In [1]:

```
import tensorflow as tf
from tensorflow.keras.utils import plot_model
import gc
import math
from IPython.display import clear_output
import time
import os
import matplotlib.pyplot as plt
import glob
import pathlib
```

In [2]:

```
# InstanceNormalization

# Code Credit: https://github.com/tensorflow/examples/blob/master/tensorflow_examples/models/pix2pix/pix2pix.py
class InstanceNormalization(tf.keras.layers.Layer):
    """Instance Normalization Layer (https://arxiv.org/abs/1607.08022)."""

    def __init__(self, epsilon=1e-5):
        super(InstanceNormalization, self).__init__()
        self.epsilon = epsilon

    def build(self, input_shape):
        self.scale = self.add_weight(
            name='scale',
            shape=input_shape[-1:],
            initializer=tf.compat.v1.truncated_normal_initializer(1., 0.02),
            trainable=True)

        self.offset = self.add_weight(
            name='offset',
            shape=input_shape[-1:],
            initializer=tf.constant_initializer(0),
            trainable=True)

    def call(self, x):
        mean, variance = tf.nn.moments(x, axes=[1, 2], keepdims=True)
        inv = tf.math.rsqrt(variance + self.epsilon)
        normalized = (x - mean) * inv
        return self.scale * normalized + self.offset
```

In [3]:

```
def c7s1_k(k, initializer='glorot_uniform', act='relu'):
    '''
    7×7 Convolution-InstanceNorm-ReLU layer with k filters and stride 1.
    '''
    model = tf.keras.models.Sequential()

    model.add(tf.keras.layers.Conv2D(filters=k, kernel_size=(7,7), strides=(1,1), padding='same', \
                                     kernel_initializer=initializer, use_bias=False))
    model.add(InstanceNormalization())
    model.add(tf.keras.layers.Activation(act))

    return model
```

In [4]:

```
def dk(k, initializer):
    '''
    3 × 3 Convolution-InstanceNorm-ReLU layer with k filters and stride 2
    '''
    model = tf.keras.models.Sequential()
    model.add(tf.keras.layers.Conv2D(filters=k, kernel_size=(3,3), strides=(2,2), padding='same', \
                                     kernel_initializer=initializer, use_bias=False))
```

```
    model.add(InstanceNormalization())
    model.add(tf.keras.layers.ReLU())

    return model
```

In [5]:

```
class Rk(tf.keras.Model):
    def __init__(self, k, initializer):
        super(Rk, self).__init__()
        self.initializer = initializer
        self.k = k

        self.conv1 = tf.keras.layers.Conv2D(filters=self.k, kernel_size=(3,3), kernel_initializer=self.
initializer, \
                                            padding='valid', use_bias=False)

        self.conv2 = tf.keras.layers.Conv2D(filters=self.k, kernel_size=(3,3), kernel_initializer=self.
initializer, \
                                            padding='valid', use_bias=False)


        self.instnorm1 = InstanceNormalization()
        self.instnorm2 = InstanceNormalization()

        self.reluact1 = tf.keras.layers.ReLU()
        self.reluact2 = tf.keras.layers.ReLU()

    def call(self, input_data):
        pad_input = tf.pad(input_data, [[0, 0], [1, 1], [1, 1], [0, 0]], "REFLECT")
        x = self.conv1(pad_input)
        x = self.instnorm1(x)
        x = self.reluact1(x)

        pad_input2 = tf.pad(x, [[0, 0], [1, 1], [1, 1], [0, 0]], "REFLECT")
        y = self.conv2(pad_input2)
        y = self.instnorm2(y)

        out = x + y
        out = self.reluact2(out)

        return out
```

In [6]:

```
def uk(k, initializer):
    '''
    3 × 3 fractional-strided-Convolution-InstanceNorm-ReLU layer with k filters and stride 1/2
    '''
    model = tf.keras.models.Sequential()
    model.add(tf.keras.layers.Conv2DTranspose(filters=k, kernel_size=(3,3), strides=(2,2), padding='sam
e', \
                                      kernel_initializer=initializer, use_bias=False))
    model.add(InstanceNormalization())
    model.add(tf.keras.layers.ReLU())

    return model
```

In [7]:

```
class Generator(tf.keras.Model):
    def __init__(self):
        super(Generator, self).__init__()

        self.initializer = tf.compat.v1.truncated_normal_initializer(0., 0.02)

        self.en1 = c7s1_k(64, self.initializer)
        self.en2 = dk(128, self.initializer)
        self.en3 = dk(256, self.initializer)

        self.res1 = Rk(256, self.initializer)
        self.res2 = Rk(256, self.initializer)
```

```
        self.res3 = Rk(256, self.initializer)
        self.res4 = Rk(256, self.initializer)
        self.res5 = Rk(256, self.initializer)
        self.res6 = Rk(256, self.initializer)

        self.de3 = uk(128, self.initializer)
        self.de2 = uk(64, self.initializer)
        self.de1 = c7s1_k(3, self.initializer, 'tanh')

    def call(self, input_tensor):
        x = self.en1(input_tensor)
        x = self.en2(x)
        x = self.en3(x)

        x = self.res1(x)
        x = self.res2(x)
        x = self.res3(x)
        x = self.res4(x)
        x = self.res5(x)
        x = self.res6(x)

        x = self.de3(x)
        x = self.de2(x)
        x = self.de1(x)

        return x
```

In [8]:

```
input_dim = (128,128,3)
input_data = tf.random.uniform(shape=(1,128,128,3))
```

In [9]:

```
model = Generator()
_ = model(input_data)
model.summary()
```

```
Model: "generator"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
sequential (Sequential)      multiple                  9536
_________________________________________________________________
sequential_1 (Sequential)    multiple                  73984
_________________________________________________________________
sequential_2 (Sequential)    multiple                  295424
_________________________________________________________________
rk (Rk)                      multiple                  1180672
_________________________________________________________________
rk_1 (Rk)                    multiple                  1180672
_________________________________________________________________
rk_2 (Rk)                    multiple                  1180672
_________________________________________________________________
rk_3 (Rk)                    multiple                  1180672
_________________________________________________________________
rk_4 (Rk)                    multiple                  1180672
_________________________________________________________________
rk_5 (Rk)                    multiple                  1180672
_________________________________________________________________
sequential_3 (Sequential)    multiple                  295168
_________________________________________________________________
sequential_4 (Sequential)    multiple                  73856
_________________________________________________________________
sequential_5 (Sequential)    multiple                  9414
=================================================================
Total params: 7,841,414
Trainable params: 7,841,414
Non-trainable params: 0
_________________________________________________________________
```

In [10]:

```
def Ck(k, stride, initializer, do_norm=True):
    '''
    4 × 4 Convolution-InstanceNorm-LeakyReLU layer with k filters and stride 2.
    '''
    model = tf.keras.Sequential()
    model.add(tf.keras.layers.Conv2D(filters=k, kernel_size=(4,4), strides=stride, padding='same', \
                                     kernel_initializer=initializer, use_bias=False))
    if do_norm:
        model.add(InstanceNormalization())

    model.add(tf.keras.layers.LeakyReLU(0.2))

    return model
```

In [11]:

```
class Discriminator(tf.keras.Model):
    def __init__(self):
        super(Discriminator, self).__init__()
        self.initializer = tf.compat.v1.truncated_normal_initializer(0., 0.02)

        self.c64 = Ck(64, (2,2), self.initializer, False)
        self.c128 = Ck(128, (2,2), self.initializer)
        self.c256 = Ck(256, (2,2), self.initializer)
        self.c512 = Ck(512, (1,1), self.initializer)

        self.conv = tf.keras.layers.Conv2D(filters=1, kernel_size=(4,4), strides=(1,1), padding='same',
                                           kernel_initializer=self.initializer, use_bias=False)

    def call(self, input_tensor):
        input_tensor = input_tensor + tf.random.normal(shape=tf.shape(input_tensor), mean=0.0, stddev=0
.1, dtype=tf.float32)
        x = self.c64(input_tensor)
        x = self.c128(x)
        x = self.c256(x)
        x = self.c512(x)

        x = self.conv(x)

        return x
```

In [12]:

```
model = Discriminator()
_ = model(input_data)
model.summary()
```

```
Model: "discriminator"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
sequential_6 (Sequential)    multiple                  3072
_________________________________________________________________
sequential_7 (Sequential)    multiple                  131328
_________________________________________________________________
sequential_8 (Sequential)    multiple                  524800
_________________________________________________________________
sequential_9 (Sequential)    multiple                  2098176
_________________________________________________________________
conv2d_20 (Conv2D)           multiple                  8192
=================================================================
Total params: 2,765,568
Trainable params: 2,765,568
Non-trainable params: 0
_________________________________________________________________
```

In [13]:

```
del input_data, input_dim
```

In [14]:

```
LAMBDA = 10
loss = tf.keras.losses.BinaryCrossentropy(from_logits=True)

def D_loss(real, generated):
    return (loss(tf.ones_like(real), real) + loss(tf.zeros_like(generated), generated)) * 0.5

def G_loss(generated):
    return loss(tf.ones_like(generated), generated)

def Similarity_loss(image1, image2):
    return tf.reduce_mean(tf.abs(image1 - image2))
```

In [15]:

```
# Code credit: https://www.tensorflow.org/tutorials/generative/cyclegan
# Generate image from particular model when feeding test_input as input
def generate_images(model, test_input):
    prediction = model(test_input)

    plt.figure(figsize=(12, 12))

    display_list = [test_input[0], prediction[0]]
    title = ['Input Image', 'Predicted Image']

    for i in range(2):
        plt.subplot(1, 2, i+1)
        plt.title(title[i])
        # getting the pixel values between [0, 1] to plot it.
        plt.imshow(display_list[i]*0.5+0.5)
        plt.axis('off')
    plt.show()
```

In [16]:

```
@tf.function
def train_step(real_x, real_y):
    with tf.GradientTape(persistent=True) as tape:
        # Setup Dy loss
        fake_y = G(real_x, training=True)
        disc_fake_y = Dy(fake_y, training=True)
        dis_y_loss = D_loss(Dy(real_y, training=True), disc_fake_y)

        with tape.stop_recording():
            Dy_gradients = tape.gradient(dis_y_loss, Dy.trainable_variables)
            Dy_optimizer.apply_gradients(zip(Dy_gradients, Dy.trainable_variables))

        # Setup Dx loss
        fake_x = F(real_y, training=True)
        disc_fake_x = Dx(fake_x, training=True)
        dis_x_loss = D_loss(Dx(real_x, training=True), disc_fake_x)

        with tape.stop_recording():
            Dx_gradients = tape.gradient(dis_x_loss, Dx.trainable_variables)
            Dx_optimizer.apply_gradients(zip(Dx_gradients, Dx.trainable_variables))

        # Setup adversarial losses
        gen_g_adv_loss = G_loss(disc_fake_y)
        gen_f_adv_loss = G_loss(disc_fake_x)

        # Setup cycle losses
        cyc_x = F(fake_y, training=True)
        cyc_x_loss = Similarity_loss(real_x, cyc_x)

        cyc_y = G(fake_x, training=True)
        cyc_y_loss =  Similarity_loss(real_y, cyc_y)

        # Setup identity losses
        id_x = F(real_x, training=True)
        id_x_loss = Similarity_loss(real_x, id_x)

        id_y = G(real_y, training=True)
```

```
        id_y = G(real_y, training=True)
        id_y_loss = Similarity_loss(real_y, id_y)

        # Finalize generator losses and calc gradients
        gen_g_loss = gen_g_adv_loss + (cyc_x_loss + cyc_y_loss) * LAMBDA + id_y_loss * 0.5 * LAMBDA
        gen_f_loss = gen_f_adv_loss + (cyc_x_loss + cyc_y_loss) * LAMBDA + id_x_loss * 0.5 * LAMBDA

        with tape.stop_recording():
            G_gradients = tape.gradient(gen_g_loss, G.trainable_variables)
            G_optimizer.apply_gradients(zip(G_gradients, G.trainable_variables))

            F_gradients = tape.gradient(gen_f_loss, F.trainable_variables)
            F_optimizer.apply_gradients(zip(F_gradients, F.trainable_variables))

    return gen_g_loss,gen_f_loss,dis_x_loss,dis_y_loss
```

In [17]:

```
# Download dataset from original site.

data_dir = tf.keras.utils.get_file(fname='monet2photo.zip', origin='https://people.eecs.berkeley.edu/~taesung_park/CycleGAN/datasets/monet2photo.zip', \
                         extract=True, archive_format='zip', cache_dir='./')
data_dir = tf.keras.utils.get_file(fname='cezanne2photo.zip', origin='https://people.eecs.berkeley.edu/~taesung_park/CycleGAN/datasets/cezanne2photo.zip', \
                         extract=True, archive_format='zip', cache_dir='./')
data_dir = tf.keras.utils.get_file(fname='vangogh2photo.zip', origin='https://people.eecs.berkeley.edu/~taesung_park/CycleGAN/datasets/vangogh2photo.zip', \
                         extract=True, archive_format='zip', cache_dir='./')
data_dir = tf.keras.utils.get_file(fname='ukiyoe2photo.zip', origin='https://people.eecs.berkeley.edu/~taesung_park/CycleGAN/datasets/ukiyoe2photo.zip', \
                         extract=True, archive_format='zip', cache_dir='./')
```

In [18]:

```
data_dir = pathlib.Path('./datasets')
print('List of folder inside dataset')
ldir = []
for i in list(os.listdir(str(data_dir))):
    try:
        if i.split('.')[1]:
            continue
    except:
        ldir.append(i)
ldir
```

```
List of folder inside dataset
```

Out[18]:

```
['cezanne2photo', 'monet2photo', 'ukiyoe2photo', 'vangogh2photo']
```

In [19]:

```
# Each dataset folder contain
os.listdir(str(data_dir)+'/'+ldir[0])
```

Out[19]:

```
['testA', 'testB', 'trainA', 'trainB']
```

In [20]:

```
TotalImg_A = 0
TotalImg_B = 0
for i in range(len(ldir)):
    dataset_sub = pathlib.Path(str(data_dir)+'/'+ldir[i]+'/')

    print('-------- For this folder:',dataset_sub,'--------')
```

```
    print('Number of images contain trainA')
    len_A = len(list(dataset_sub.glob('trainA/*')))
    TotalImg_A += len_A
    print(len_A)
    print('\nNumber of images contain trainB')
    len_B = len(list(dataset_sub.glob('trainB/*')))
    print(len_B)

TotalImg_B += len_B

list_1 = tf.data.Dataset.list_files(str(data_dir)+'/'+ldir[0]+'/trainA/*')
list_2 = tf.data.Dataset.list_files(str(data_dir)+'/'+ldir[1]+'/trainA/*')
list_A = list_1.concatenate(list_2)
list_3 = tf.data.Dataset.list_files(str(data_dir)+'/'+ldir[2]+'/trainA/*')
list_A = list_A.concatenate(list_3)
list_4 = tf.data.Dataset.list_files(str(data_dir)+'/'+ldir[3]+'/trainA/*')
list_A = list_A.concatenate(list_4)

list_B = tf.data.Dataset.list_files(str(data_dir)+'/'+ldir[0]+'/trainB/*')
del list_1, list_2, list_3, list_4
```

```
-------- For this folder: datasets\cezanne2photo --------
Number of images contain trainA
525

Number of images contain trainB
6287
-------- For this folder: datasets\monet2photo --------
Number of images contain trainA
1072

Number of images contain trainB
6287
-------- For this folder: datasets\ukiyoe2photo --------
Number of images contain trainA
562

Number of images contain trainB
6287
-------- For this folder: datasets\vangogh2photo --------
Number of images contain trainA
400

Number of images contain trainB
6287
```

In [21]:

```
print('Total Number of Images in trainA (artist)',TotalImg_A)
print('Total Number of Images in trainB (photo)',TotalImg_B)
```

```
Total Number of Images in trainA (artist) 2559
Total Number of Images in trainB (photo) 6287
```

In [22]:

```
BATCH_SIZE = 1
IMG_HEIGHT = 256
IMG_WIDTH = 256
```

In [23]:

```
print('List of files from trainA directory')
for f in list_A.take(5):
    print(f.numpy())

print('\nList of files from trainB directory')
for f in list_B.take(5):
    print(f.numpy())
```

```
List of files from trainA directory
b'datasets\\cezanne2photo\\trainA\\00229.jpg'
b'datasets\\cezanne2photo\\trainA\\00139.jpg'
b'datasets\\cezanne2photo\\trainA\\00366.jpg'
b'datasets\\cezanne2photo\\trainA\\00211.jpg'
b'datasets\\cezanne2photo\\trainA\\00383.jpg'

List of files from trainB directory
b'datasets\\cezanne2photo\\trainB\\2014-06-29 04_36_04.jpg'
b'datasets\\cezanne2photo\\trainB\\2015-05-30 01_47_24.jpg'
b'datasets\\cezanne2photo\\trainB\\2014-05-17 20_53_46.jpg'
b'datasets\\cezanne2photo\\trainB\\2015-08-25 11_14_51.jpg'
b'datasets\\cezanne2photo\\trainB\\2016-03-09 09_43_22.jpg'
```

In [24]:

```
def random_crop(image):
    cropped_image = tf.image.random_crop(image, size=[IMG_HEIGHT, IMG_WIDTH, 3])

    return cropped_image

def random_jitter(image):
    # resizing to 286 x 286 x 3
    image = tf.image.resize(image, [286, 286], method=tf.image.ResizeMethod.NEAREST_NEIGHBOR)

    # randomly cropping to 256 x 256 x 3
    image = random_crop(image)

    # random mirroring
    image = tf.image.random_flip_left_right(image)

    return image

def normalize(img):
    img = tf.cast(img, tf.float32)
    img = (img / 127.5) - 1
    return img

def read_file(filename):
    # read the filename
    x = tf.io.read_file(filename)
    # Convert into color image
    x = tf.image.decode_jpeg(x, channels=3)
    x = random_jitter(x)
    x = normalize(x)
    # return image with specific image width and height
    return tf.image.resize(x, [IMG_WIDTH//2, IMG_HEIGHT//2])

print('Print the size of a image from trainA folder')
trainA = list_A.map(read_file, num_parallel_calls=-1)
for i in trainA.take(1):
    print(i.numpy().shape)

print('\nPrint the size of a image from trainB folder')
trainB = list_B.map(read_file, num_parallel_calls=-1)
for i in trainB.take(1):
    print(i.numpy().shape)
```

```
Print the size of a image from trainA folder
(128, 128, 3)

Print the size of a image from trainB folder
(128, 128, 3)
```

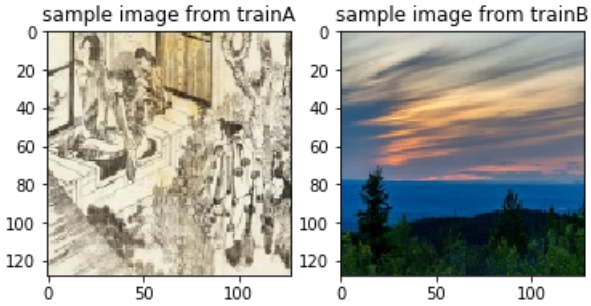
In [25]:

```
Total_Img = math.floor(min(TotalImg_A,TotalImg_B)/100) * 100

trainA = trainA.shuffle(Total_Img).batch(BATCH_SIZE)
trainB = trainB.shuffle(Total_Img).batch(BATCH_SIZE)
```

In [26]:

In [26]:

```
sampleA = next(iter(trainA))
sampleB = next(iter(trainB))

plt.subplot(121)
plt.imshow(sampleA[0]*0.5+0.5)
plt.title('sample image from trainA')
plt.subplot(122)
plt.imshow(sampleB[0]*0.5+0.5)
plt.title('sample image from trainB')
plt.show()
```



In [27]:

```
print('Create instance of all models and save initial weights when model instanstiad: G, F, Dx, Dy')
inp_shape=(IMG_WIDTH//2,IMG_HEIGHT//2,3)
inp = tf.keras.Input(shape=inp_shape)

G = Generator()
_ = G(inp)
G.save_weights('./weights/G_Weights')

F = Generator()
_ = F(inp)
F.save_weights('./weights/F_Weights')

Dx = Discriminator()
_ = Dx(inp)
Dx.save_weights('./weights/Dx_Weights')

Dy = Discriminator()
_ = Dy(inp)
Dy.save_weights('./weights/Dy_Weights')

del G, F, Dx, Dy
```

```
Create instance of all models and save initial weights when model instanstiad: G, F, Dx, Dy
```

In [28]:

```
print('Reload the initial weights')
inp_shape=(IMG_WIDTH//2,IMG_HEIGHT//2,3)
G = Generator()
G.load_weights('./weights/G_Weights')
F = Generator()
F.load_weights('./weights/F_Weights')
Dx = Discriminator()
Dx.load_weights('./weights/Dx_Weights')
Dy = Discriminator()
Dy.load_weights('./weights/Dy_Weights')


# A per paper, it used lamda = 10
lr = 0.0002

print('optimizer defining...')
# Define Optimizer for G and F model
G_optimizer = tf.keras.optimizers.Adam(lr, beta_1=0.5)
F_optimizer = tf.keras.optimizers.Adam(lr, beta_1=0.5)
# Define Optimizer for Dx and Dy model
```

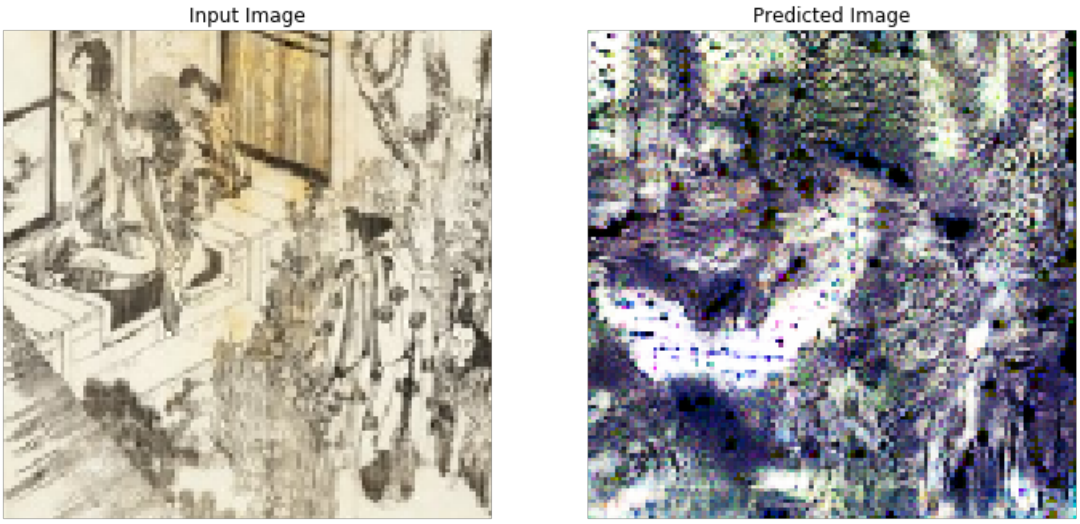
```
Dx_optimizer = tf.keras.optimizers.Adam(lr, beta_1=0.5)
Dy_optimizer = tf.keras.optimizers.Adam(lr, beta_1=0.5)
```

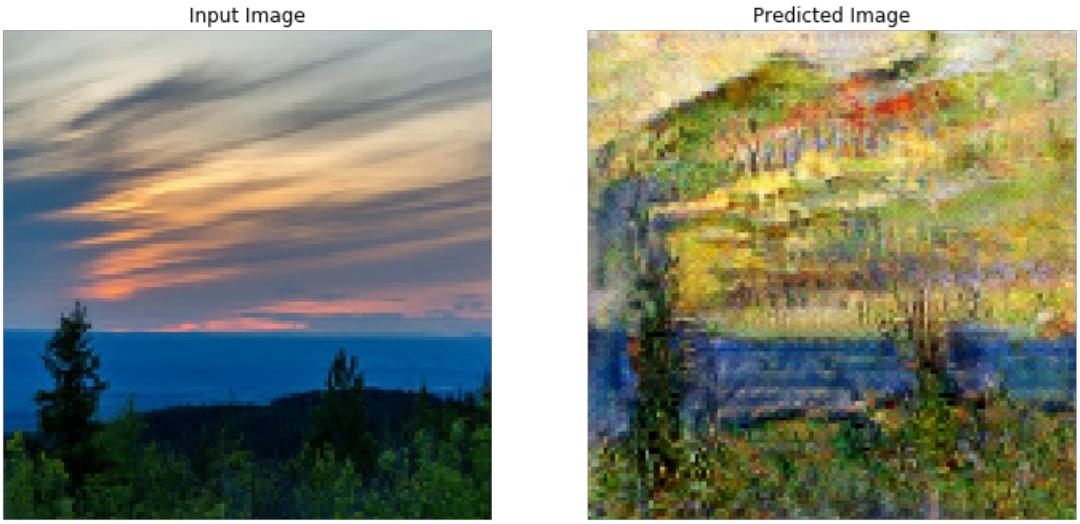
```
Reload the initial weights
optimizer defining...
```

In [29]:

```
deltalr = lr/100
log_dir="logs/"

G_Loss_M = tf.metrics.Mean()
F_Loss_M = tf.metrics.Mean()
Dx_Loss_M = tf.metrics.Mean()
Dy_Loss_M = tf.metrics.Mean()

summary_writer_epoch = tf.summary.create_file_writer(log_dir + "train_per_epoch/")
summary_writer_steps = tf.summary.create_file_writer(log_dir + "train_per_step/")

for epoch in range(200):
    tf.keras.backend.clear_session()

    l_G = []
    l_F = []
    l_Dy = []
    l_Dx = []

    # After 100 epoch learning rate set to linear decay
    if epoch >= 100:
        lr = lr - deltalr
        # Update learning rate in Optimizer for G and F model
        tf.keras.backend.set_value(G_optimizer.lr, lr)
        tf.keras.backend.set_value(F_optimizer.lr, lr)
        # Update learning rate in Optimizer for Dx and Dy model
        tf.keras.backend.set_value(Dx_optimizer.lr, lr)
        tf.keras.backend.set_value(Dy_optimizer.lr, lr)

    start = time.time()
    n = 0
    for image_x, image_y in zip(trainA, trainB):
        total_gen_g_loss,total_gen_f_loss,disc_x_loss,disc_y_loss = train_step(image_x, image_y)

        l_G.append(total_gen_g_loss)
        l_F.append(total_gen_f_loss)
        l_Dx.append(disc_x_loss)
        l_Dy.append(disc_y_loss)

        if n % 100 == 0:
            print('.', end='')
            with summary_writer_steps.as_default():
                tf.summary.scalar('Total_Gloss', total_gen_g_loss, step=epoch*Total_Img+n)
                tf.summary.scalar('Total_Floss', total_gen_f_loss, step=epoch*Total_Img+n)
                tf.summary.scalar('Dx_loss', disc_x_loss, step=epoch*Total_Img+n)
                tf.summary.scalar('Dy_loss', disc_y_loss, step=epoch*Total_Img+n)

        n+=1

    # Clear the output
    clear_output(wait=True)
    # generate image based on Generator G
    generate_images(G, sampleA)
    # generate image based on Generator F
    generate_images(F, sampleB)


    G_Loss_M.update_state(l_G)
    F_Loss_M.update_state(l_F)
    Dx_Loss_M.update_state(l_Dx)
    Dy_Loss_M.update_state(l_Dy)

    with summary_writer_epoch.as_default():
        tf.summary.scalar('Total_Gloss', G_Loss_M.result().numpy(), step=epoch)
        tf.summary.scalar('Total_Floss', F_Loss_M.result().numpy(), step=epoch)
        tf.summary.scalar('Dx_loss', Dx_Loss_M.result().numpy(), step=epoch)
```

```
        tf.summary.scalar('Dy_loss', Dy_Loss_M.result().numpy(), step=epoch)

    G_Loss_M.reset_states()
    F_Loss_M.reset_states()
    Dx_Loss_M.reset_states()
    Dy_Loss_M.reset_states()

    if (epoch+1) % 10 == 0:
        print('Saving weights')
        G.save_weights('./train/G_Weights_epoch'+str(epoch+1))
        F.save_weights('./train/F_Weights_epoch'+str(epoch+1))
        Dx.save_weights('./train/Dx_Weights_epoch'+str(epoch+1))
        Dy.save_weights('./train/Dy_Weights_epoch'+str(epoch+1))

    print ('Time taken for epoch {} is {} sec\n'.format(epoch+1, time.time()-start))
```






```
Saving weights
Time taken for epoch 200 is 1064.9246473312378 sec
```

In [30]:

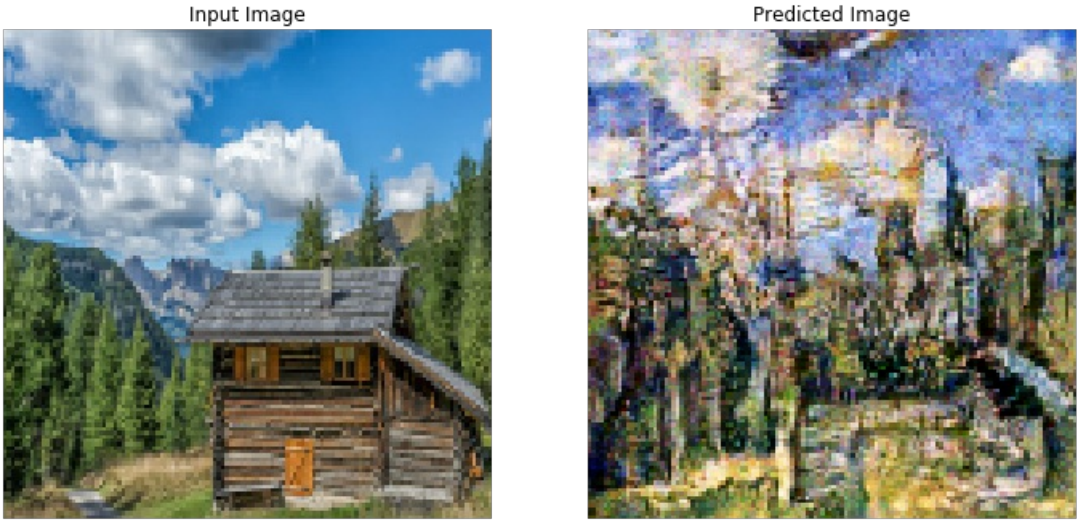
```
G.save('G_Model')
F.save('F_Model')
Dx.save('Dx_Model')
Dy.save('Dy_Model')
```

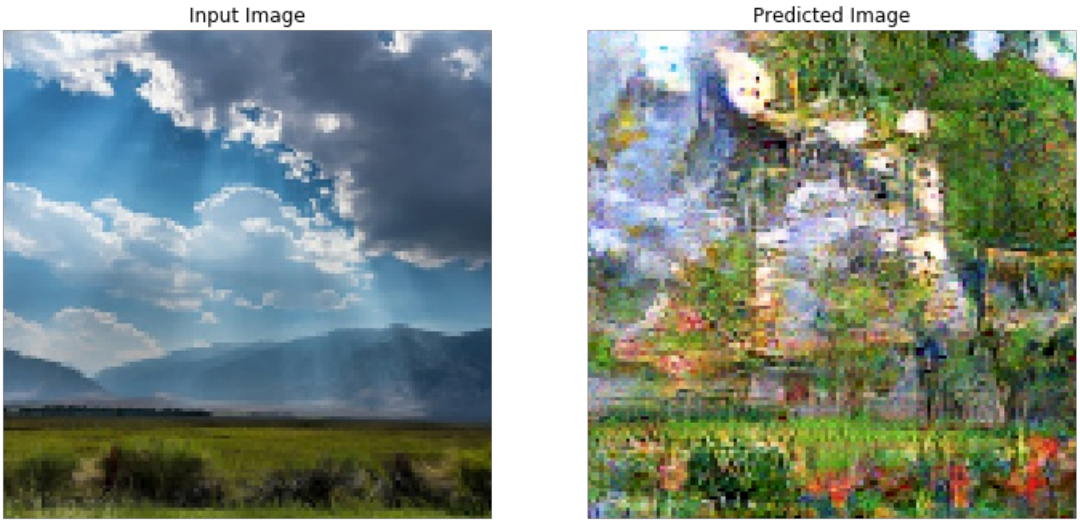
```
WARNING:tensorflow:From D:\anaconda3\lib\site-packages\tensorflow\python\ops\resource_variable_ops.py:1
817: calling BaseResourceVariable.__init__ (from tensorflow.python.ops.resource_variable_ops) with cons
traint is deprecated and will be removed in a future version.
Instructions for updating:
```

```
Instructions for updating:
If using Keras pass *_constraint arguments to layers.
INFO:tensorflow:Assets written to: G_Model\assets
INFO:tensorflow:Assets written to: F_Model\assets
INFO:tensorflow:Assets written to: Dx_Model\assets
INFO:tensorflow:Assets written to: Dy_Model\assets
```

In [36]:

```
for inp in trainB.take(5):
    generate_images(F, inp)
```





Observation: From the above observation

1. F model didn't interpret very well for cloud which shown as trees
2. F model didn't interpret for night images. See first images, it did observe road and trees well but not sunset. You will find sunset result like this.
3. Rest of the image shown pretty decent for art point of view except blurrness.

In [ ]: