Project 1 – Introduction to Python scikit-image

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Date Created

9/4/2019

Python Version

3.7

Description

This program draws an E at the center of an input image.

Purpose

The purpose of this assignment is to introduce the basic functions of the Python scikit-image library -- a simple and popular open source library for image processing in Python. The scikitimage extends scipy.ndimage to provide a set of image processing routines including I/O, color and geometric transformations, segmentation, and other basic features.

File Path

In [1]:

```
# Move to the directory where the input images are located
%cd D:\Dropbox\[redacted]

# List the files in that directory
%ls
```

```
 Volume in drive D is DATA
 Volume Serial Number is CADB-0435

 Directory of D:\Dropbo[redacted]

09/04/2019  01:41 PM    <DIR>          .
09/04/2019  01:41 PM    <DIR>          ..
09/04/2019  10:21 AM           100,655 architecture_roof_buildings_baked.jpg
09/04/2019  07:32 AM             5,483 e_critical_points.PNG
09/04/2019  08:34 AM            11,187 e_critical_points_scratch_paper.xlsx
09/04/2019  11:10 AM            31,549 statue.JPG
09/04/2019  09:19 AM            39,741 test_image.jpg
               5 File(s)        188,615 bytes
               2 Dir(s)  883,542,827,008 bytes free
```

Code

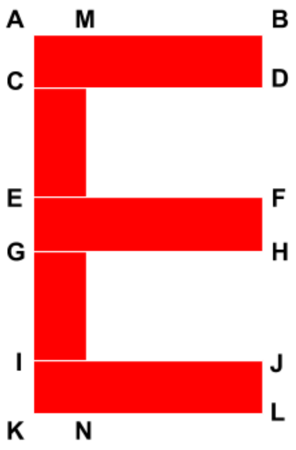
In [2]:

```
# Import scikit-image
import skimage

# Import module to read and write images in various formats
from skimage import io

# Import matplotlib functionality
import matplotlib.pyplot as plt

# Import numpy
import numpy as np
import numpy as np

# Set the color of the E
# [red, green, blue]
COLOR_OF_E = [255, 0, 0]
```

In [3]:

```
# Show the critical points of E
from IPython.display import Image
Image(filename = "e_critical_points.PNG", width = 200, height = 200)
```

Out[3]:



In [4]:

```
def e_generator(y_dim, x_dim):
    """
    Generates the coordinates of the E
    :param y_dim int: The y dimensions of the input image
    :param x_dim int: The x dimensions of the input image
    :return: The critical coordinates
    :rtype: list
    """
    # Set all the critical points
    A =  [int(0.407 * y_dim), int(0.423 *  x_dim)]
    B =  [int(0.407 * y_dim), int(0.589 *  x_dim)]
    C =  [int(0.488 * y_dim), int(0.423 *  x_dim)]
    D =  [int(0.488 * y_dim), int(0.589 *  x_dim)]
    E =  [int(0.572 * y_dim), int(0.423 *  x_dim)]
    F =  [int(0.572 * y_dim), int(0.581 *  x_dim)]
    G =  [int(0.657 * y_dim), int(0.423 *  x_dim)]
    H =  [int(0.657 * y_dim), int(0.581 *  x_dim)]
    I =  [int(0.735 * y_dim), int(0.423 *  x_dim)]
    J =  [int(0.735 * y_dim), int(0.589 *  x_dim)]
    K =  [int(0.819 * y_dim), int(0.423 *  x_dim)]
    L =  [int(0.819 * y_dim), int(0.589 *  x_dim)]
    M =  [int(0.407 * y_dim), int(0.47 *  x_dim)]
    N =  [int(0.819 * y_dim), int(0.47 *  x_dim)]

    return A,B,C,D,E,F,G,H,I,J,K,L,M,N
```

In [5]:

```
def plot_image_with_e(image, A, B, C, D, E, F, G, H, I, J, K, L, M, N):
    """
    Plots an E on an input image
    :param image: The input image
    :param A, B, etc. list: The coordinates of the critical points
    :return: image_with_e
    :rtype: image
    """
    # Copy the image
    image_with_e = np.copy(image)
    # Top horizontal rectangle
    image_with_e[A[0]:C[0], A[1]:B[1], :] = COLOR_OF_E

    # Middle horizontal rectangle
    image_with_e[E[0]:G[0], E[1]:F[1], :] = COLOR_OF_E

    # Bottom horizontal rectangle
    image_with_e[I[0]:K[0], I[1]:J[1], :] = COLOR_OF_E

    # Vertical connector rectangle
    image_with_e[A[0]:K[0], A[1]:M[1], :] = COLOR_OF_E

    # Display image
    plt.imshow(image_with_e);

    return image_with_e
```

In [6]:

```
def print_image_details(image):
    """
    Prints the details of an input image
    :param image: The input image
    """
    print("Size: ", image.size)
    print("Shape: ", image.shape)
    print("Type: ", image.dtype)
    print("Max: ", image.max())
    print("Min: ", image.min())
```

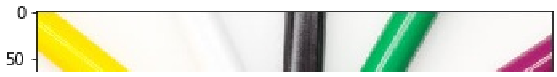
In [7]:

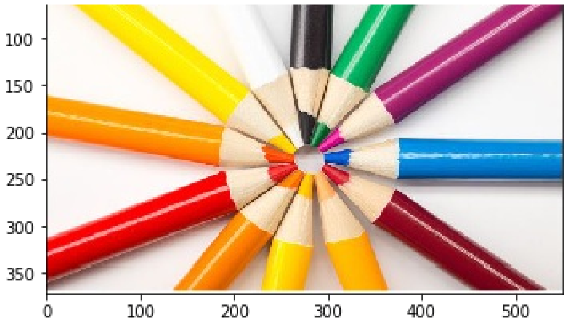
```
def compare(original_image, annotated_image):
    """
    Compare two images side-by-side
    :param original_image: The original input image
    :param annotated_image: The annotated-version of the original input image
    """
    # Compare the two images side-by-side
    f, (ax0, ax1) = plt.subplots(1, 2, figsize=(20,10))

    ax0.imshow(original_image)
    ax0.set_title('Original', fontsize = 18)
    ax0.axis('off')

    ax1.imshow(annotated_image)
    ax1.set_title('Annotated', fontsize = 18)
    ax1.axis('off')
```

In [8]:

```
# Load the test image
image = io.imread("test_image.jpg")

# Store the y and x dimensions of the input image
y_dimensions = image.shape[0]
x_dimensions = image.shape[1]

# Print the image details
print_image_details(image)

# Display the image
plt.imshow(image);
```

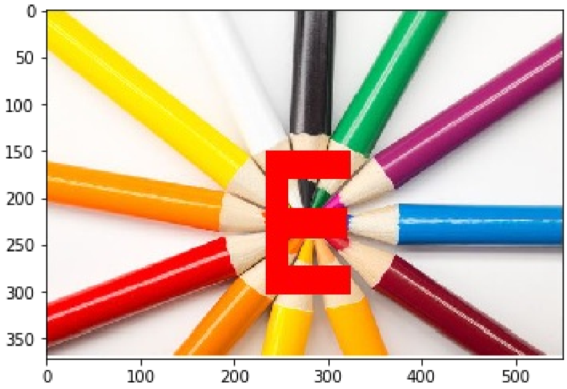
```
Size:  614916
Shape:  (372, 551, 3)
Type:  uint8
Max:  255
Min:  0
```





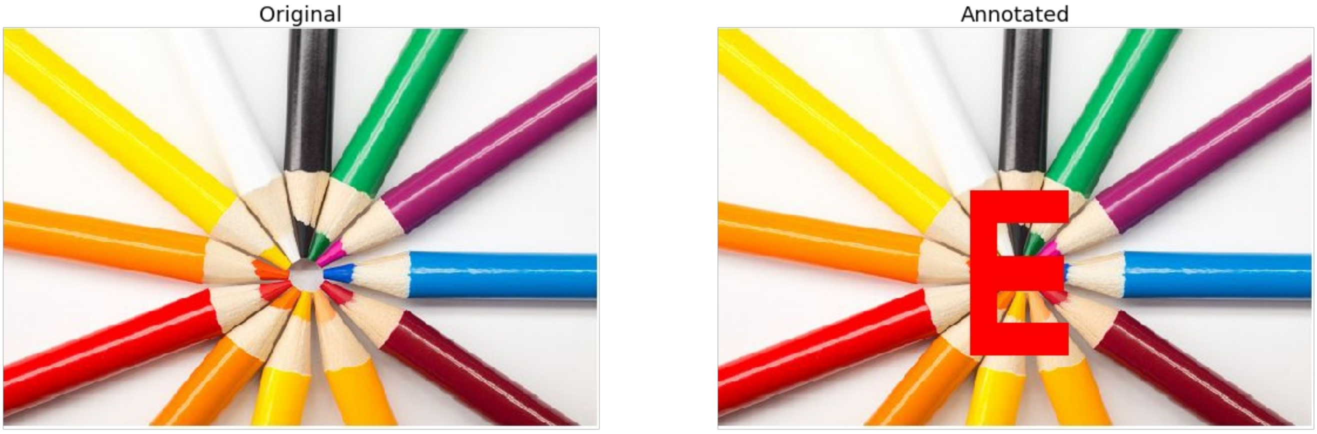
In [9]:

```
# Set all the critical points of the image
A,B,C,D,E,F,G,H,I,J,K,L,M,N = e_generator(y_dimensions, x_dimensions)

# Plot the image with E and store it
image_with_e = plot_image_with_e(image, A, B, C, D, E, F, G, H, I, J, K, L, M, N)

# Save the output image
plt.imsave('test_image_annotated.jpg', image_with_e)
```



In [10]:

```
compare(image, image_with_e)
```


Original

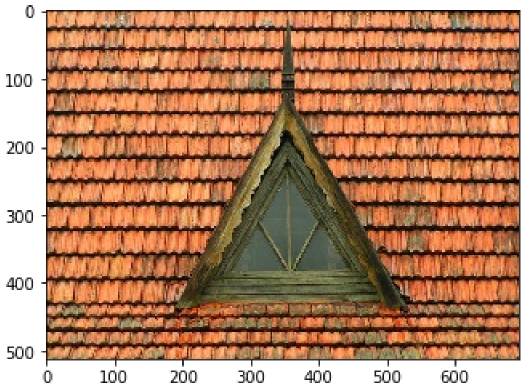
Annotated

In [11]:

```
# Load the first image
image = io.imread("architecture_roof_buildings_baked.jpg")

# Store the y and x dimensions of the input image
y_dimensions = image.shape[0]
x_dimensions = image.shape[1]

# Print the image details
print_image_details(image)
```

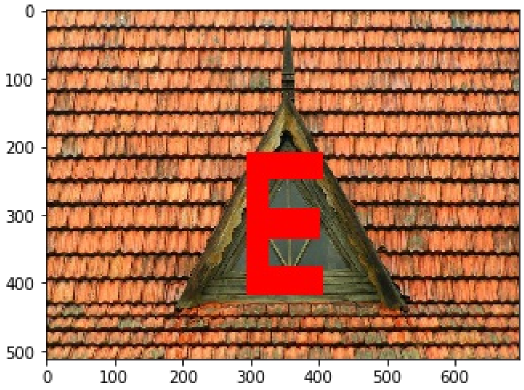
```
# Display the image
plt.imshow(image);
```

```
Size:  1065984
Shape:  (512, 694, 3)
Type:  uint8
Max:  255
Min:  0
```



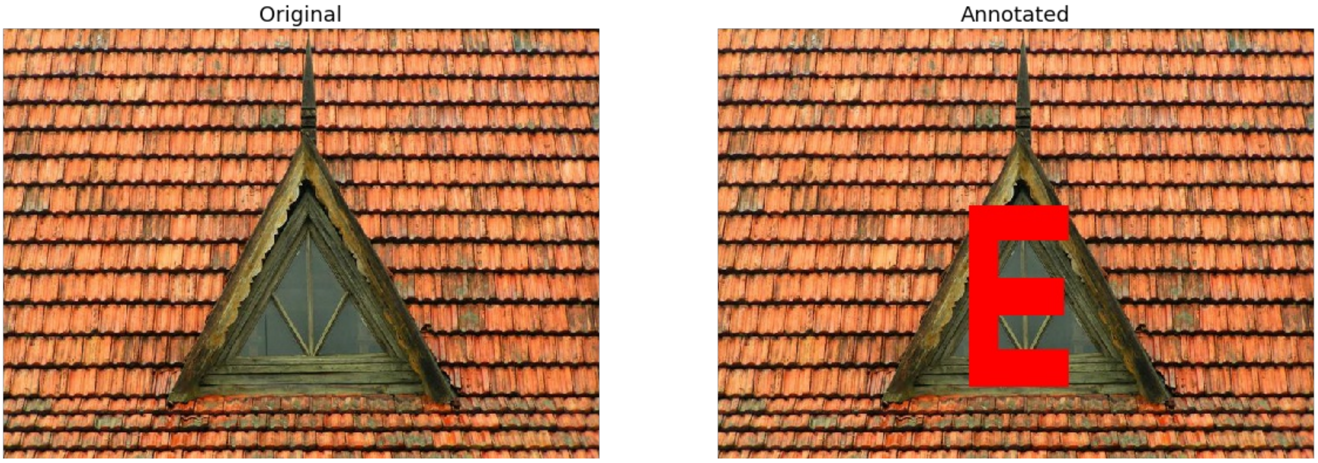
In [12]:

```
# Set all the critical points of the image
A,B,C,D,E,F,G,H,I,J,K,L,M,N = e_generator(y_dimensions, x_dimensions)

# Plot the image with E and store it
image_with_e = plot_image_with_e(image, A, B, C, D, E, F, G, H, I, J, K, L, M, N)

# Save the output image
plt.imsave('architecture_roof_buildings_baked_annotated.jpg', image_with_e)
```



In [13]:

```
compare(image, image_with_e)
```



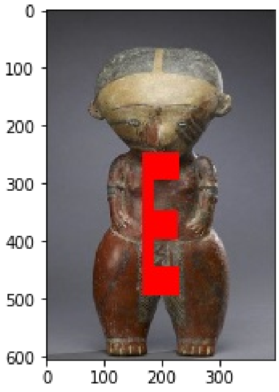
In [14]:

```
# Load the second image
image = io.imread("statue.jpg")

# Store the y and x dimensions of the input image
y_dimensions = image.shape[0]
x_dimensions = image.shape[1]

# Print the image details
print_image_details(image)

# Display the image
plt.imshow(image);
```

```
Size:  716925
Shape:  (605, 395, 3)
Type:  uint8
Max:  247
Min:  0
```

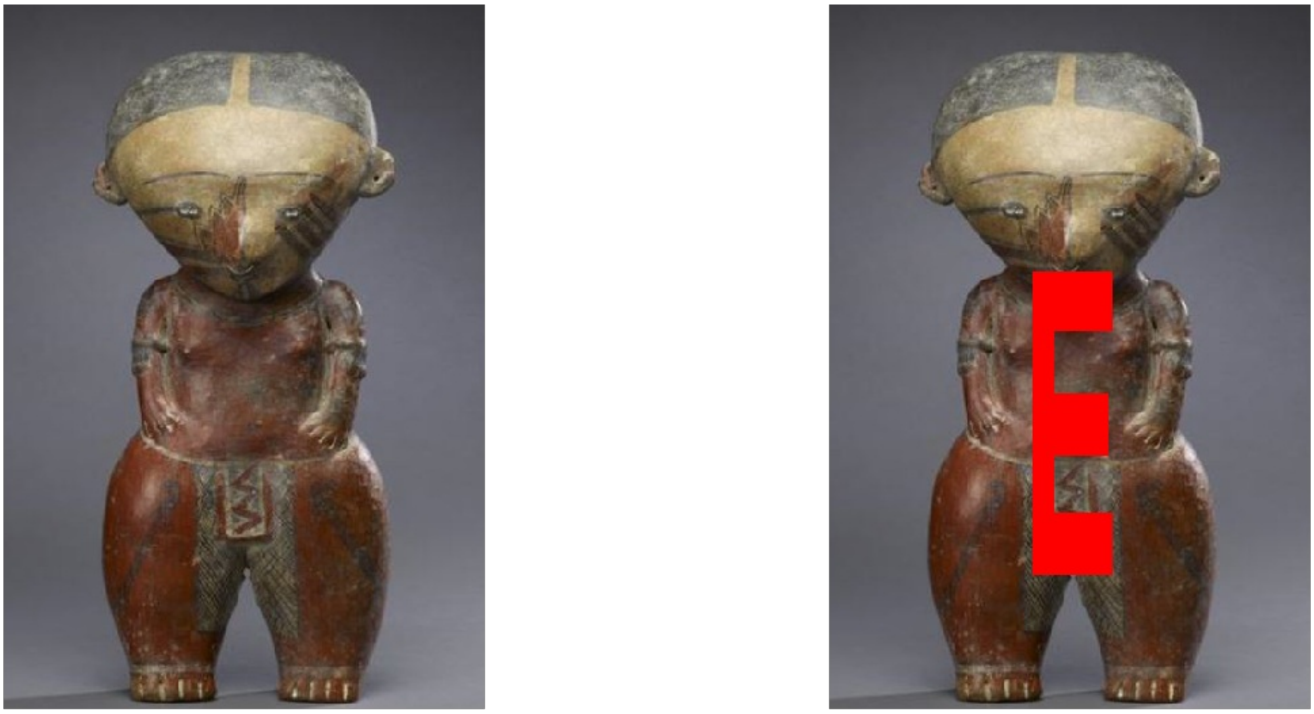
In [15]:

```
# Set all the critical points of the image
A,B,C,D,E,F,G,H,I,J,K,L,M,N = e_generator(y_dimensions, x_dimensions)

# Plot the image with E and store it
image_with_e = plot_image_with_e(image, A, B, C, D, E, F, G, H, I, J, K, L, M, N)

# Save the output image
plt.imsave('statue_annotated.jpg', image_with_e)
```



In [16]:

```
compare(image, image_with_e)
```



In [ ]: