In [1]:

```
from google.colab import drive
drive.mount('/content/drive')
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, cal
l drive.mount("/content/drive", force_remount=True).
```

GAN Implementation Project

It is mainly used in Deep Flakes Problems

In [1]:

```
import tensorflow as tf
import numpy as np
import matplotlib.pyplot as plt
from tensorflow import keras
```

In [2]:

```
mnist = tf.keras.datasets.mnist
```

In [3]:

```
(X_train, Y_train), (X_test, Y_test) = mnist.load_data()  ##Loaded Mnist datasets
```

```
Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-dat
asets/mnist.npz (https://storage.googleapis.com/tensorflow/tf-keras-dataset
s/mnist.npz)
11493376/11490434 [==============================] - 0s 0us/step
```

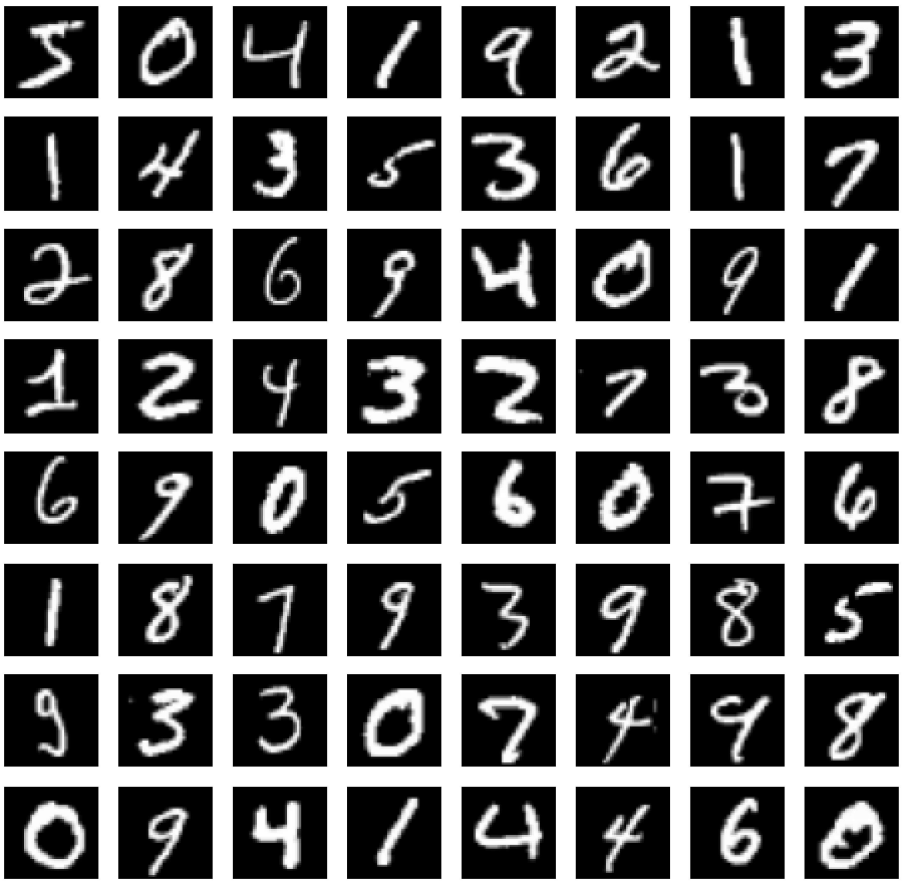
In [4]:

```
print(X_train.shape)
print(X_test.shape)
print(Y_train.shape)
print(Y_test.shape)
```

```
(60000, 28, 28)
(10000, 28, 28)
(60000,)
(10000,)
```

In [5]:

```
plt.figure(figsize = (8, 8))  ##Plotting the handwritten images
for i in range(64):
  plt.subplot(8, 8, 1+i)
  plt.axis('off')
  plt.imshow(X_train[i], cmap = 'gray')
```



In [6]:

```
##Normalise

X_train = X_train / 255
```

In [7]:

```
batch_size = 32
dataset = tf.data.Dataset.from_tensor_slices(X_train).shuffle(1000)
dataset = dataset.batch(batch_size, drop_remainder = True).prefetch(1)
```

In [8]:

```
##defining random noise that will feed to generator

codings_size = 30 #a set of random values at which it will generate fake images



generator = keras.models.Sequential([
                      keras.layers.Dense(100, activation = 'selu', input_shape = [codings_s
                      keras.layers.Dense(150, activation = 'selu'),
                      keras.layers.Dense(28*28, activation = 'sigmoid'),
                      keras.layers.Reshape([28,28])
])
```

In [9]:

```
## Building discrimanator Neural Network....Simple RNN

discriminator = keras.models.Sequential([
                                        keras.layers.Flatten(input_shape = [28, 28]),
                                        keras.layers.Dense(150, activation = 'selu'),
                                        keras.layers.Dense(100, activation = 'selu'),
                                        keras.layers.Dense(1, activation = 'sigmoid')
])
```

In [10]:

```
gan = keras.models.Sequential([generator, discriminator])  ##Completed architecture of GAN
```

In [11]:

```
generator.summary()
```

```
Model: "sequential"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
dense (Dense)                (None, 100)               3100
_________________________________________________________________
dense_1 (Dense)              (None, 150)               15150
_________________________________________________________________
dense_2 (Dense)              (None, 784)               118384
_________________________________________________________________
reshape (Reshape)            (None, 28, 28)            0
=================================================================
Total params: 136,634
Trainable params: 136,634
Non-trainable params: 0
_________________________________________________________________
```

In [12]:

```
discriminator.summary()
```

```
Model: "sequential_1"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
flatten (Flatten)            (None, 784)               0
_________________________________________________________________
dense_3 (Dense)              (None, 150)               117750
_________________________________________________________________
dense_4 (Dense)              (None, 100)               15100
_________________________________________________________________
dense_5 (Dense)              (None, 1)                 101
=================================================================
Total params: 132,951
Trainable params: 132,951
Non-trainable params: 0
_________________________________________________________________
```

In [13]:

```
gan.summary()
```

```
Model: "sequential_2"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
sequential (Sequential)      (None, 28, 28)            136634
_________________________________________________________________
sequential_1 (Sequential)    (None, 1)                 132951
=================================================================
Total params: 269,585
Trainable params: 269,585
Non-trainable params: 0
_________________________________________________________________
```

In [14]:

```
#We are going to take equal number of real images as fake images
discriminator.compile(loss = 'binary_crossentropy', optimizer = 'rmsprop')
discriminator.trainable = False #It means discriminator parameters are not going to be upda
gan.compile(loss = 'binary_crossentropy', optimizer = 'rmsprop') #In GAN, discriminator par
```

In [15]:

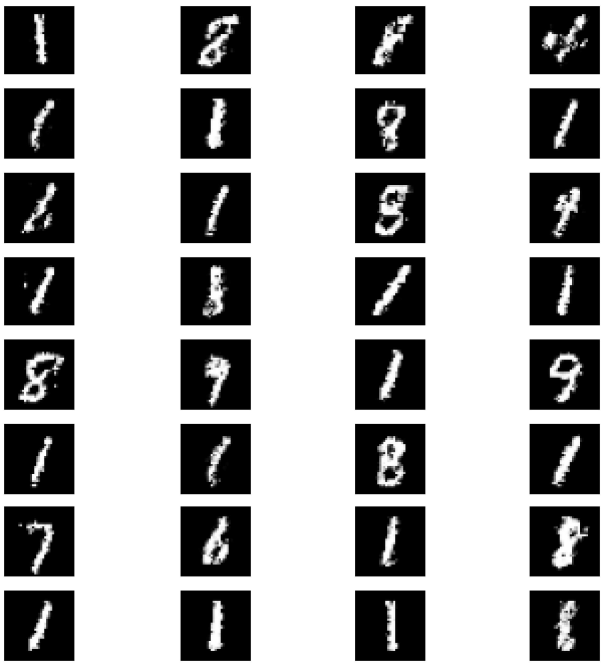
```
def train_gan(gan, dataset, batch_size, codings_size, n_epochs = 10):
  generator, discriminator = gan.layers  #Two layers are going to return. One will save in
  for epoch in range(n_epochs): #outer loop is for number of epochs
    for X_batch in dataset: #inner loop is for batches 32 images it creates
      # training the discriminator
      noise = tf.random.normal(shape = [batch_size, codings_size])#we are providing random
      generated_images = generator(noise)
      X_batch = tf.cast(X_batch, tf.float32)#We are typecasting it in float to match with g
      X_fake_and_real = tf.concat([generated_images, X_batch], axis = 0) #It will combine 3
      y1 = tf.constant([[0.]] * batch_size + [[1.]] * batch_size) #labelling images as 0 fo
      discriminator.trainable = True #to avoid warning setting discriminator trainable as T
      discriminator.train_on_batch(X_fake_and_real, y1) #training the discriminator.

      #training the generator
      noise = tf.random.normal(shape = [batch_size, codings_size])
      y2 = tf.constant(([[1.]] * batch_size))  #we want GAN to generate fake images that sh
      discriminator.trainable = False
      gan.train_on_batch(noise, y2)

  plt.figure(figsize=(6,6))
  for i in range(32):
    plt.subplot(8, 4, 1+i)
    plt.axis('off')
    plt.imshow(generated_images[i], cmap = 'gray')
```

In [16]:

```
train_gan(gan, dataset, batch_size, codings_size)
```



In [17]:

```
noise = tf.random.normal(shape = [1,codings_size])
generated_image = generator(noise)
generated_image.shape
```

Out[17]:

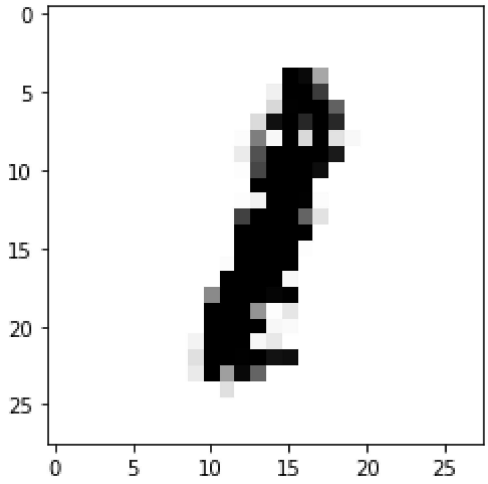
```
TensorShape([1, 28, 28])
```

In [21]:

```
plt.figure()
plt.imshow(generated_image[0], cmap = 'gray_r')
```

Out[21]:

```
<matplotlib.image.AxesImage at 0x7fc7bef5cb90>
```



Neural Style Transfer

We take 2 images. One content image and one style image. It feed to Neural Networks. It change the content image as per the style images.

###Tensorflow Hub: It is a repository that provides pre-trained model. It is used in Transfer Learning.

In [47]:

```
import tensorflow_hub as hub
import tensorflow as tf
from matplotlib import pyplot as plt
import numpy as np
import cv2
```

In [50]:

```
model = hub.load('https://tfhub.dev/google/magenta/arbitrary-image-stylization-v1-256/2') #
```

In [51]:

```
def load_image(img_path):
    img = tf.io.read_file(img_path) #reading the file path.
    img = tf.image.decode_image(img, channels=3)
    img = tf.image.convert_image_dtype(img, tf.float32)
    img = img[tf.newaxis, :] #It is reshaping
    return img
```

In [53]:

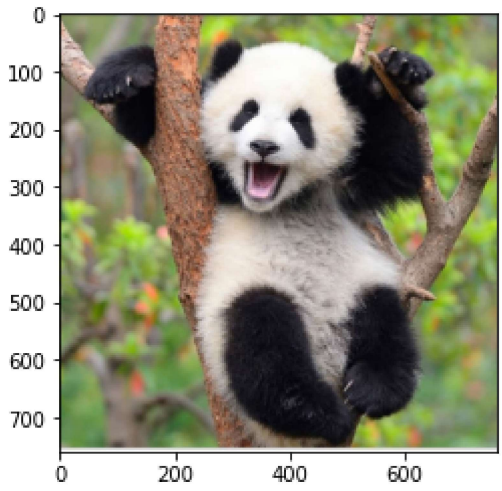
```
content_image =  load_image('/content/images/panda.jpeg')
style_image = load_image('/content/images/monet.jpeg')
```

In [54]:

```
plt.imshow(np.squeeze(content_image)) #squeeze function---> eliminates single dimension.
```

Out[54]:

```
<matplotlib.image.AxesImage at 0x7f43fb195710>
```

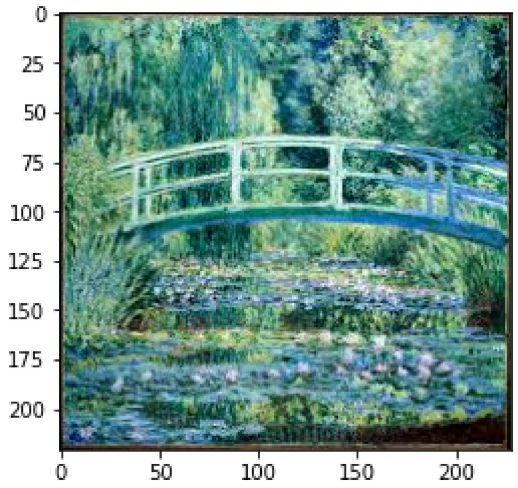


In [55]:

```
plt.imshow(np.squeeze(style_image))
```

Out[55]:

```
<matplotlib.image.AxesImage at 0x7f43fb1ca9d0>
```



In [58]:

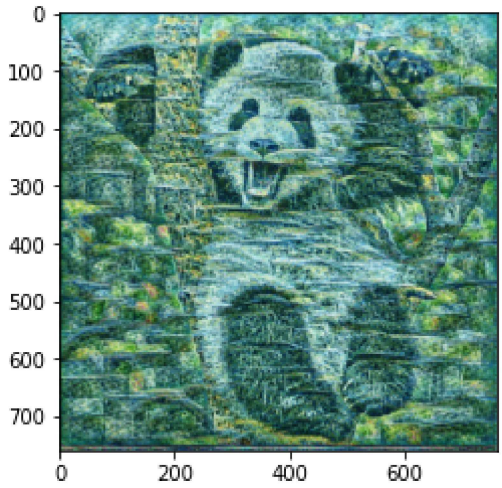
```
stylized_image = model(tf.constant(content_image), tf.constant(style_image))[0] #image is s
```

In [59]:

```
plt.imshow(np.squeeze(stylized_image))
```

Out[59]:

```
<matplotlib.image.AxesImage at 0x7f4421ee0190>
```



In [60]:

```
content_image =  load_image('/content/images/baby_yoda.jpeg')
style_image = load_image('/content/images/starrynight.jpeg')
```

In [61]:

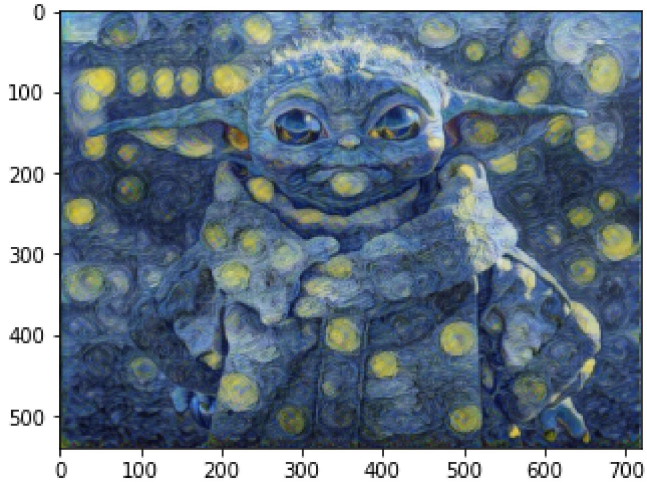
```
stylized_image = model(tf.constant(content_image), tf.constant(style_image))[0] #image is s
```

In [62]:

```
plt.imshow(np.squeeze(stylized_image))
```

Out[62]:

```
<matplotlib.image.AxesImage at 0x7f4421ebefd0>
```



In [ ]:

```

```

Transfer Learning

Data Augmentation

In [63]:

```
!wget --no-check-certificate \
    https://storage.googleapis.com/mledu-datasets/cats_and_dogs_filtered.zip \
    -O /tmp/cats_and_dogs_filtered.zip
```

```
--2021-05-16 14:52:15--  https://storage.googleapis.com/mledu-datasets/cats_
and_dogs_filtered.zip (https://storage.googleapis.com/mledu-datasets/cats_an
d_dogs_filtered.zip)
Resolving storage.googleapis.com (storage.googleapis.com)... 74.125.195.128,
173.194.203.128, 74.125.20.128, ...
Connecting to storage.googleapis.com (storage.googleapis.com)|74.125.195.128
|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 68606236 (65M) [application/zip]
Saving to: ‘/tmp/cats_and_dogs_filtered.zip’

/tmp/cats_and_dogs_ 100%[===================>]  65.43M   106MB/s    in 0.6s

2021-05-16 14:52:15 (106 MB/s) - ‘/tmp/cats_and_dogs_filtered.zip’ saved [68
606236/68606236]
```

In [64]:

```
import os
import zipfile
import tensorflow as tf
from tensorflow.keras.optimizers import RMSprop
from tensorflow.keras.preprocessing.image import ImageDataGenerator
```

In [65]:

```
local_zip = '/tmp/cats_and_dogs_filtered.zip'
zip_ref = zipfile.ZipFile(local_zip, 'r')
zip_ref.extractall('/tmp')
zip_ref.close()

base_dir = '/tmp/cats_and_dogs_filtered'
train_dir = os.path.join(base_dir, 'train')
validation_dir = os.path.join(base_dir, 'validation')
```

In [ ]:

```

```