

EE 440 HW1 Report

1. a. Self-portrait before enlargement (original):



Fig. 1. Self-portrait Original

I chose Adobe Photoshop as the image editing tool. To obtain the enlarged image, I followed these steps: 1) open “Image size” under “Image,” and found the image size to be 300 pixel * 300 pixel; 2) I calculated the desired size of the image after enlargement by multiplying each dimension by a factor of 2.5, which lead us to the new size of 750 pixel * 750 pixel; 3) Manually entered the new width and height for “Image size” and save the new image. Below in Fig.2. is the new image.

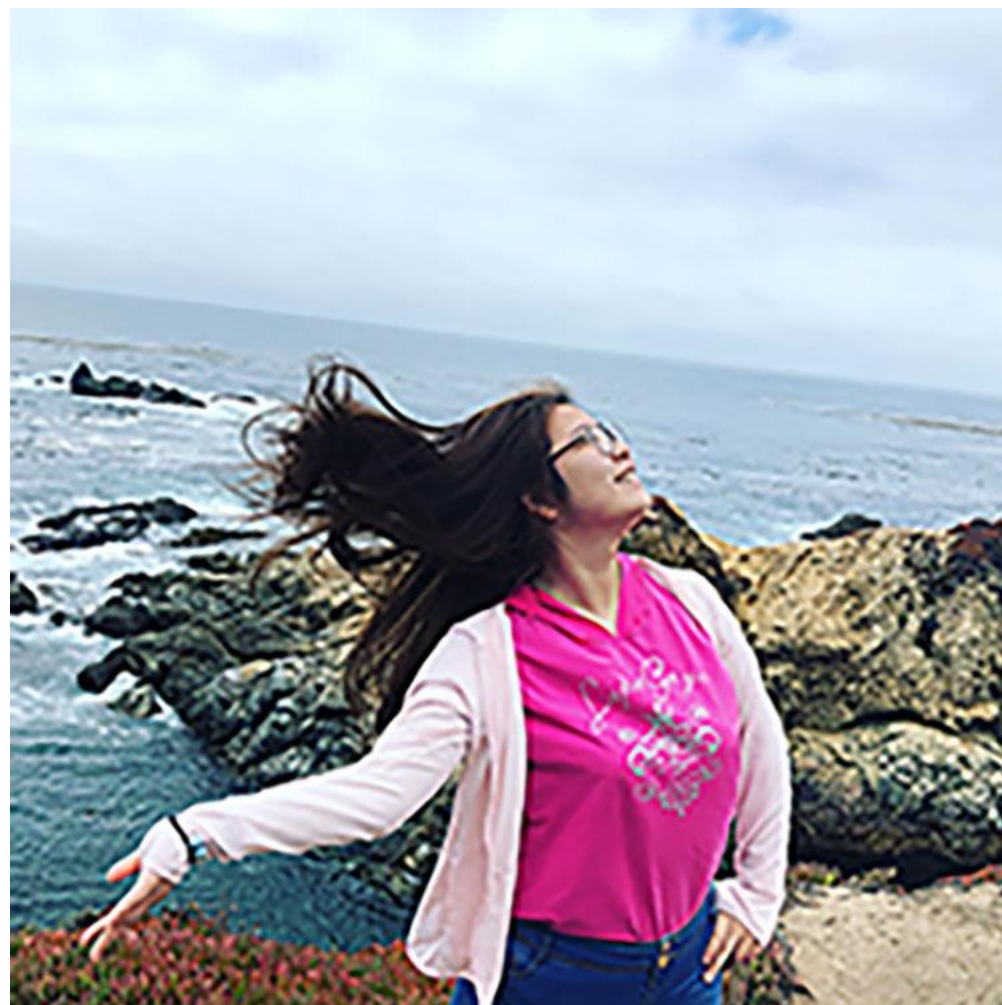


Fig.2. Self-Portrait after enlargement

- b. Since the original image is a bit dark and dim, I changed the “Exposure” to +2.35, “Brightness” to +8, “Contrast” to -10, and “Saturation” (It might be “Natural Saturation,” I am not quite sure since my Photoshop is set to Chinese) to +2. The image is now much normal, but I think it seems a bit more prone to magenta to me, so I changed “Laves” (under “Color Balance”) to 0, +2, 0. So now it looks like the coaches arguing under the sun on a game field. Here, below in Fig.3. is what I’ve obtained.



Fig. 3. Adjusted 1_1.jpg

2. I used matlab's figure(), add_subplot(), and imshow() to display the three images desired in this problem. See APPENDIX. I.

In a. I got the original image.

In b. The data type as uint8, the maximum value to be 255, and the minimum value to be 0. As shown in Fig.4.

In c. I get a blank image, so imshow cannot show double type lena directly.

In d. I showed lena by casting the double type back to uint8 type. As shown below in Fig.4. in the screenshot

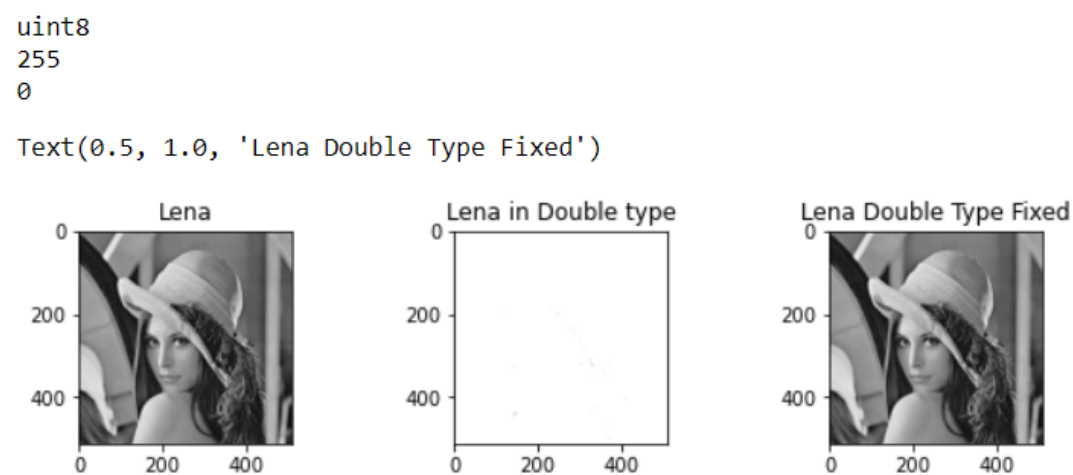


Fig. 4. Problem 2 Output

3. d) Yes, I observed difference between Z0 and Z1. First major difference is that Z1 is more blurry than Z0. The second difference is that when rotating once (to Z0), we kept most sharp edges of the picture, but when we rotate more times (to Z1), we have a rounder edge of the picture, making it rounder.

e) Below in Fig. 5 is the image of Y, Z0, and Z1.

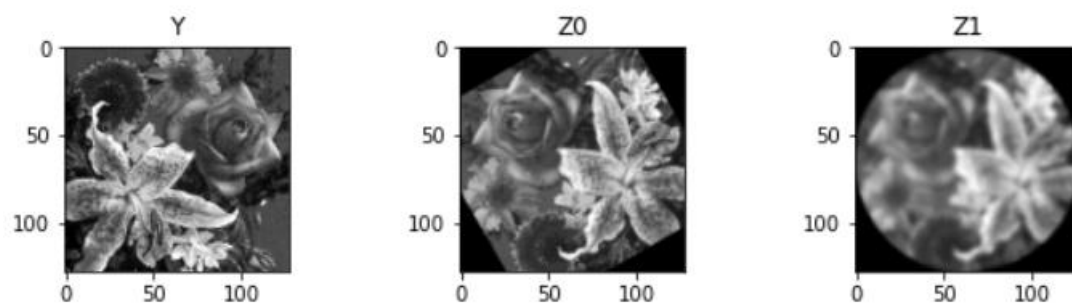


Fig. 5. Problem 3 Output

APPENDIX:

I (Problem 2):

```
In [49]: # This is the import cell
import numpy as np
import cv2
import matplotlib.pyplot as plt
```

```
In [50]: # Problem 2

## figure to display multiple pictures
fig = plt.figure(figsize=(10, 7))

# a. read and show the image lena
fig.add_subplot(3, 3, 1)
lena = plt.imread('1_2.bmp')
plt.imshow(lena)
plt.title("Lena")

# b. show type/max/min of image lena
datatype = lena.dtype
max_value = np.amax(lena)
min_value = np.amin(lena)
print(datatype)
print(max_value)
print(min_value)
```

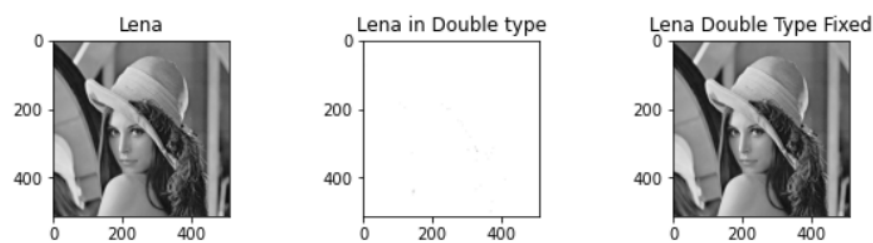
```
# c. attempt to show lena in double type
lena_double = lena.astype('double')
fig.add_subplot(3, 3, 2)
plt.imshow(lena_double)
plt.title("Lena in Double type")

# d. show "double" type lena
fig.add_subplot(3, 3, 3)
plt.imshow(lena_double.astype('uint8')) # cast value back to uint8
plt.title("Lena Double Type Fixed")
```

Clipping input data to the valid range for imshow with RGB data ([0..1] for floats or [0..255] for integers).

```
uint8
255
0
```

Out[50]: Text(0.5, 1.0, 'Lena Double Type Fixed')



II (Problem 3):

```
In [51]: # Problem 3

## figure to display multiple images
fig2 = plt.figure(figsize=(10, 7))

# a. display grayscale "1_3.tif"
fig2.add_subplot(3, 3, 1)
X = plt.imread('1_3.tif')
Y = cv2.cvtColor(X, cv2.COLOR_BGR2GRAY)
plt.imshow(Y, cmap='gray')
plt.title("Y")

## define function for image rotation
def imRotate (X, degrees):
    """
    Args:
        X: numpy array of shape [height, width, channels]
        degrees: rotation angle, positive means counter clockwise rotation
    Output: rotate image
    """
    height, width = X.shape
    M = cv2.getRotationMatrix2D((height/2.0, width/2.0), degrees, 1)
    return cv2.warpAffine(X, M, (height, width))
```

```

# b. show grayscale 1_3.tif with 120 degree clockwise rotation
fig2.add_subplot(3, 3, 2)
Z0 = imRotate(Y, 120)
plt.imshow(Z0, cmap='gray')
plt.title("Z0")

# c. show grayscale 1_3.tif with 12 times of 10 degree clockwise rotation
fig2.add_subplot(3, 3, 3)
Z1 = Y
for i in range(12):
    temp = Z1
    Z1 = imRotate(temp, 10)
plt.imshow(Z1, cmap='gray')
plt.title("Z1")

```

Out[51]: Text(0.5, 1.0, 'Z1')

