In [ ]:
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Class - BE Artificial Intelligence and Data Science.
Roll No. - 37
Practical No. 10 - Create and Art with Neural style transfer on given image using deep learning.
```

In [1]:
```
# Import Required Libraries
```

In [2]:
```
import tensorflow as tf
import numpy as np
import matplotlib.pyplot as plt
from tensorflow.keras.preprocessing import image
from tensorflow.keras.applications import vgg19
```

In [3]:
```
# Load and Preprocess Image
```

In [4]:
```
def load_and_process_img(img_path, target_size=(128, 128)):
    img = image.load_img(img_path, target_size=target_size)
    img = image.img_to_array(img)
    img = np.expand_dims(img, axis=0)
    img = vgg19.preprocess_input(img)
    return img

def deprocess_img(img):
    img = img.squeeze()
    img = img + [103.939, 116.779, 123.68]  # Convert back to BGR
    img = np.clip(img, 0, 255).astype('uint8')
    return img
```

In [5]:
```
# Load the Content and Style Images
```

In [6]:
```
content_path = r"C:\Users\saira\Downloads\Content.jpg"
style_path = r"C:\Users\saira\Downloads\style.jpg"

content_img = load_and_process_img(content_path)
style_img = load_and_process_img(style_path)
```

In [7]:
```
# Load the VGG19 Model
```

In [8]:
```
model = vgg19.VGG19(weights='imagenet', include_top=False)

# Define the layers we will use for content and style
content_layer = 'block5_conv2'  # Content layer
style_layers = ['block1_conv1', 'block2_conv1', 'block3_conv1', 'block4_conv1', 'block5_conv1']
```

In [9]:
```
# Define a Function to Get Feature Representations
```

In [10]:
```
def get_feature_representations(model, content_img, style_img):
    content_output = model.get_layer(content_layer).output
    style_outputs = [model.get_layer(layer).output for layer in style_layers]

    model = tf.keras.models.Model(inputs=model.input, outputs=[content_output] + style_outputs)

    content_features = model(content_img)
    style_features = model(style_img)

    content_feature = content_features[0]
    style_features = style_features[1:]

    return content_feature, style_features
```

In [11]:
```
# Compute the Losses (Content, Style, and Total Variation Loss)
```

In [12]:
```
def compute_content_loss(content, generated):
    return tf.reduce_mean(tf.square(content - generated))

def compute_style_loss(style, generated):
    gram_style = gram_matrix(style)
    gram_generated = gram_matrix(generated)
    return tf.reduce_mean(tf.square(gram_style - gram_generated))

def gram_matrix(x):
    channels = int(x.shape[-1])
    a = tf.reshape(x, [-1, channels])
    gram = tf.matmul(a, a, transpose_a=True)
    return gram

def compute_total_variation_loss(generated):
    return tf.reduce_mean(tf.image.total_variation(generated))
```

In [13]:
```
# Compute the Gradients and Perform Optimization
```

In [14]:
```
def compute_loss(content_feature, style_features, generated_img):
    generated_content_feature, generated_style_features = get_feature_representations(model, generate
    content_loss = compute_content_loss(content_feature, generated_content_feature)
    style_loss = sum(compute_style_loss(style, generated) for style, generated in zip(style_features,
    total_variation_loss = compute_total_variation_loss(generated_img)

    total_loss = content_loss + 0.025 * style_loss + 1.0 * total_variation_loss
    return total_loss

def compute_gradients(content_feature, style_features, generated_img):
    with tf.GradientTape() as tape:
        tape.watch(generated_img)
        loss = compute_loss(content_feature, style_features, generated_img)
    grads = tape.gradient(loss, generated_img)
    return grads
```

In [15]:
```
# Initialize and Optimize the Generated Image
```

In [16]:
```
generated_img = tf.Variable(content_img, dtype=tf.float32)

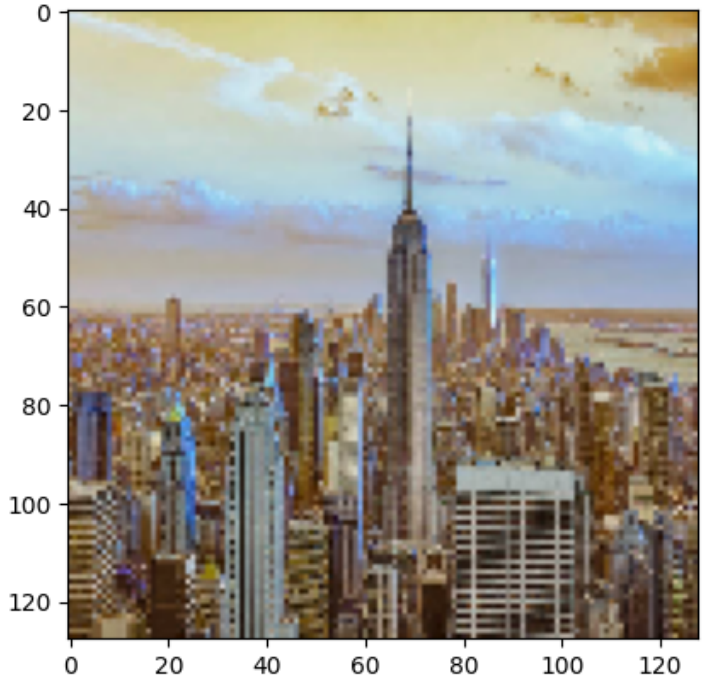
content_feature, style_features = get_feature_representations(model, content_img, style_img)

optimizer = tf.optimizers.Adam(learning_rate=0.01)
iterations = 200

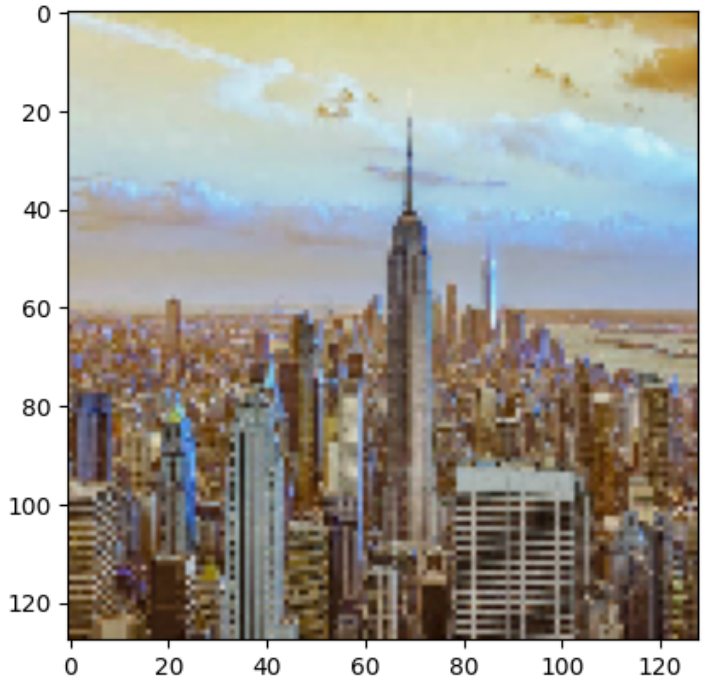
for i in range(iterations):
    grads = compute_gradients(content_feature, style_features, generated_img)
    optimizer.apply_gradients([(grads, generated_img)])

    if i % 100 == 0:
        print(f"Iteration {i}")
        img = deprocess_img(generated_img.numpy())
        plt.imshow(img)
        plt.show()
```

```
Iteration 0
```

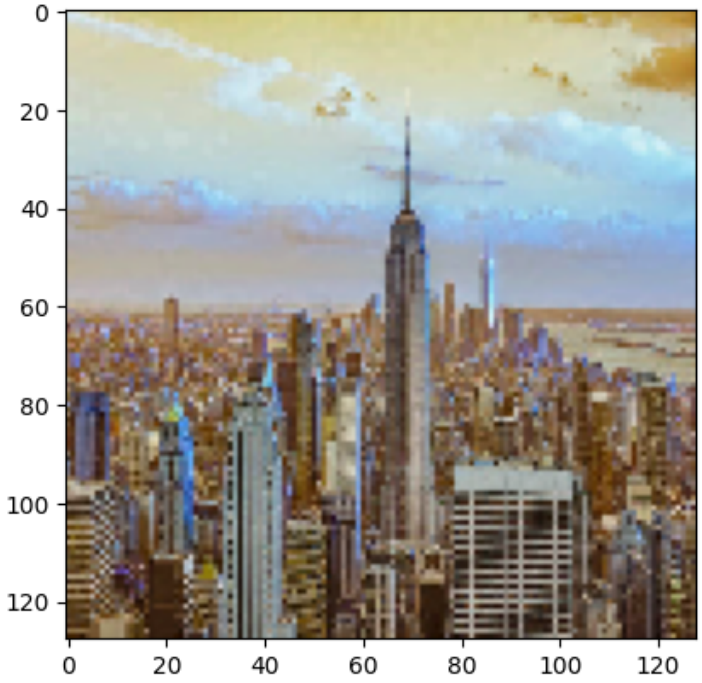



```
Iteration 100
```



In [17]:
```
# Display the Final Image
```

In [18]:
```
final_img = deprocess_img(generated_img.numpy())
plt.imshow(final_img)
plt.show()
```



In [ ]: