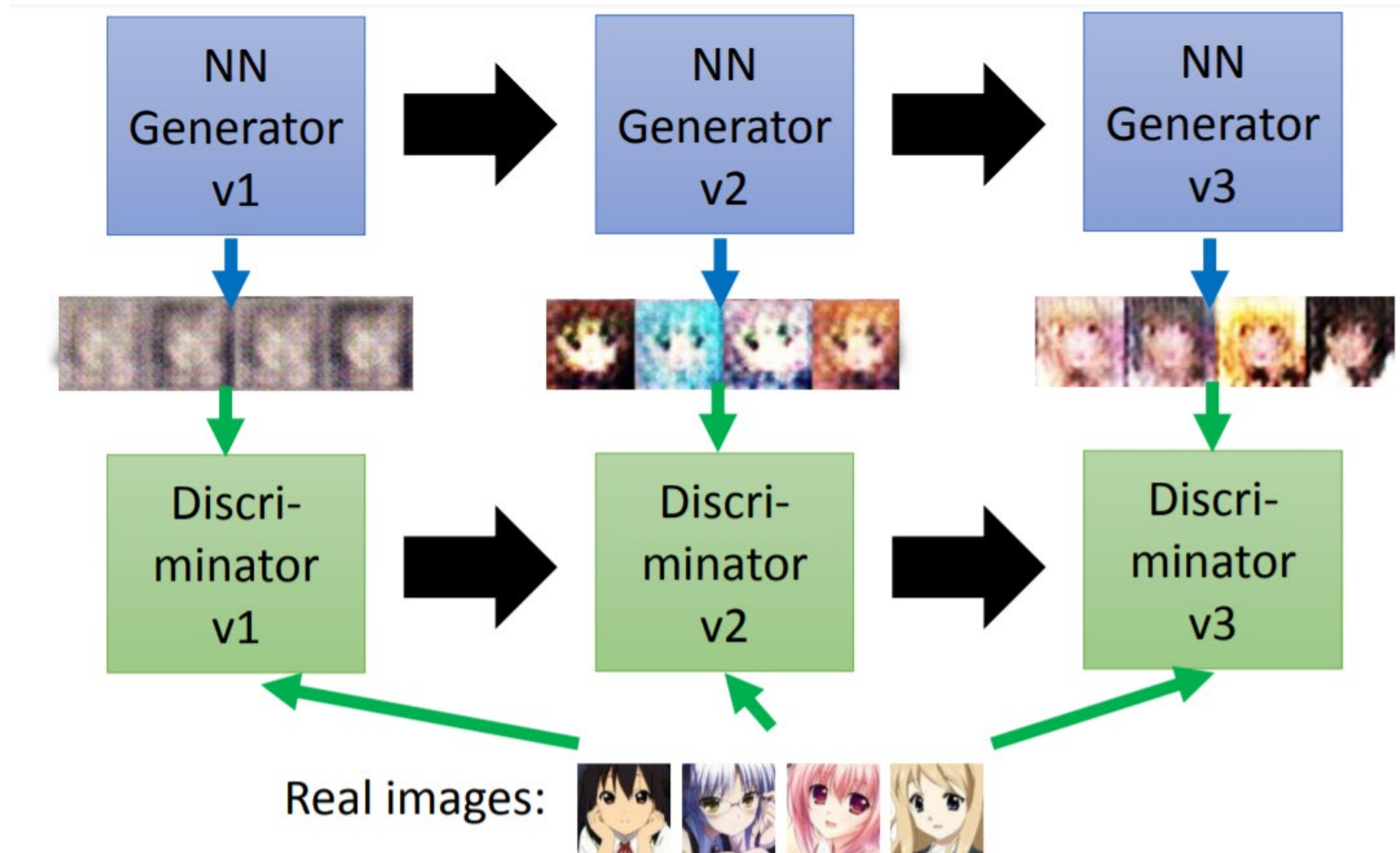


Generative Adversarial Network (GAN)

An evolution process



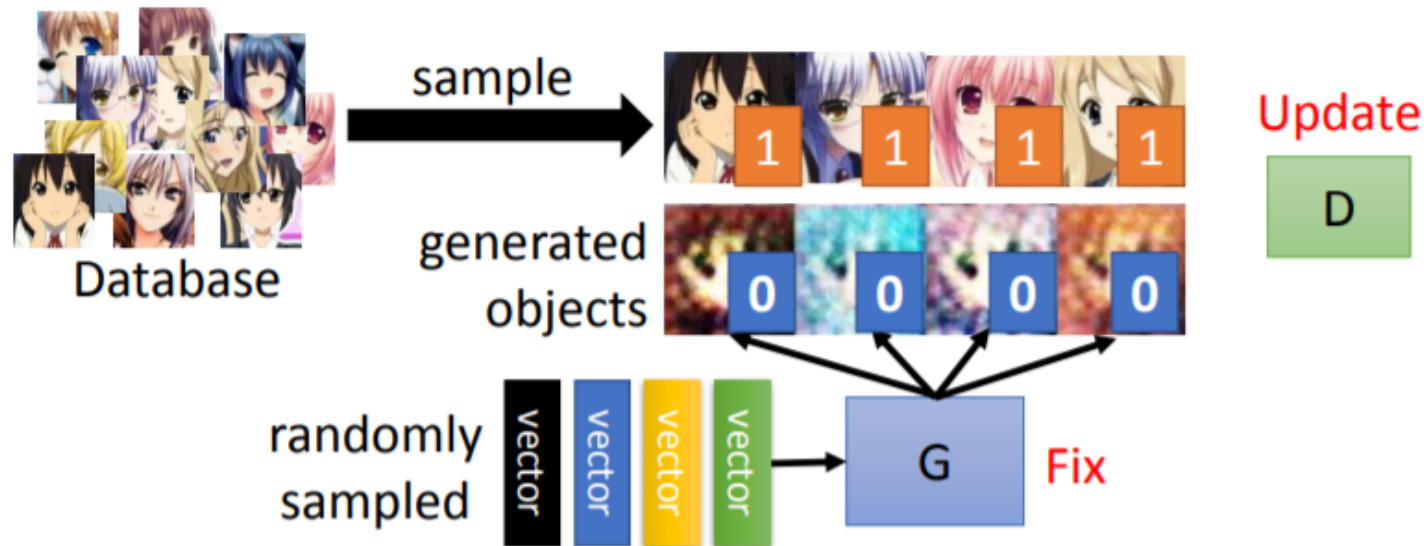
Algorithm

- Initialize generator and discriminator



- In each training iteration:

Step 1: Fix generator G, and update discriminator D

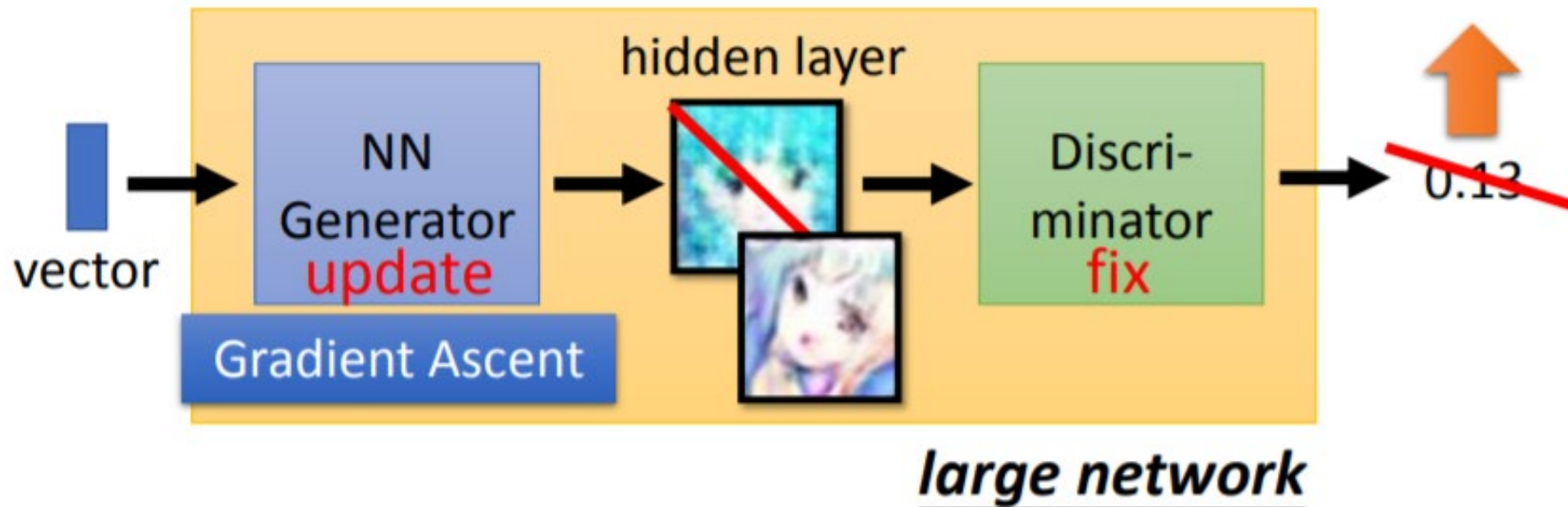


Discriminator learns to assign high scores to real objects and low scores to generated objects.

Algorithm

Step 2: Fix discriminator D, and update generator G

Generator learns to “fool” the discriminator



Algorithm Initialize θ_d for D and θ_g for G

- In each training iteration:

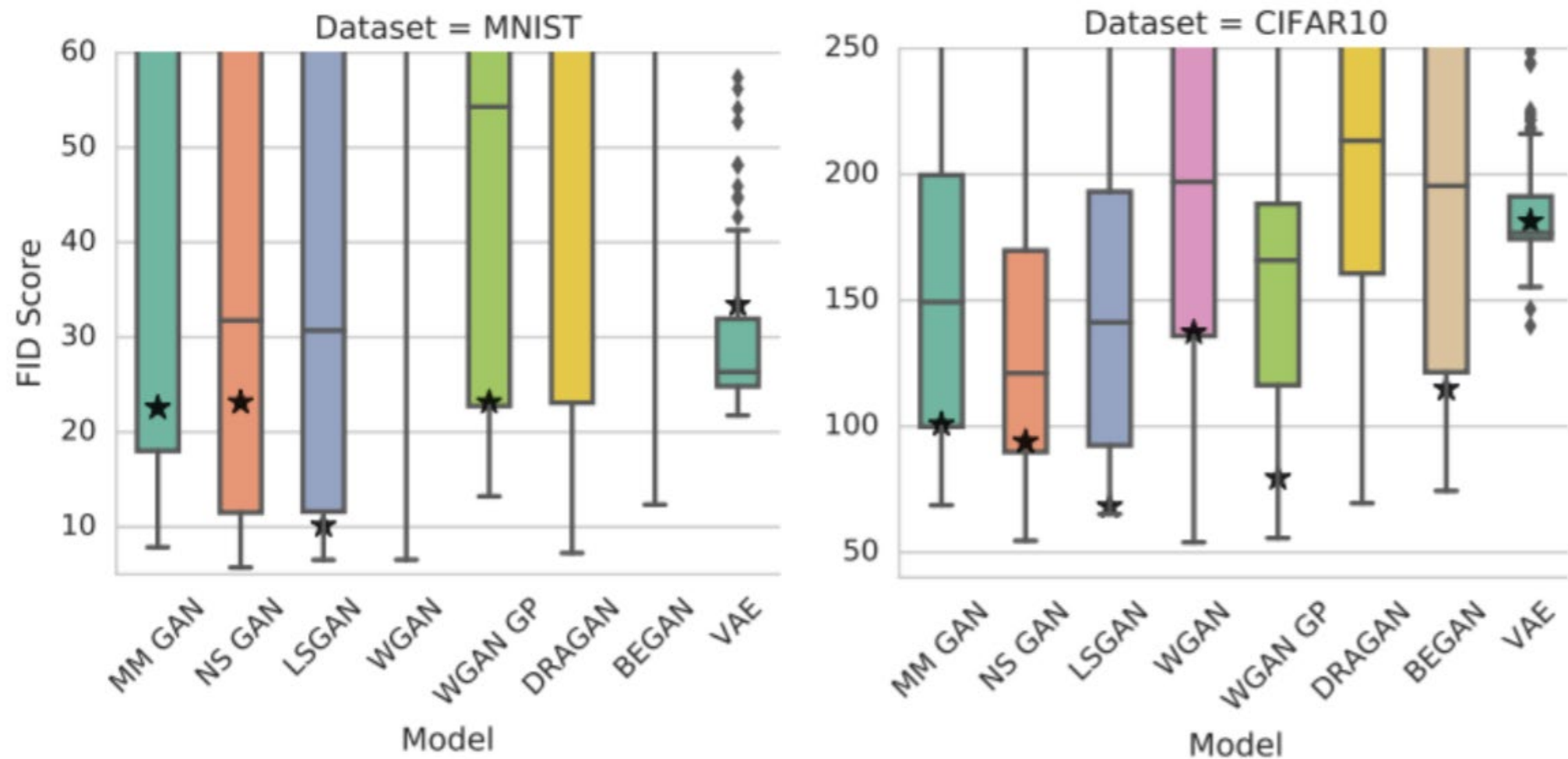
Learning
D

- Sample m examples $\{x^1, x^2, \dots, x^m\}$ from database
- Sample m noise samples $\{z^1, z^2, \dots, z^m\}$ from a distribution
- Obtaining generated data $\{\tilde{x}^1, \tilde{x}^2, \dots, \tilde{x}^m\}$, $\tilde{x}^i = G(z^i)$
- Update discriminator parameters θ_d to maximize
 - $\tilde{V} = \frac{1}{m} \sum_{i=1}^m \log D(x^i) + \frac{1}{m} \sum_{i=1}^m \log (1 - D(\tilde{x}^i))$
 - $\theta_d \leftarrow \theta_d + \eta \nabla \tilde{V}(\theta_d)$

Learning
G

- Sample m noise samples $\{z^1, z^2, \dots, z^m\}$ from a distribution
- Update generator parameters θ_g to maximize
 - $\tilde{V} = \frac{1}{m} \sum_{i=1}^m \log (D(G(z^i)))$
 - $\theta_g \leftarrow \theta_g - \eta \nabla \tilde{V}(\theta_g)$

GAN is sensitive to hyper-parameter tuning and its performance range is large. Different GANs' performances are similar





8.1. GAN.ipynb

檔案 編輯 檢視畫面 插入 執行階段 工具 說明 無法儲存變更

共用



檔案



- <>
- gdrive
- generated
 - generated-images-0001.png
 - generated-images-0051.png
 - generated-images-0101.png
 - generated-images-0151.png
 - generated-images-0201.png
- sample_data

+ 程式碼

+ 文字

複製到雲端硬碟



```
# Log losses & scores ()
print("Epoch [{} / {}], loss_g: {:.4f}, loss_d: {:.4f}"
      .format(epoch+1, epochs, loss_g, loss_d))

# Save generated images
latent = torch.randn(batch_size)
save_samples(epoch+start_idx, latent)
#save_samples(epoch+start_idx, latent)
```

```
0, Epoch [1/1200], loss_g: 5.6803, loss_d: 5.6803
Saving generated-images-0001.png
10, 20, 30, 40, 50, Epoch [51/1200], loss_g: 5.6803, loss_d: 5.6803
Saving generated-images-0051.png
60, 70, 80, 90, 100, Epoch [101/1200], loss_g: 5.6803, loss_d: 5.6803
Saving generated-images-0101.png
110, 120, 130, 140, 150, Epoch [151/1200], loss_g: 5.6803, loss_d: 5.6803
Saving generated-images-0151.png
160, 170, 180, 190, 200, Epoch [201/1200], loss_g: 5.6803, loss_d: 5.6803
Saving generated-images-0201.png
210, 220,
```

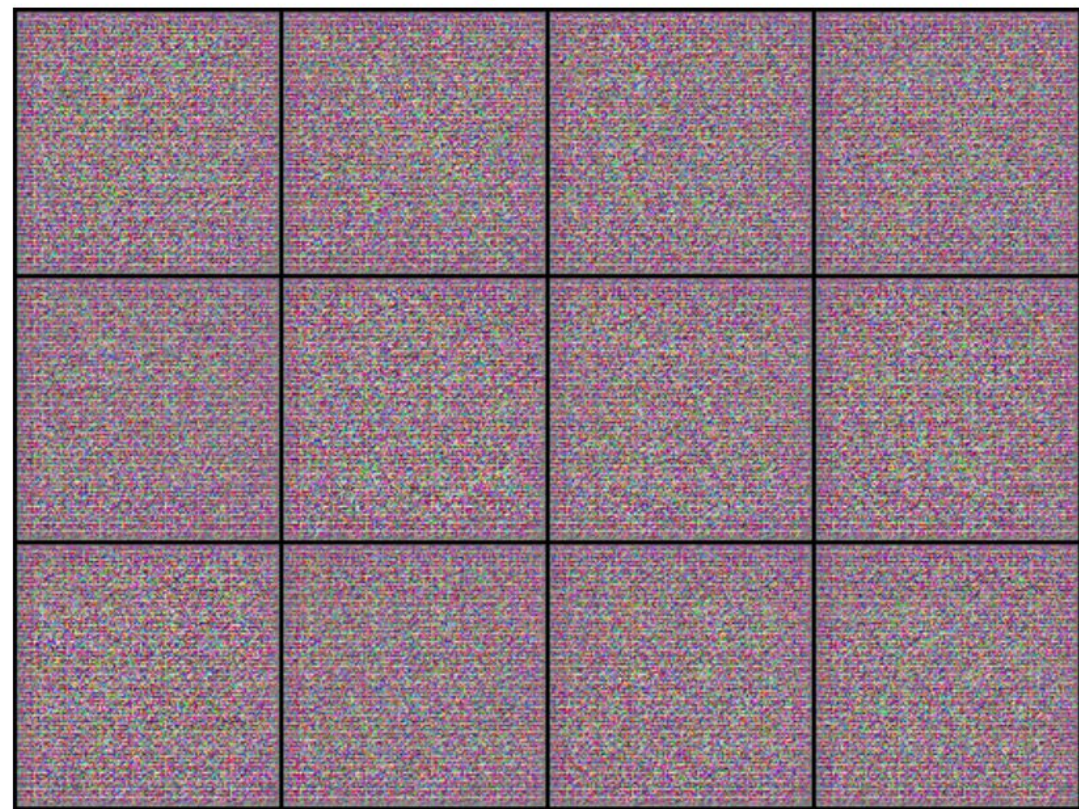
RAM
磁碟

編輯



generated-images-0201.png X

generated-images-0001.png X



檔案



<>

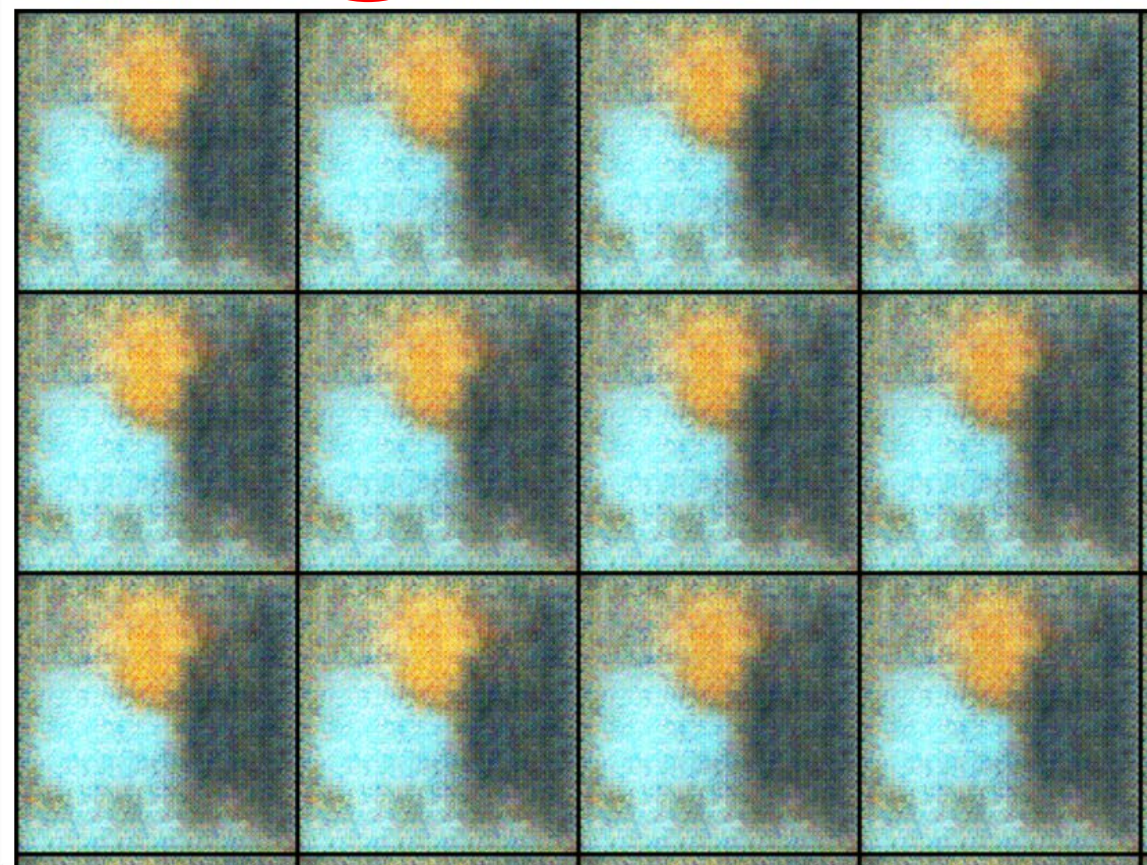


- ..
- gdrive
- generated
 - generated-images-0001.png
 - generated-images-0051.png
 - generated-images-0101.png
 - generated-images-0151.png
 - generated-images-0201.png
 - generated-images-0251.png
- sample_data

+ 程式碼 + 文字 複製到雲端硬碟

```
Saving generated-images-0001.png  
10, 20, 30, 40, 50, Epoch [51/1200], loss_  
Saving generated-images-0051.png  
60, 70, 80, 90, 100, Epoch [101/1200], los  
Saving generated-images-0101.png  
110, 120, 130, 140, 150, Epoch [151/1200],  
Saving generated-images-0151.png  
160, 170, 180, 190, 200, Epoch [201/1200],  
Saving generated-images-0201.png  
210, 220, 230, 240, 250, Epoch [251/1200],  
Saving generated-images-0251.png  
260, 270, 280,
```

generated-images-0251.png X



檔案



gdrive
generated

generated-images-0001.png
generated-images-0051.png
generated-images-0101.png
generated-images-0151.png
generated-images-0201.png
generated-images-0251.png
generated-images-0301.png

sample_data

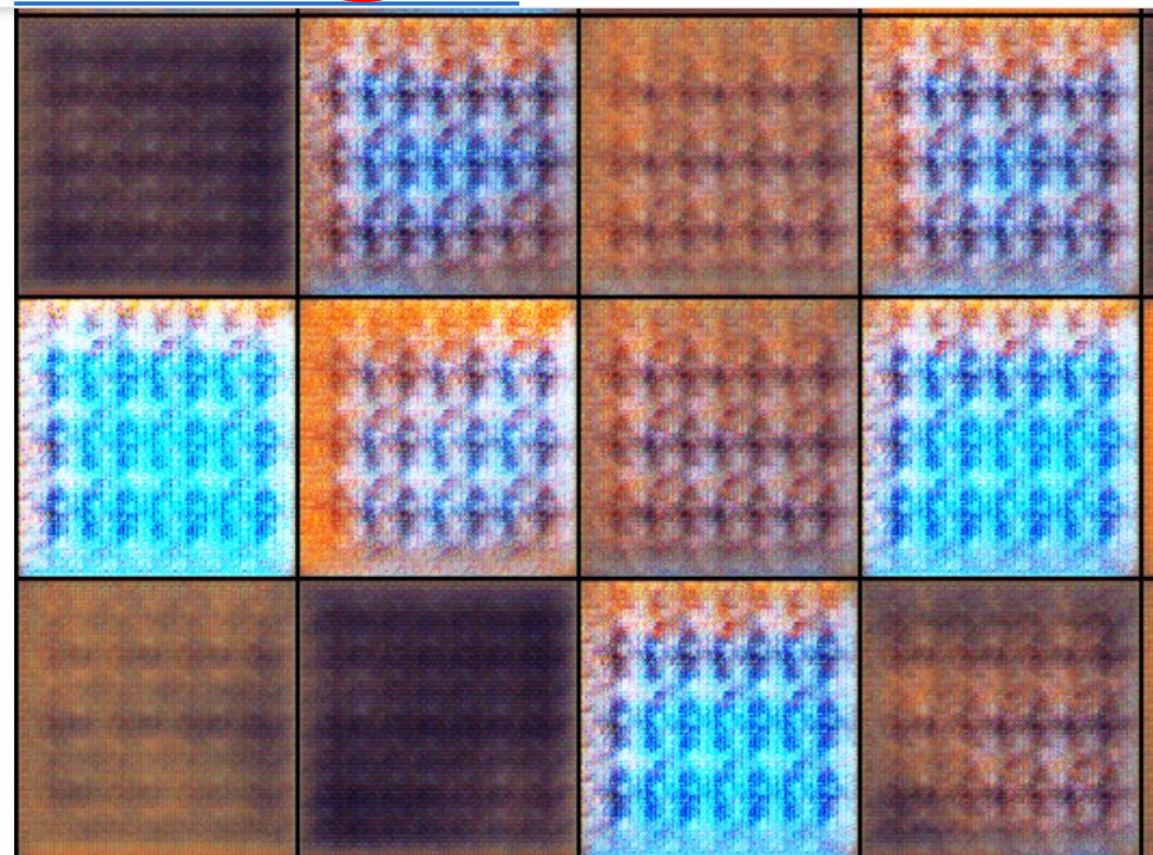
+ 程式碼 + 文字 複製到雲端硬碟

```
Saving generated-images-0001.png  
10, 20, 30, 40, 50, Epoch [51/1200], loss_  
Saving generated-images-0051.png  
60, 70, 80, 90, 100, Epoch [101/1200], los  
Saving generated-images-0101.png  
110, 120, 130, 140, 150, Epoch [151/1200],  
Saving generated-images-0151.png  
160, 170, 180, 190, 200, Epoch [201/1200],  
Saving generated-images-0201.png  
210, 220, 230, 240, 250, Epoch [251/1200],  
Saving generated-images-0251.png  
260, 270, 280, 290, 300, Epoch [301/1200],  
Saving generated-images-0301.png  
310, 320, 330, 340,
```

RAM
磁碟

編輯

generated-images-0301.png X



Unsupervised conditional generation

Two approaches for unsupervised conditional generation

- Approach 1: Direct Transformation



Domain X



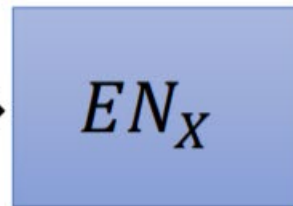
Domain Y

For texture or
color change

- Approach 2: Projection to Common Space



Domain X



Encoder of
domain X



Face
Attribute



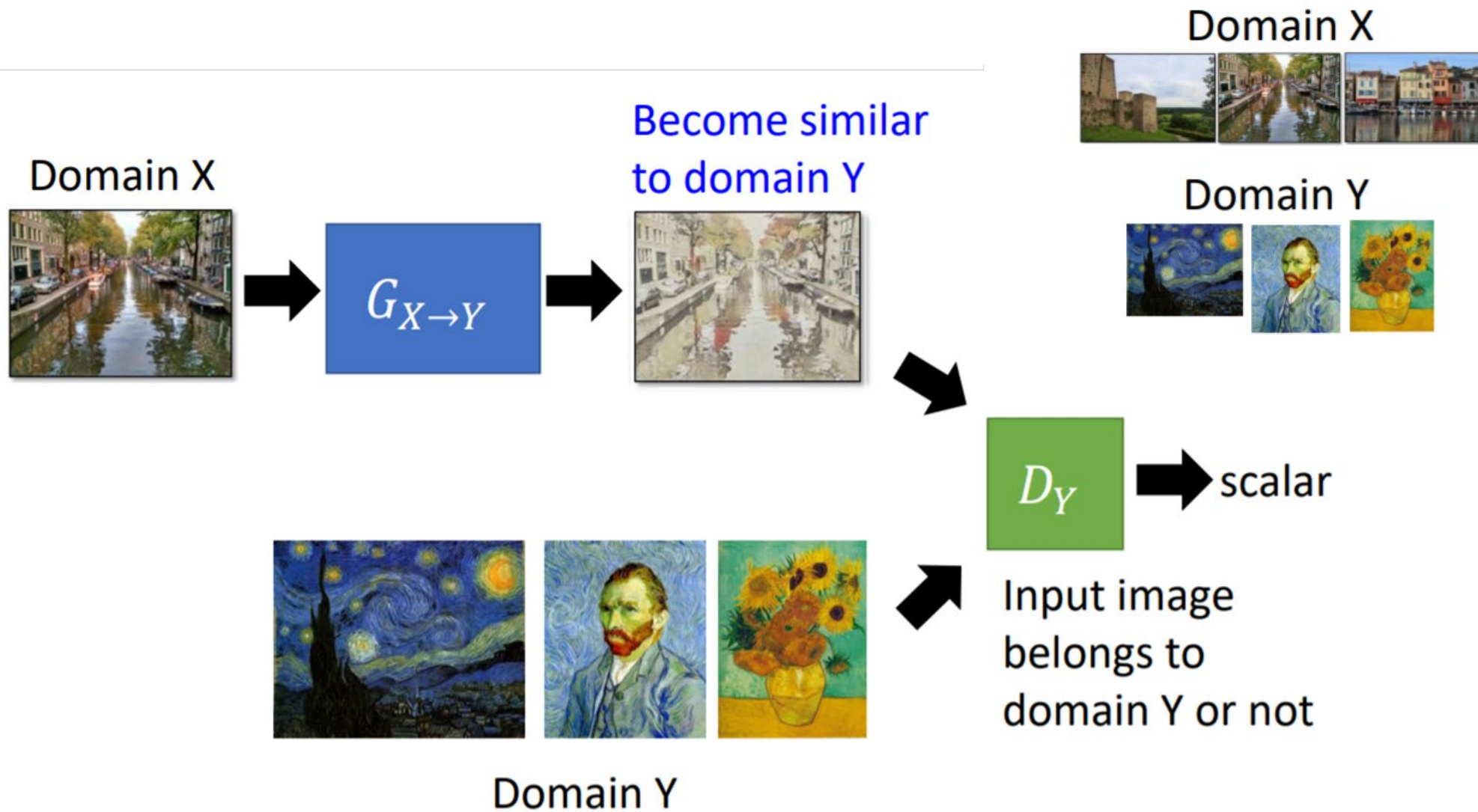
Decoder of
domain Y



Domain Y

Larger change, only keep the semantics

Direct transform



Cycle GAN

[Jun-Yan Zhu, et al., ICCV, 2017]

