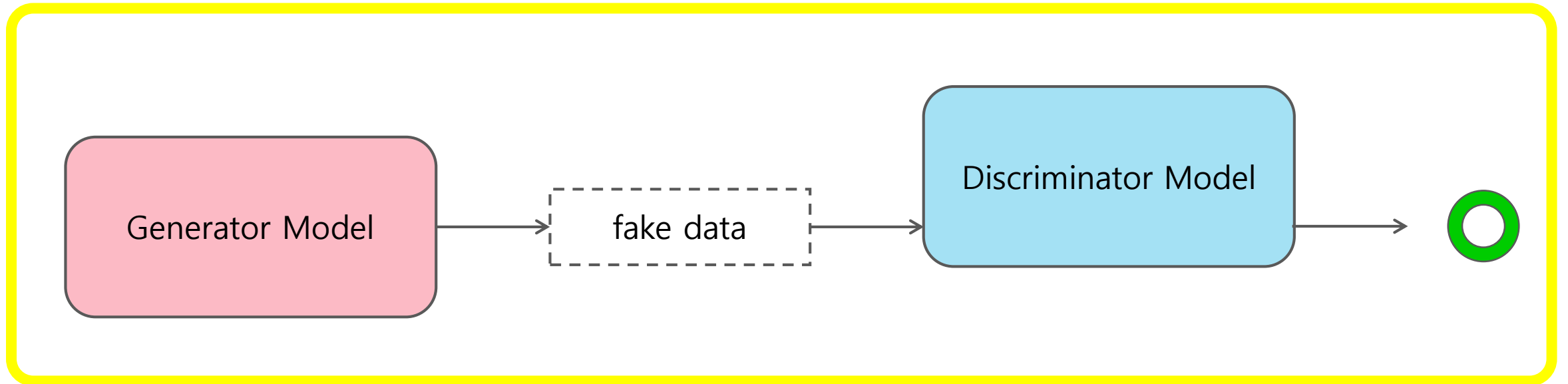
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# Generative Adversarial Networks

$$\begin{aligned}\min_G V(D^*, G) &= E_{x \sim p_{data}(x)} [\log D^*(x)] + E_{x \sim p_g(x)} [\log \{1 - D^*(x)\}] \\&= E_{x \sim p_{data}(x)} \left[ \log \frac{p_{data}(x)}{p_{data}(x) + p_g(x)} \right] + E_{x \sim p_g(x)} \left[ \log \frac{p_g(x)}{p_{data}(x) + p_g(x)} \right] \\&= \int_x p_{data}(x) \log \frac{p_{data}(x)}{p_{data}(x) + p_g(x)} dx + \int_x p_g(x) \log \frac{p_g(x)}{p_{data}(x) + p_g(x)} dx \\&= -\log 4 + \int_x p_{data}(x) \log \frac{2 \cdot p_{data}(x)}{p_{data}(x) + p_g(x)} dx + \int_x p_g(x) \log \frac{2 \cdot p_g(x)}{p_{data}(x) + p_g(x)} dx \\&= -\log 4 + \int_x p_{data}(x) \log \frac{p_{data}(x)}{\frac{p_{data}(x) + p_g(x)}{2}} dx + \int_x p_g(x) \log \frac{p_g(x)}{\frac{p_{data}(x) + p_g(x)}{2}} dx \\&= -\log 4 + KLD \left( p_{data}(x) \parallel \frac{p_{data}(x) + p_g(x)}{2} \right) + KLD \left( p_g(x) \parallel \frac{p_{data}(x) + p_g(x)}{2} \right) \\&= -\log 4 + 2 \cdot JSD(p_{data}(x) \parallel p_g(x))\end{aligned}$$

# MNIST in CSV

[illegible]



# Generative Adversarial Networks

## 한계점

1. Generator가 생성한 fake data가 어떠한 이유로 생성되었는 지 알 수 없다.
2. Generator가 생성한 fake data가 real data에 얼마나 근사한 지 객관적으로 판단하기 어렵다.
3. GANs은 학습이 잘 안 된다.

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① 사람이 직접 평가

② labeled data로 지도학습한 분류기 모델로 평가

# Generative Adversarial Networks

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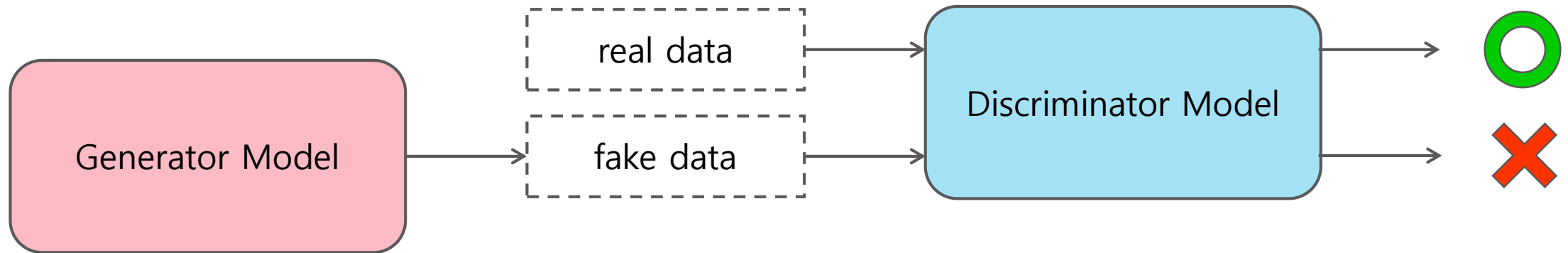
# Generative Adversarial Networks

## 한계점

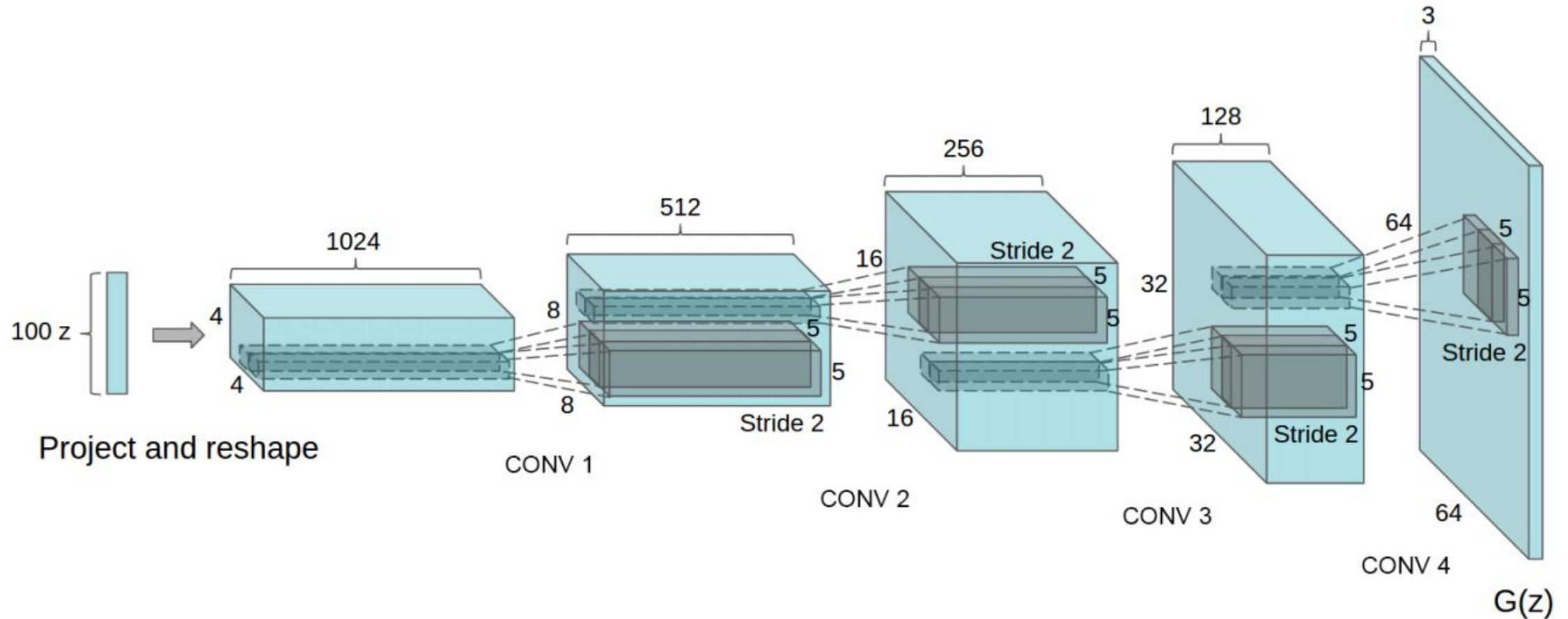
1. Generator가 생성한 fake data가 어떠한 이유로 생성되었는 지 알 수 없다.
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3. GANs은 학습이 잘 안 된다.
  - ① Generator가 다양성을 잃는 경우
  - ② Generator와 Discriminator가 균형있게 학습이 안 되는 경우

# Generative Adversarial Networks

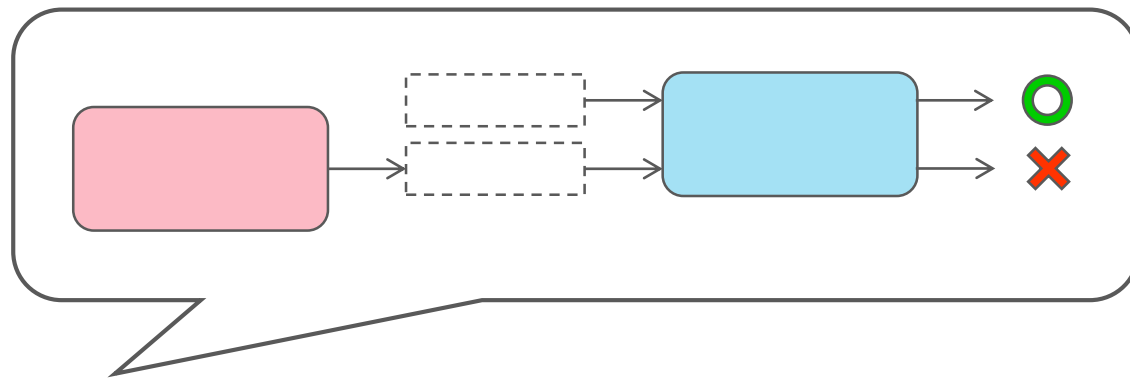
## 한계점



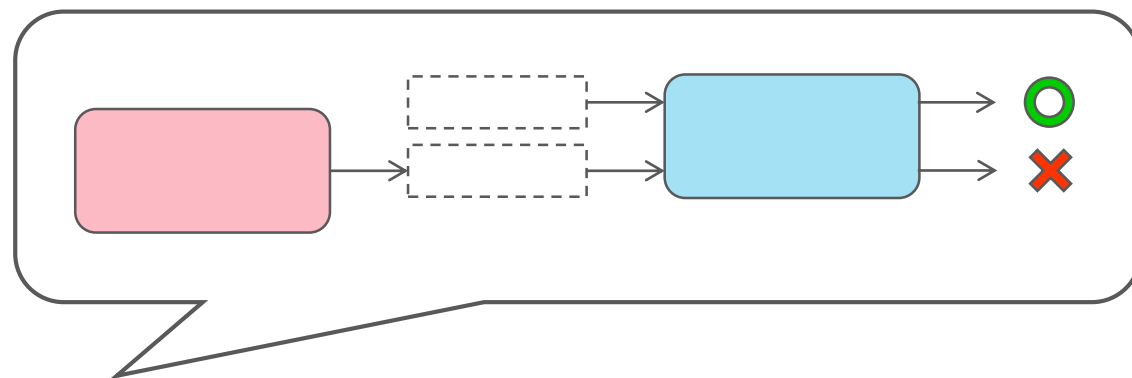
# Deep Convolutional GAN (DCGAN)

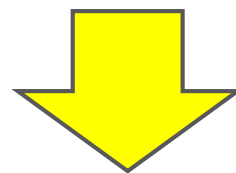
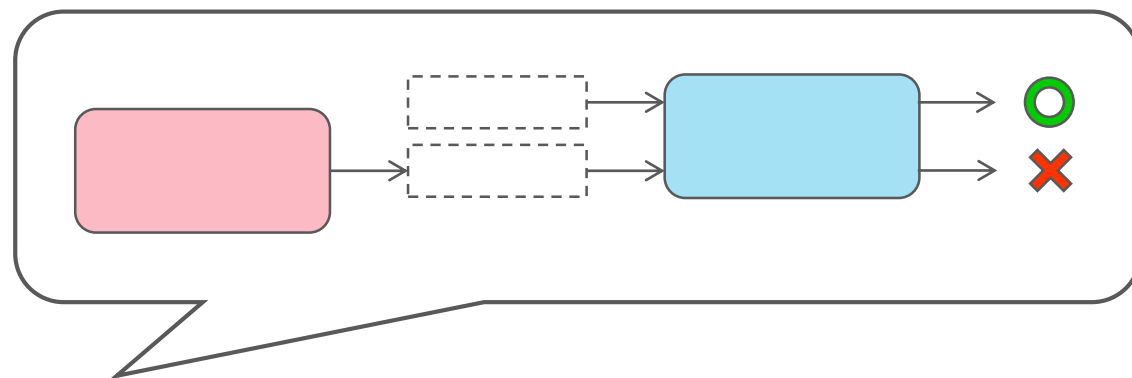


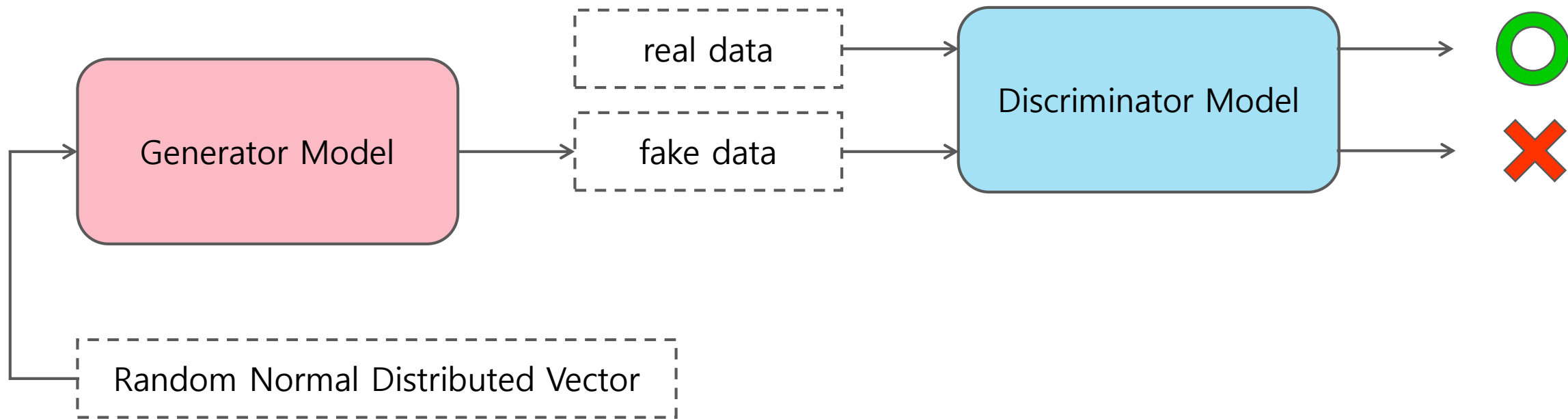


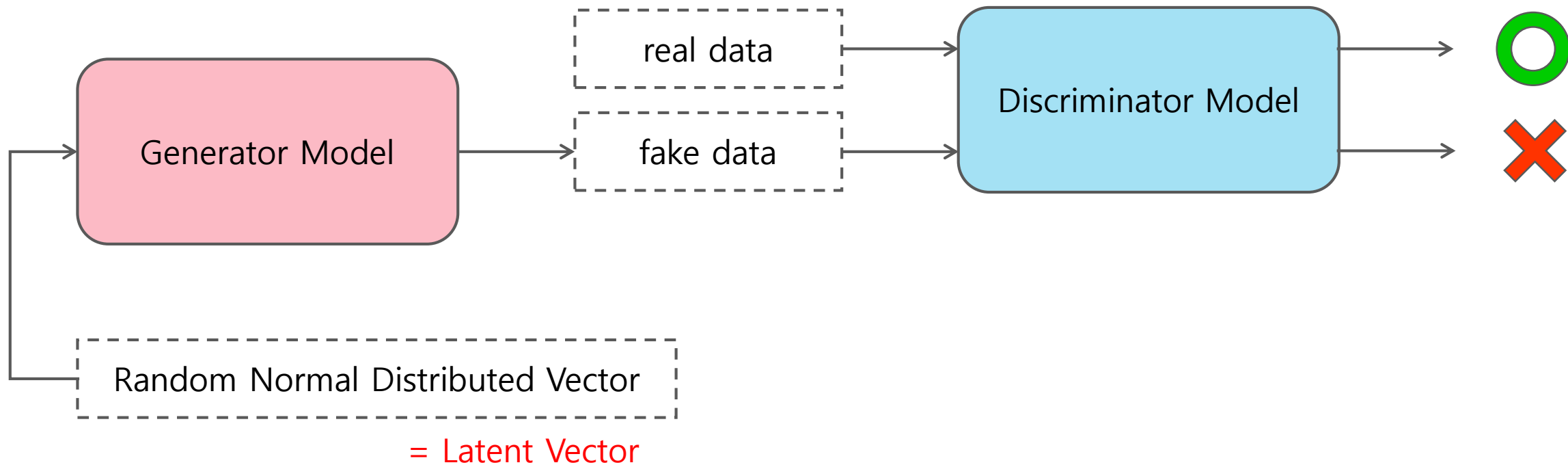


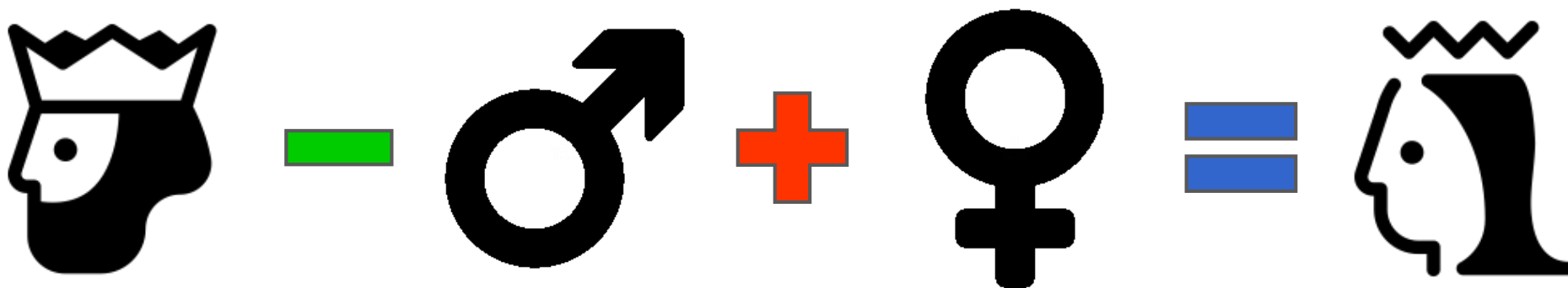
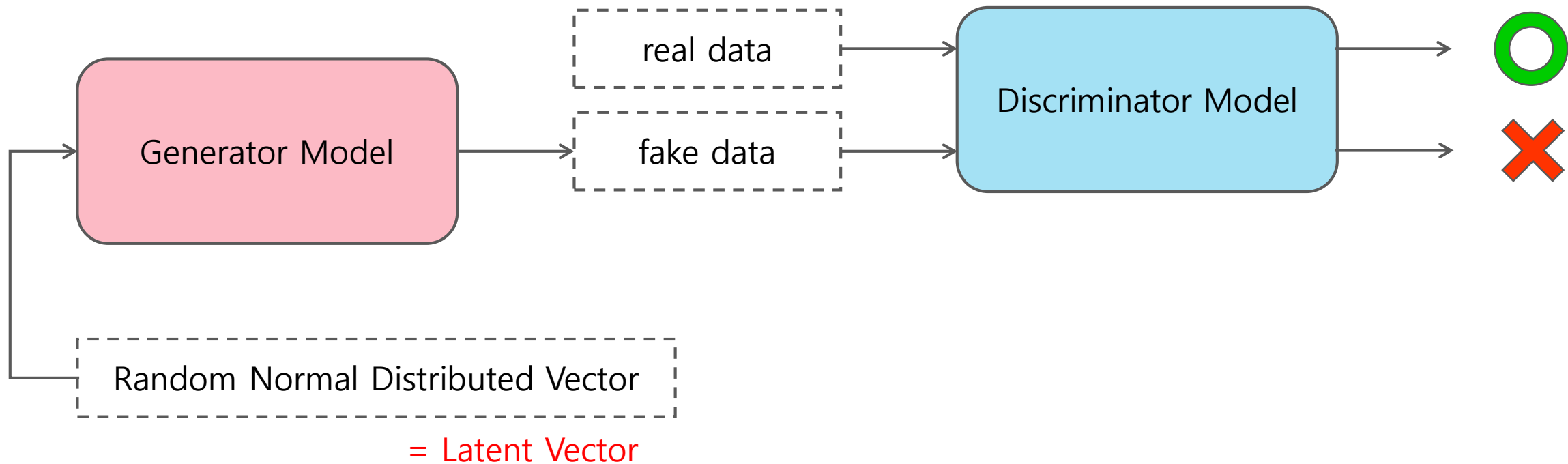








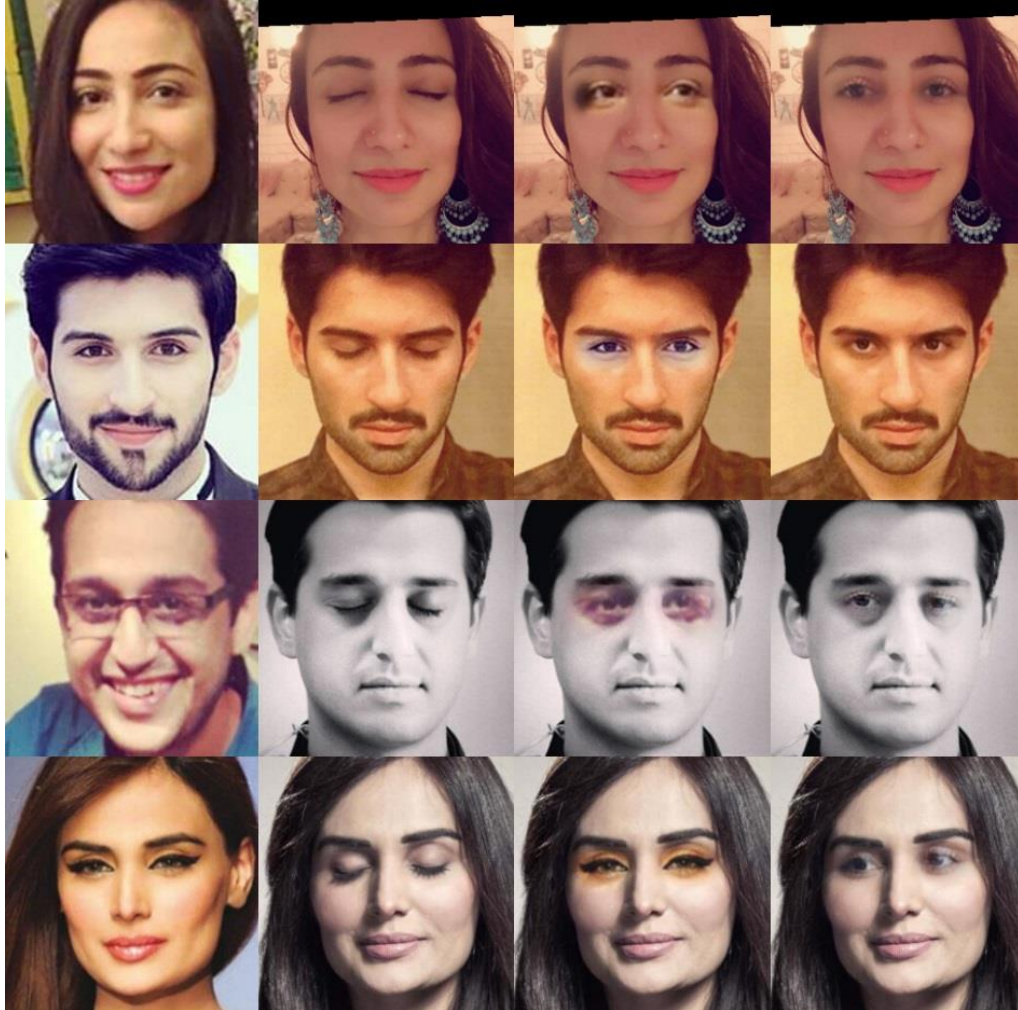




# DeepFake



# Real eye-opener





# Image traslation

Input



Monet



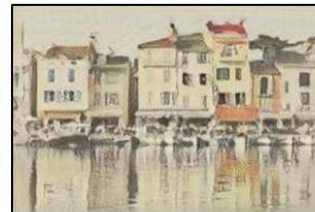
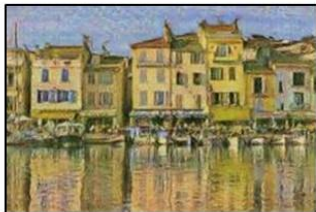
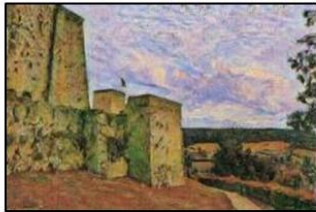
Van Gogh



Cezanne



Ukiyo-e





# Image traslation



# Image traslation

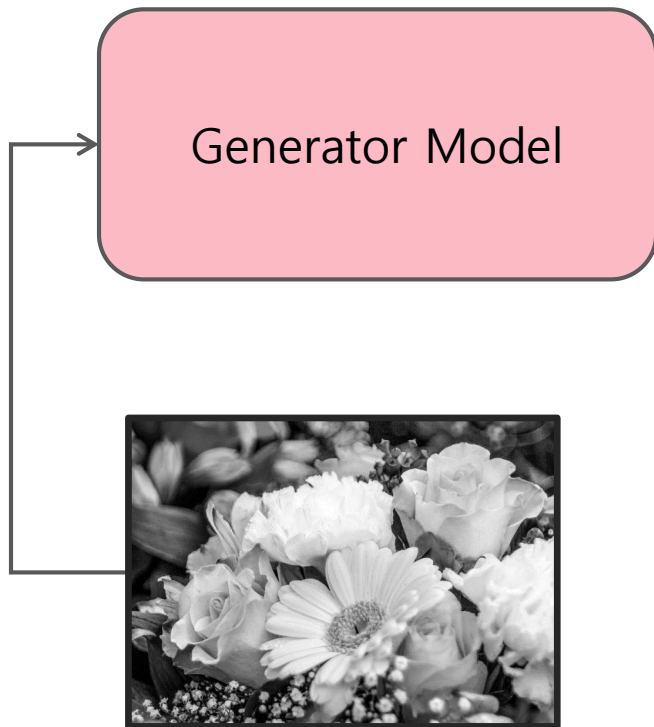


# pix2pix

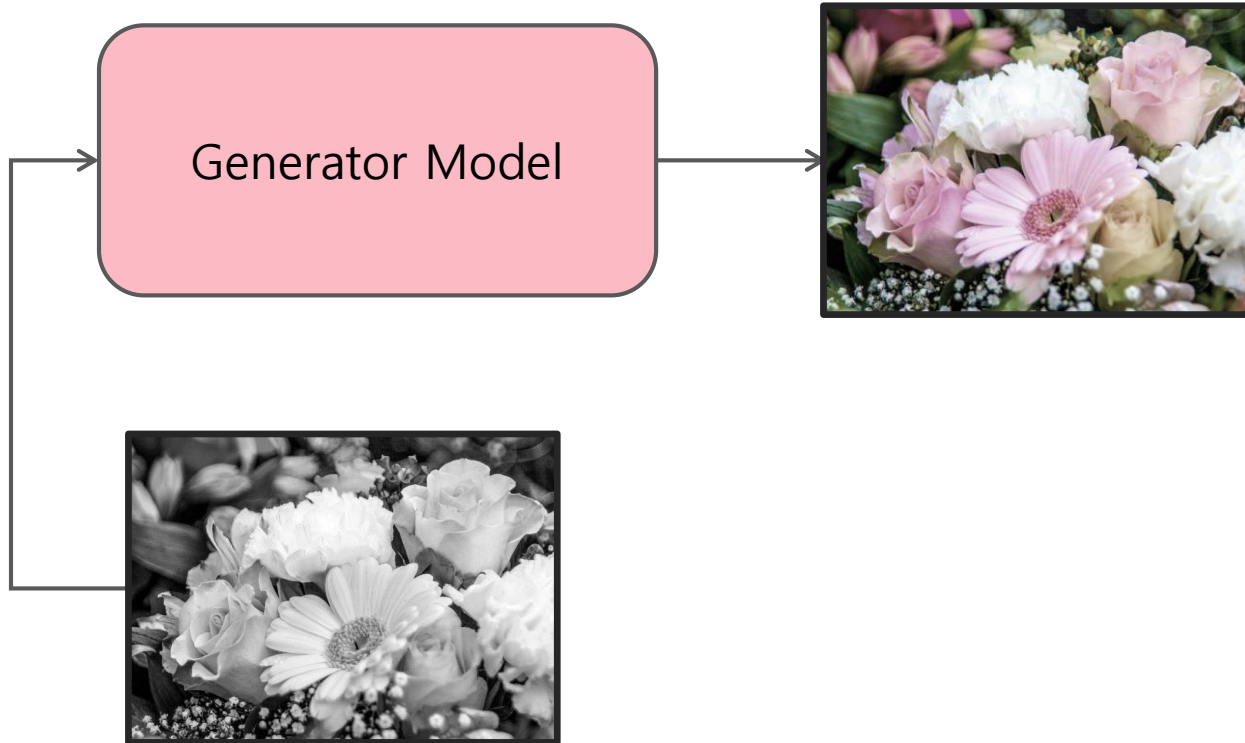


Generator Model

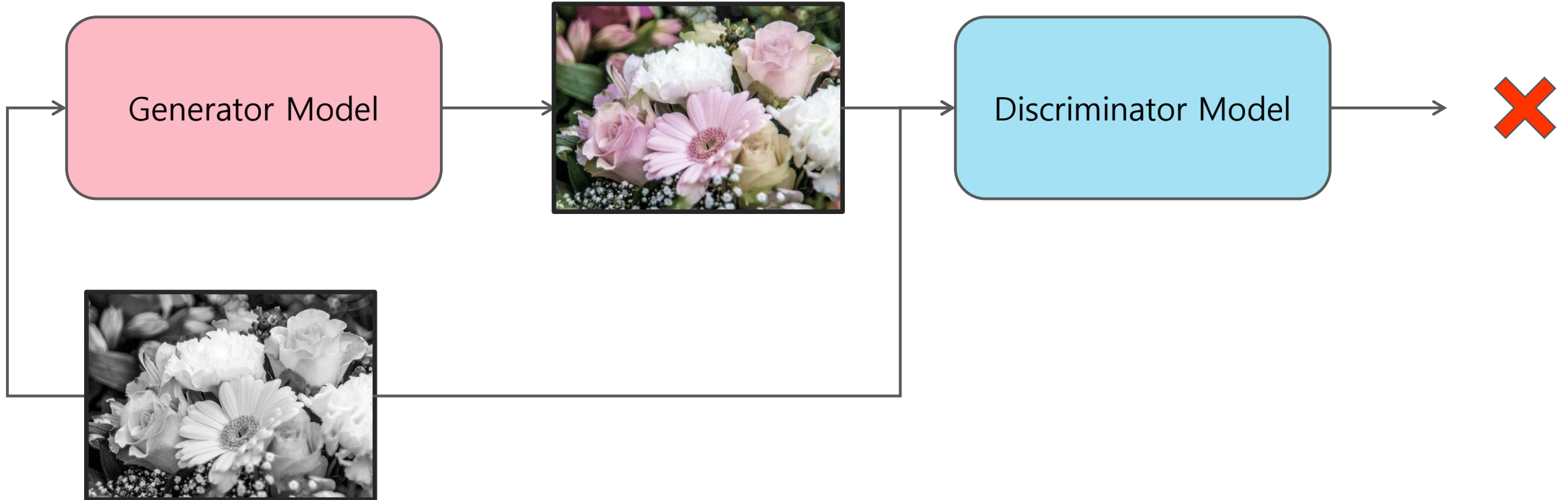
# pix2pix



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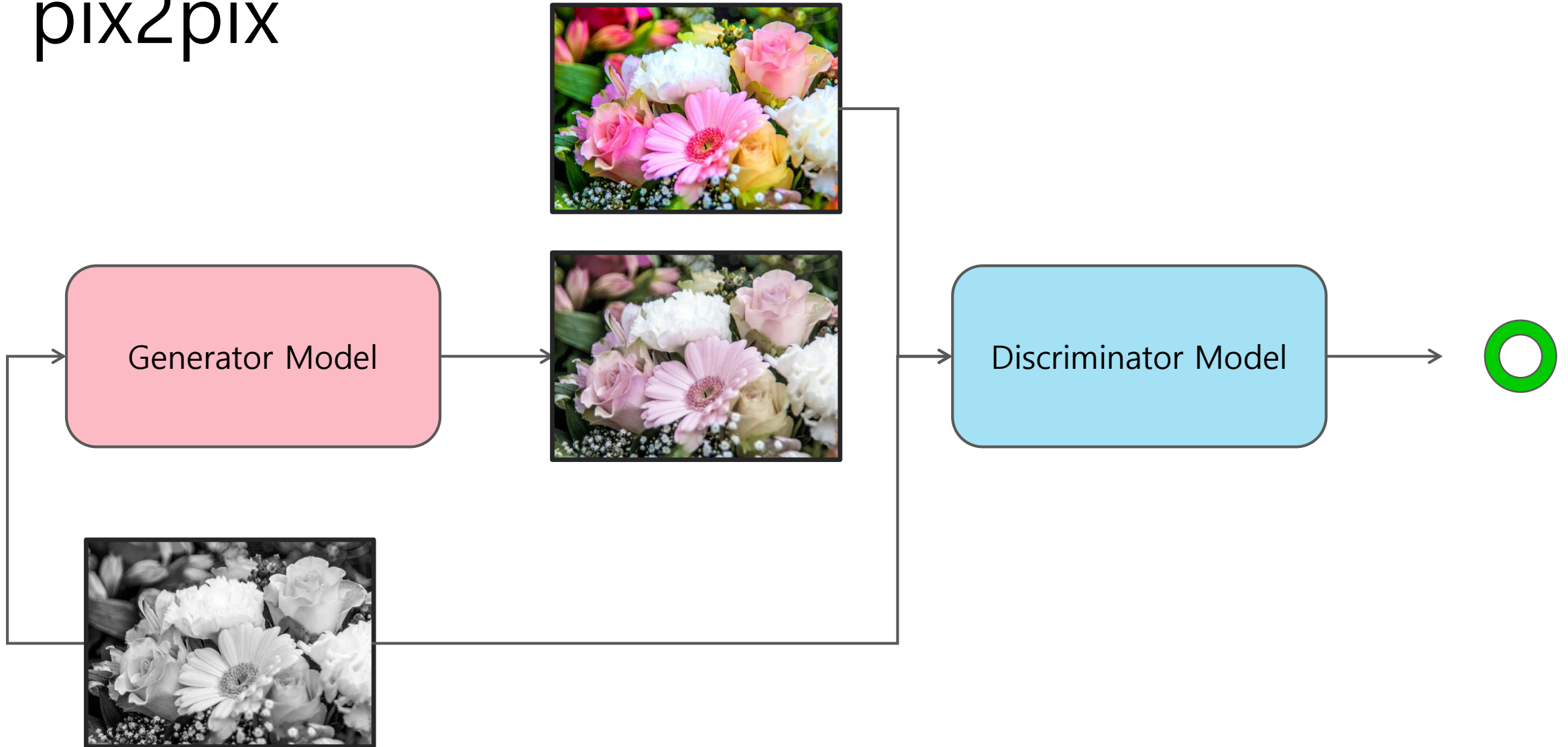


# pix2pix

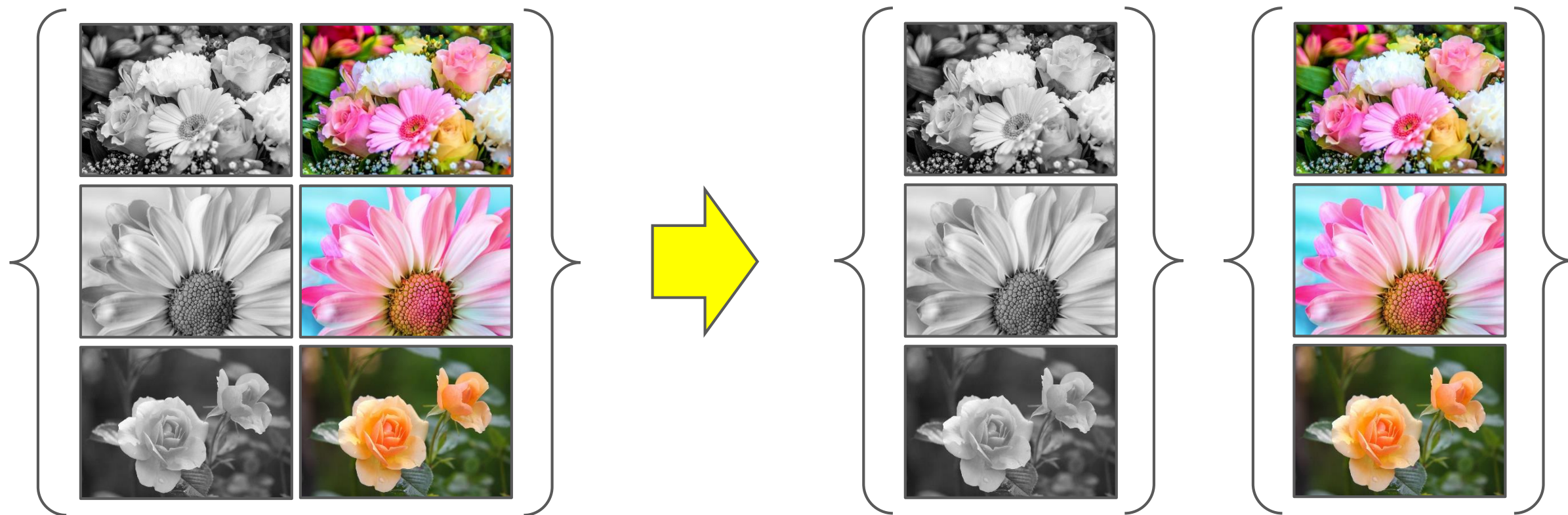




# pix2pix

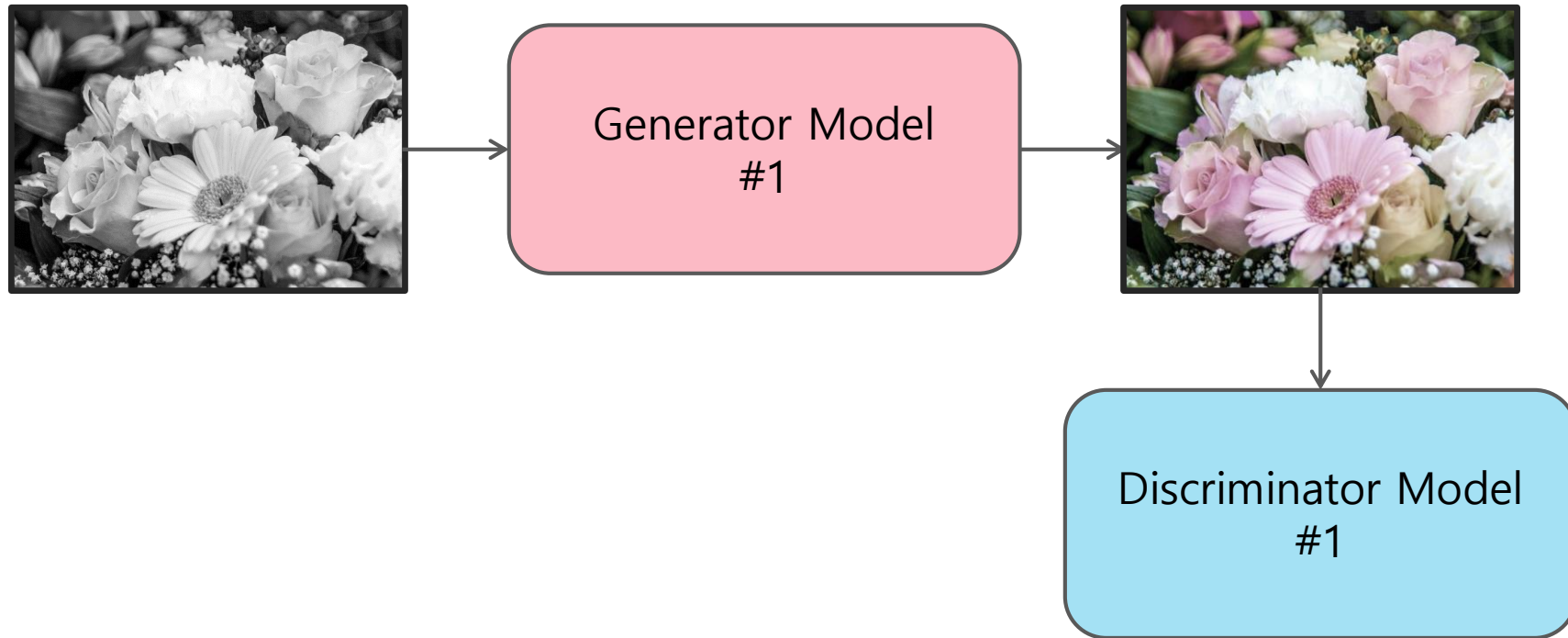


# CycleGAN

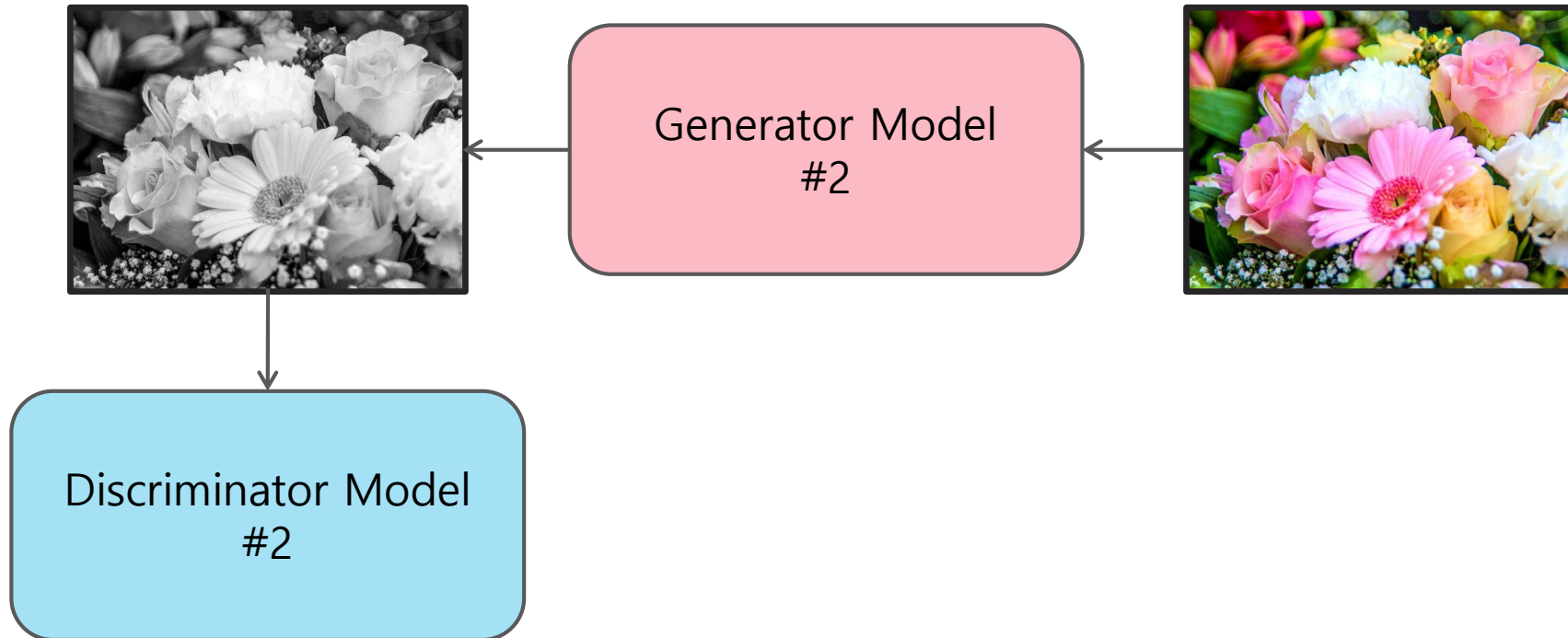




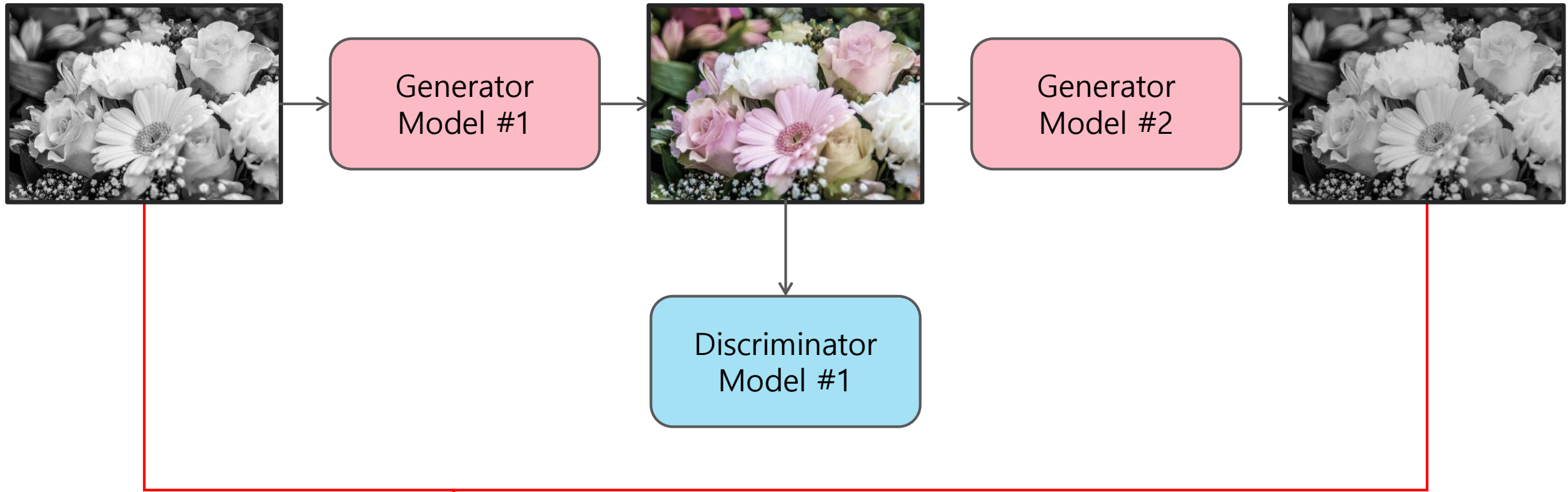
# CycleGAN



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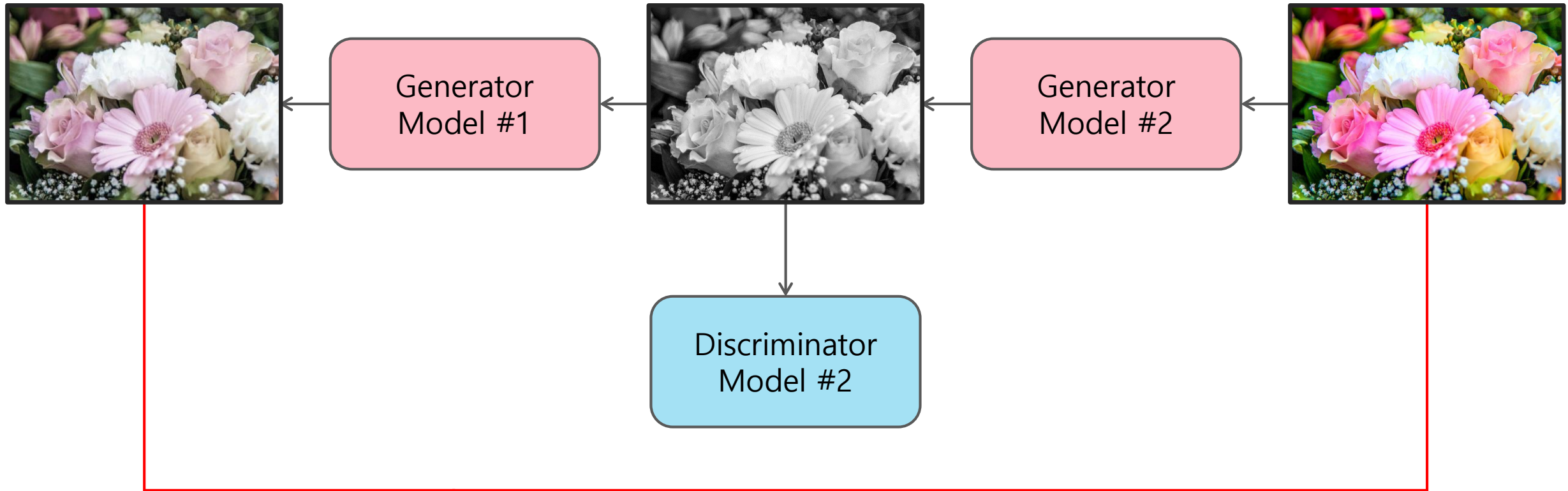


# CycleGAN



비슷한 형태가 되도록 regularization  
추가

# CycleGAN



비슷한 형태가 되도록 regularization  
추가

# 정리하며...

GAN의 학습을 안정화시키기 위한 많은 노력이 있었지만 아직 갈 길이 구만 리

latent vector를 학습하는 VAE (Variational Auto-Encoder)를 대체재로 고려해 보는 것도

# 정리하며...

그렇다면 우리는 GAN을 어디에 써야 할까?

- ① 아쉽게도 GAN은 이미지나 음성 분야에서는 성공 사례가 많으나  
자연어를 생성하는 분야에서는 성공 사례가 없음
- ② 양성 샘플을 생성하는 GAN을 만들면 부족한 양성 샘플을 늘릴 수 있지 않을까?