MNIST 데이터 셋을 활용한 GAN 실습

학습 내용

- GAN 모델을 실습을 통해 구현해 봅니다.
- MNIST의 이미지를 생성하는 것을 확인해 봅니다.

목차

In [1]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
```

In [2]:

```
import keras
from keras.layers import Dense, Dropout, Input
from keras.models import Model,Sequential
from keras.datasets import mnist
from tqdm import tqdm
from tensorflow.keras.layers.advanced_activations import LeakyReLU
from tensorflow.keras.optimizers import Adam
```

데이터 불러오기

In [3]:

```
def load_data():
    (x_train, y_train), (x_test, y_test) = mnist.load_data()
    x_train = (x_train.astype(np.float32) - 127.5)/127.5

    print("데이터 값의 범위 : ", np.min(x_train), np.max(x_train) )
    # convert shape of x_train from (60000, 28, 28) to (60000, 784)
    # 784 columns per row
    x_train = x_train.reshape(60000, 784)
    return (x_train, y_train, x_test, y_test)
```

In [4]:

```
(X_train, y_train,X_test, y_test)=load_data()
print(X_train.shape)
```

```
Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-datasets/mn
ist.npz (https://storage.googleapis.com/tensorflow/tf-keras-datasets/mnist.npz)
11493376/11490434 [==============================] - 0s 0us/step
11501568/11490434 [==============================] - 0s 0us/step
데이터 값의 범위 :  -1.0 1.0
(60000, 784)
```

In [5]:

```
def adam_optimizer():
    return Adam(lr=0.0002, beta_1=0.5)
```

01. 생성 모델

목차로 이동하기

In [6]:

```
def create_generator():
    generator=Sequential()
    generator.add(Dense(units=256,input_dim=100))
    generator.add(LeakyReLU(0.2))

    generator.add(Dense(units=512))
    generator.add(LeakyReLU(0.2))

    generator.add(Dense(units=1024))
    generator.add(LeakyReLU(0.2))

    generator.add(Dense(units=784, activation='tanh'))

    generator.compile(loss='binary_crossentropy', optimizer=adam_optimizer())
    return generator

g=create_generator()
g.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 dense (Dense)               (None, 256)               25856

 leaky_re_lu (LeakyReLU)     (None, 256)               0

 dense_1 (Dense)             (None, 512)               131584

 leaky_re_lu_1 (LeakyReLU)   (None, 512)               0

 dense_2 (Dense)             (None, 1024)              525312

 leaky_re_lu_2 (LeakyReLU)   (None, 1024)              0

 dense_3 (Dense)             (None, 784)               803600

=================================================================
Total params: 1,486,352
Trainable params: 1,486,352
Non-trainable params: 0
_________________________________________________________________

/usr/local/lib/python3.7/dist-packages/keras/optimizer_v2/adam.py:105: UserWarning:
The `lr` argument is deprecated, use `learning_rate` instead.
  super(Adam, self).__init__(name, **kwargs)
```

02. 구분 모델

목차로 이동하기

In [7]:

```
def create_discriminator():
    discriminator=Sequential()
    discriminator.add(Dense(units=1024,input_dim=784))
    discriminator.add(LeakyReLU(0.2))
    discriminator.add(Dropout(0.3))

    discriminator.add(Dense(units=512))
    discriminator.add(LeakyReLU(0.2))
    discriminator.add(Dropout(0.3))

    discriminator.add(Dense(units=256))
    discriminator.add(LeakyReLU(0.2))

    discriminator.add(Dense(units=1, activation='sigmoid'))

    discriminator.compile(loss='binary_crossentropy', optimizer=adam_optimizer())
    return discriminator

d =create_discriminator()
d.summary()
```

```
Model: "sequential_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 dense_4 (Dense)             (None, 1024)              803840

 leaky_re_lu_3 (LeakyReLU)   (None, 1024)              0

 dropout (Dropout)           (None, 1024)              0

 dense_5 (Dense)             (None, 512)               524800

 leaky_re_lu_4 (LeakyReLU)   (None, 512)               0

 dropout_1 (Dropout)         (None, 512)               0

 dense_6 (Dense)             (None, 256)               131328

 leaky_re_lu_5 (LeakyReLU)   (None, 256)               0

 dense_7 (Dense)             (None, 1)                 257

=================================================================
Total params: 1,460,225
Trainable params: 1,460,225
Non-trainable params: 0
_________________________________________________________________
```

In [8]:

```
def create_gan(discriminator, generator):
    discriminator.trainable=False
    gan_input = Input(shape=(100,))
    x = generator(gan_input)
    gan_output= discriminator(x)
    gan= Model(inputs=gan_input, outputs=gan_output)    # 레이어를 객체로 그룹화
    gan.compile(loss='binary_crossentropy', optimizer='adam')
    return gan

# g = create_generator()     # 생성자
# d = create_discriminator()  # 판별자

gan = create_gan(d,g)
gan.summary()
```

```
Model: "model"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 input_1 (InputLayer)        [(None, 100)]             0

 sequential (Sequential)     (None, 784)               1486352

 sequential_1 (Sequential)   (None, 1)                 1460225

=================================================================
Total params: 2,946,577
Trainable params: 1,486,352
Non-trainable params: 1,460,225
_________________________________________________________________
```

In [9]:

```
def plot_generated_images(epoch, generator, examples=100, dim=(10,10), figsize=(10,10)):
    noise= np.random.normal(loc=0, scale=1, size=[examples, 100])
    generated_images = generator.predict(noise)
    generated_images = generated_images.reshape(100,28,28)
    plt.figure(figsize=figsize)
    for i in range(generated_images.shape[0]):
        plt.subplot(dim[0], dim[1], i+1)
        plt.imshow(generated_images[i], interpolation='nearest')
        plt.axis('off')
    plt.tight_layout()
    plt.savefig('gan_generated_image %d.png' %epoch)
```

03. GAN 학습

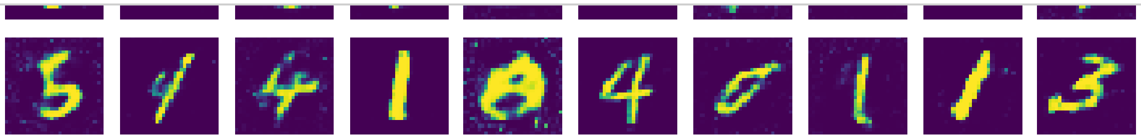
목차로 이동하기

In [10]:

```
def training(epochs=1, batch_size=128):

    # 데이터 불러오기(Loading the data)
    (X_train, y_train, X_test, y_test) = load_data()
    batch_count = X_train.shape[0] / batch_size

    # Creating GAN
    generator= create_generator()
    discriminator= create_discriminator()
    gan = create_gan(discriminator, generator)

    for e in range(1,epochs+1 ):
        print("Epoch %d" %e)
        for _ in tqdm(range(batch_size)):
        #generate  random noise as an input  to  initialize the  generator
            noise= np.random.normal(0,1, [batch_size, 100])

            # Noise를 이용하여 MNIST이미지 만들기( Generate fake MNIST images from noised input )
            generated_images = generator.predict(noise)

            # Get a random set of real images
            image_batch =X_train[np.random.randint(low=0,high=X_train.shape[0],size=batch_size)]

            # Construct different batches of  real and fake data
            X= np.concatenate([image_batch, generated_images])

            # Labels for generated and real data
            y_dis=np.zeros(2*batch_size)
            y_dis[:batch_size]=0.9

            # Pre train discriminator on  fake and real data  before starting the gan.
            discriminator.trainable=True
            discriminator.train_on_batch(X, y_dis)

            # Tricking the noised input of the Generator as real data
            noise= np.random.normal(0,1, [batch_size, 100])
            y_gen = np.ones(batch_size)

            # During the training of gan,
            # the weights of discriminator should be fixed.
            # We can enforce that by setting the trainable flag
            discriminator.trainable=False

            # training  the GAN by alternating the training of the Discriminator
            # and training the chained GAN model with Discriminator’ s weights freezed.
            gan.train_on_batch(noise, y_gen)

        if e == 1 or e % 20 == 0:

            plot_generated_images(e, generator)
```

In [11]:

```
%%time

training(200,256)
```



REF

- https://medium.com/datadriveninvestor/generative-adversarial-network-gan-using-keras-ce1c05cfdfd3 (https://medium.com/datadriveninvestor/generative-adversarial-network-gan-using-keras-ce1c05cfdfd3)