MACHINE VISION

LAB 1

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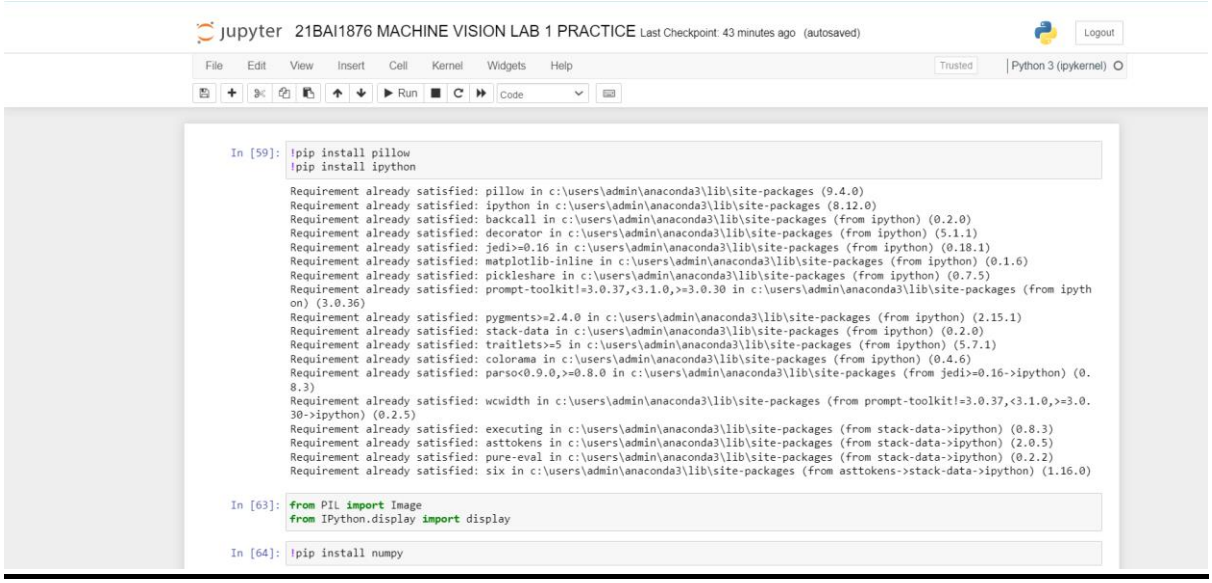
REGISTER NUMBER: 21BAI1876

1. READ A BLACK AND WHITE IMAGE AND DISPLAY THE BLACK AND WHITE PIXELS OF THE IMAGE READ RESPECTIVELY. ALSO DISPLAY THE IMAGE IN BLACK AND WHITE CHANNELS SEPERATELY.



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Trusted | Python 3 (ipykernel)

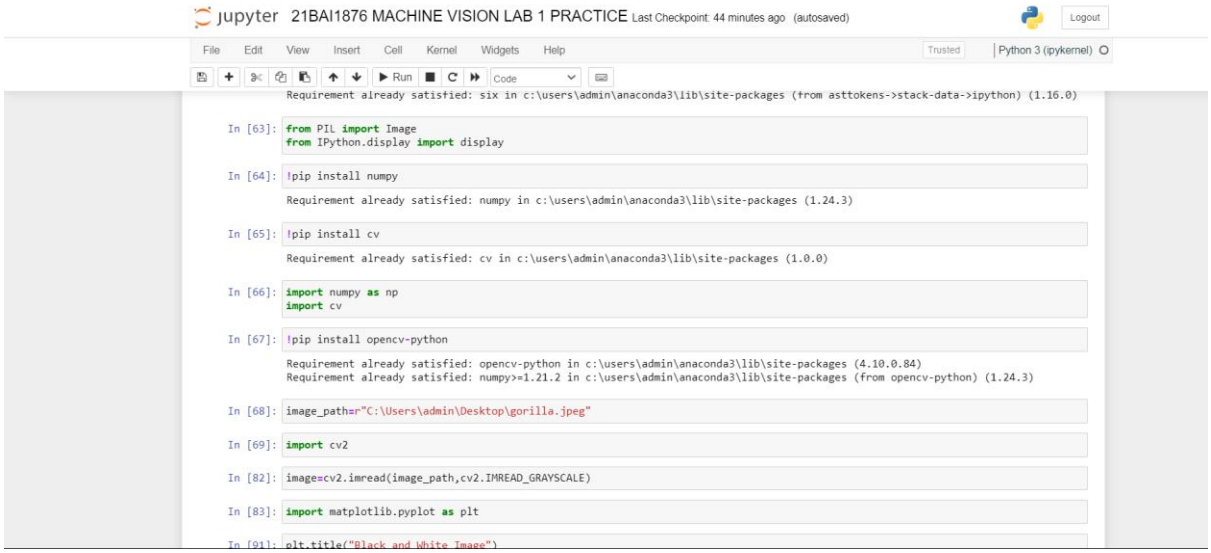
Run Code

```
In [59]: !pip install pillow
         !pip install ipython

Requirement already satisfied: pillow in c:\users\admin\anaconda3\lib\site-packages (9.4.0)
Requirement already satisfied: ipython in c:\users\admin\anaconda3\lib\site-packages (8.12.0)
Requirement already satisfied: backcall in c:\users\admin\anaconda3\lib\site-packages (from ipython) (0.2.0)
Requirement already satisfied: decorator in c:\users\admin\anaconda3\lib\site-packages (from ipython) (5.1.1)
Requirement already satisfied: jedi>=0.16 in c:\users\admin\anaconda3\lib\site-packages (from ipython) (0.18.1)
Requirement already satisfied: matplotlib-inline in c:\users\admin\anaconda3\lib\site-packages (from ipython) (0.1.6)
Requirement already satisfied: pickleshare in c:\users\admin\anaconda3\lib\site-packages (from ipython) (0.7.5)
Requirement already satisfied: prompt-toolkit!=3.0.37,<3.1.0,>=3.0.30 in c:\users\admin\anaconda3\lib\site-packages (from ipyth
on) (3.0.36)
Requirement already satisfied: pygments>=2.4.0 in c:\users\admin\anaconda3\lib\site-packages (from ipython) (2.15.1)
Requirement already satisfied: stack-data in c:\users\admin\anaconda3\lib\site-packages (from ipython) (0.2.0)
Requirement already satisfied: traitlets>=5 in c:\users\admin\anaconda3\lib\site-packages (from ipython) (5.7.1)
Requirement already satisfied: colorama in c:\users\admin\anaconda3\lib\site-packages (from ipython) (0.4.6)
Requirement already satisfied: parso<0.9.0,>=0.8.0 in c:\users\admin\anaconda3\lib\site-packages (from jedi>=0.16->ipython) (0.
8.3)
Requirement already satisfied: wcwidth in c:\users\admin\anaconda3\lib\site-packages (from prompt-toolkit!=3.0.37,<3.1.0,>=3.0.
30->ipython) (0.2.5)
Requirement already satisfied: executing in c:\users\admin\anaconda3\lib\site-packages (from stack-data->ipython) (0.8.3)
Requirement already satisfied: asttokens in c:\users\admin\anaconda3\lib\site-packages (from stack-data->ipython) (2.0.5)
Requirement already satisfied: pure-eval in c:\users\admin\anaconda3\lib\site-packages (from stack-data->ipython) (0.2.2)
Requirement already satisfied: six in c:\users\admin\anaconda3\lib\site-packages (from asttokens->stack-data->ipython) (1.16.0)

In [63]: from PIL import Image
         from IPython.display import display

In [64]: !pip install numpy
```



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Run Code

```
Requirement already satisfied: six in c:\users\admin\anaconda3\lib\site-packages (from asttokens->stack-data->ipython) (1.16.0)

In [63]: from PIL import Image
         from IPython.display import display

In [64]: !pip install numpy

Requirement already satisfied: numpy in c:\users\admin\anaconda3\lib\site-packages (1.24.3)

In [65]: !pip install cv

Requirement already satisfied: cv in c:\users\admin\anaconda3\lib\site-packages (1.0.0)

In [66]: import numpy as np
         import cv

In [67]: !pip install opencv-python

Requirement already satisfied: opencv-python in c:\users\admin\anaconda3\lib\site-packages (4.10.0.84)
Requirement already satisfied: numpy>=1.21.2 in c:\users\admin\anaconda3\lib\site-packages (from opencv-python) (1.24.3)

In [68]: image_path=r"C:\Users\admin\Desktop\gorilla.jpeg"

In [69]: import cv2

In [82]: image=cv2.imread(image_path,cv2.IMREAD_GRAYSCALE)

In [83]: import matplotlib.pyplot as plt

In [91]: plt.title("Black and White Image")
```

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Run Code

In [83]:
```
import matplotlib.pyplot as plt
```

In [91]:
```
plt.title("Black and White Image")
plt.axis('off')
plt.show()
```

In [85]:
```
black_pixels=np.argwhere(image==0)
white_pixels=np.argwhere(image==255)
```

In [86]:
```
print(f"Black pixels (total {black_pixels.shape[0]})")
print(black_pixels)
```

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Run Code

In [85]:
```
black_pixels=np.argwhere(image==0)
white_pixels=np.argwhere(image==255)
```

In [86]:
```
print(f"Black pixels (total {black_pixels.shape[0]})")
print(black_pixels)
```

```
Black pixels (total 559)
[[  6  24]
 [ 20   6]
 [ 26  42]
 ...
 [220 219]
 [221  34]
 [223 206]]
```

In [87]:
```
print(f"\n white pixels (total {white_pixels.shape[0]})")
print(white_pixels)
```

```
 [ 94 202]
 [ 95 173]
 [ 95 202]
 [ 96 174]
 [ 96 201]
 [ 97 174]
 [ 97 201]
 [ 98 175]
 [ 98 202]
 [ 99 175]
 [ 99 202]
```

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Trusted | Python 3 (ipykernel)

Run Code

```
[102 202]
[103 173]
[103 202]
```

In [77]:
```
ig=Image.open('gorilla.jpeg')
```

In [78]:
```
ig
```

Out[78]:

In [92]:
```
# Threshold the image to separate black and white pixels
_, black_channel = cv2.threshold(image, 127, 255, cv2.THRESH_BINARY_INV)
_, white_channel = cv2.threshold(image, 127, 255, cv2.THRESH_BINARY)

# Display the original image
plt.subplot(1, 3, 1)
plt.imshow(image, cmap='gray')
plt.title('Original Image')
plt.axis('off')
```

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Trusted | Python 3 (ipykernel)

Run Code

In [92]:
```
# Threshold the image to separate black and white pixels
_, black_channel = cv2.threshold(image, 127, 255, cv2.THRESH_BINARY_INV)
_, white_channel = cv2.threshold(image, 127, 255, cv2.THRESH_BINARY)

# Display the original image
plt.subplot(1, 3, 1)
plt.imshow(image, cmap='gray')
plt.title('Original Image')
plt.axis('off')

# Display the black channel
plt.subplot(1, 3, 2)
plt.imshow(black_channel, cmap='gray')
plt.title('Black Channel')
plt.axis('off')

# Display the white channel
plt.subplot(1, 3, 3)
plt.imshow(white_channel, cmap='gray')
plt.title('White Channel')
plt.axis('off')

plt.show()
```

2. READ A COLOUR IMAGE AND SEPARATE THE RED,BLUE AND GREEN CHANNELS.

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Trusted | Python 3 (ipykernel)

Run Code

In [95]:
```
"""2.READ A COLOUR IMAGE AND SEPARATE THE RED,BLUE AND GREEN CHANNELS."""
```

Out[95]:
```
'2.READ A COLOUR IMAGE AND SEPARATE THE RED,BLUE AND GREEN CHANNELS.'
```

In [96]:
```
image_path2=r"C:\Users\admin\Desktop\colourimage.jpeg"
```

In [97]:
```
img2=cv2.imread(image_path2)
```

In [102]:
```
# Convert the image from BGR to RGB format
image_rgb = cv2.cvtColor(img2, cv2.COLOR_BGR2RGB)

# Segregate the channels
red_channel = image_rgb.copy()
red_channel[:, :, 1] = 0  # Set green channel to 0
red_channel[:, :, 2] = 0  # Set blue channel to 0

green_channel = image_rgb.copy()
green_channel[:, :, 0] = 0  # Set red channel to 0
green_channel[:, :, 2] = 0  # Set blue channel to 0

blue_channel = image_rgb.copy()
blue_channel[:, :, 0] = 0  # Set red channel to 0
blue_channel[:, :, 1] = 0  # Set green channel to 0
```

In [103]:
```
# Display the images
plt.figure(figsize=(10, 7))

plt.subplot(2, 2, 1)
plt.imshow(image_rgb)
plt.title('Original Image')
plt.axis('off')
```

Out[103]:
```
(-0.5, 274.5, 182.5, -0.5)
```

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Trusted | Python 3 (ipykernel)

Run Code

In [103]:
```
# Display the images
plt.figure(figsize=(10, 7))

plt.subplot(2, 2, 1)
plt.imshow(image_rgb)
plt.title('Original Image')
plt.axis('off')
```

Out[103]:
```
(-0.5, 274.5, 182.5, -0.5)
```

Original Image

In [104]:
```
plt.subplot(2, 2, 2)
plt.imshow(red_channel)
plt.title('Red Channel')
plt.axis('off')
```

Out[104]:
```
(-0.5, 274.5, 182.5, -0.5)
```

Red Channel

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Trusted | Python 3 (ipykernel)

Run Code

In [104]:
```
plt.subplot(2, 2, 2)
plt.imshow(red_channel)
plt.title('Red Channel')
plt.axis('off')
```

Out[104]: (-0.5, 274.5, 182.5, -0.5)

Red Channel

In [105]:
```
plt.subplot(2, 2, 3)
plt.imshow(green_channel)
plt.title('Green Channel')
plt.axis('off')
```

Out[105]: (-0.5, 274.5, 182.5, -0.5)

Green Channel

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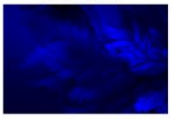
Trusted | Python 3 (ipykernel)

Run Code

In [106]:
```
plt.subplot(2, 2, 4)
plt.imshow(blue_channel)
plt.title('Blue Channel')
plt.axis('off')
```

Out[106]: (-0.5, 274.5, 182.5, -0.5)

Blue Channel



In [107]:
```
plt.tight_layout()
plt.show()
```

<Figure size 640x480 with 0 Axes>

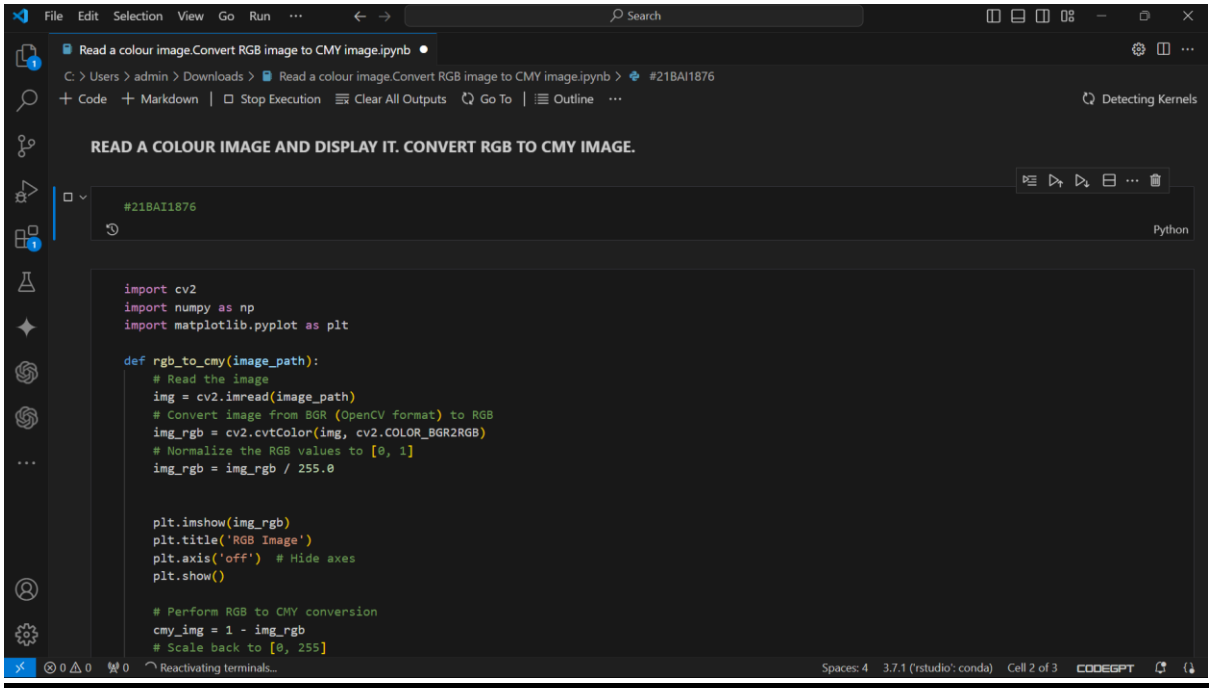
3. CONVERT A RGB IMAGE TO CMY IMAGE WHICH WILL BE THE NEGATIVE OF THE ORIGINAL IMAGE

CODE:

```
import cv2
import numpy as np
import matplotlib.pyplot as plt

def rgb_to_cmy(image_path):
    # Read the image
    img = cv2.imread(image_path)
    # Convert image from BGR (OpenCV format) to RGB
    img_rgb = cv2.cvtColor(img, cv2.COLOR_BGR2RGB)
    # Normalize the RGB values to [0, 1]
    img_rgb = img_rgb / 255.0



    plt.imshow(img_rgb)
    plt.title('RGB Image')
    plt.axis('off')  # Hide axes
    plt.show()

    # Perform RGB to CMY conversion
    cmy_img = 1 - img_rgb
    # Scale back to [0, 255]
    cmy_img = (cmy_img * 255).astype(np.uint8)
    return cmy_img
```

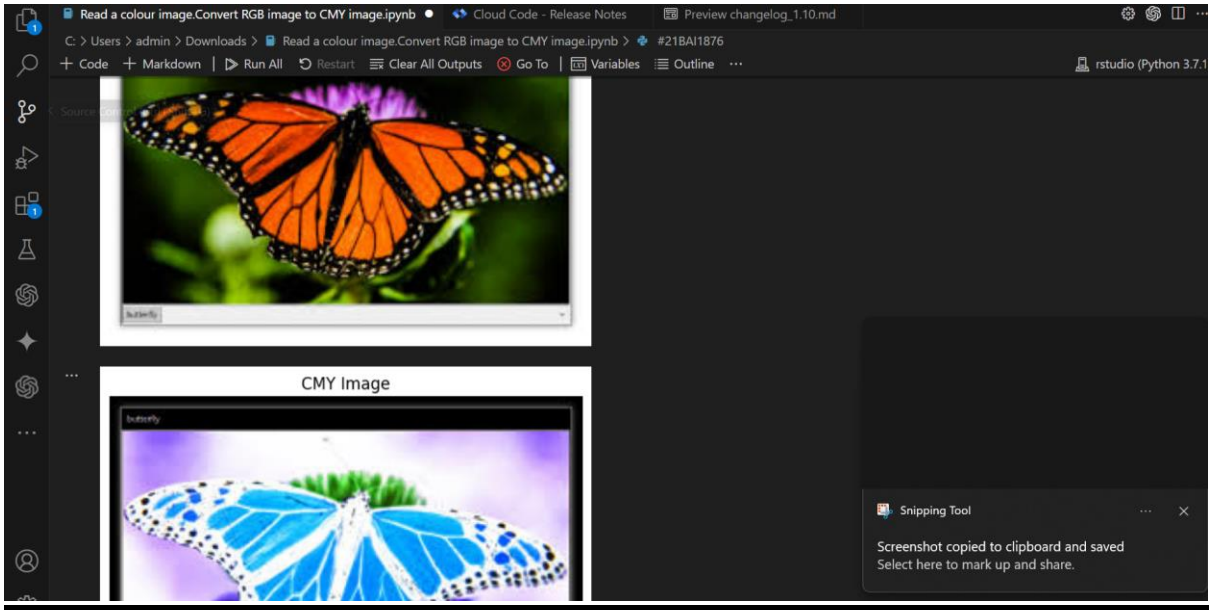
```
# Example usage
image_path = '/content/moth.jpeg'
cmy_image = rgb_to_cmy(image_path)

# Display the CMY image using Matplotlib
plt.imshow(cmy_image)
plt.title('CMY Image')
plt.axis('off')  # Hide axes
plt.show()

# Save the CMY image
cv2.imwrite('/content/moth_cmy.jpg', cv2.cvtColor(cmy_image,
cv2.COLOR_RGB2BGR))
```

OUTPUT:



```python
    # Normalize the RGB values to [0, 1]
    img_rgb = img_rgb / 255.0


    plt.imshow(img_rgb)
    plt.title('RGB Image')
    plt.axis('off')  # Hide axes
    plt.show()

    # Perform RGB to CMY conversion
    cmy_img = 1 - img_rgb
    # Scale back to [0, 255]
    cmy_img = (cmy_img * 255).astype(np.uint8)
    return cmy_img

# Example usage
image_path = '/content/moth.jpeg'
cmy_image = rgb_to_cmy(image_path)

# Display the CMY image using Matplotlib
plt.imshow(cmy_image)
plt.title('CMY Image')
plt.axis('off')  # Hide axes
plt.show()

# Save the CMY image
cv2.imwrite('/content/moth_cmy.jpg', cv2.cvtColor(cmy_image, cv2.COLOR_RGB2BGR))
```

[13] Python



4. And 5. CONVERT A RGB IMAGE TO HSI IMAGE AND THEN BACK TO RGB

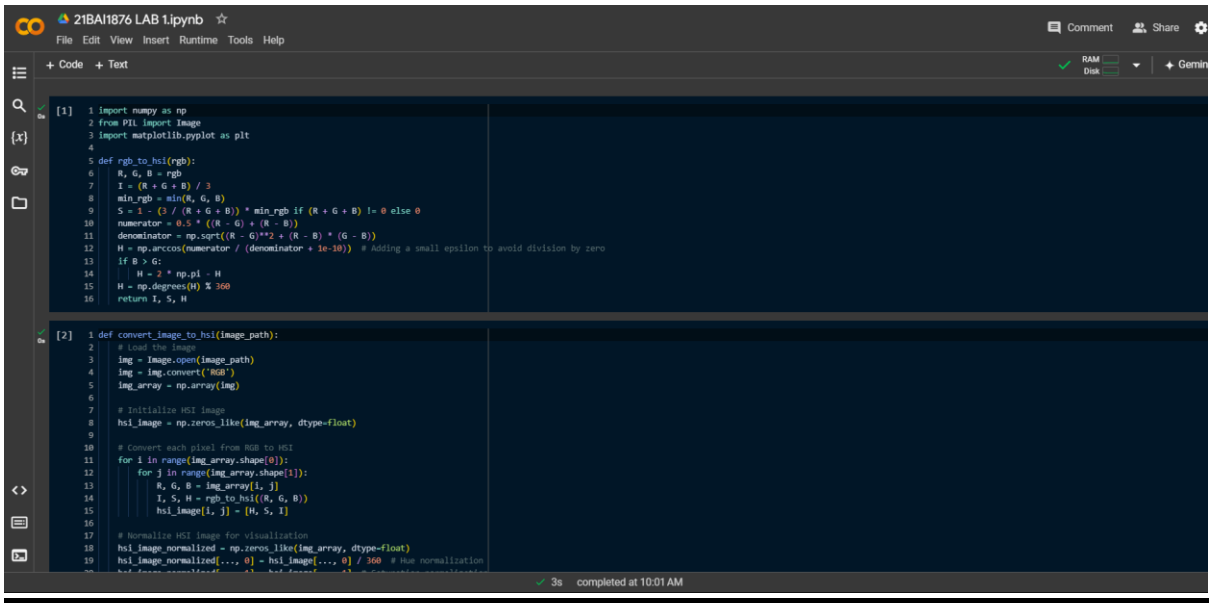
CODE:

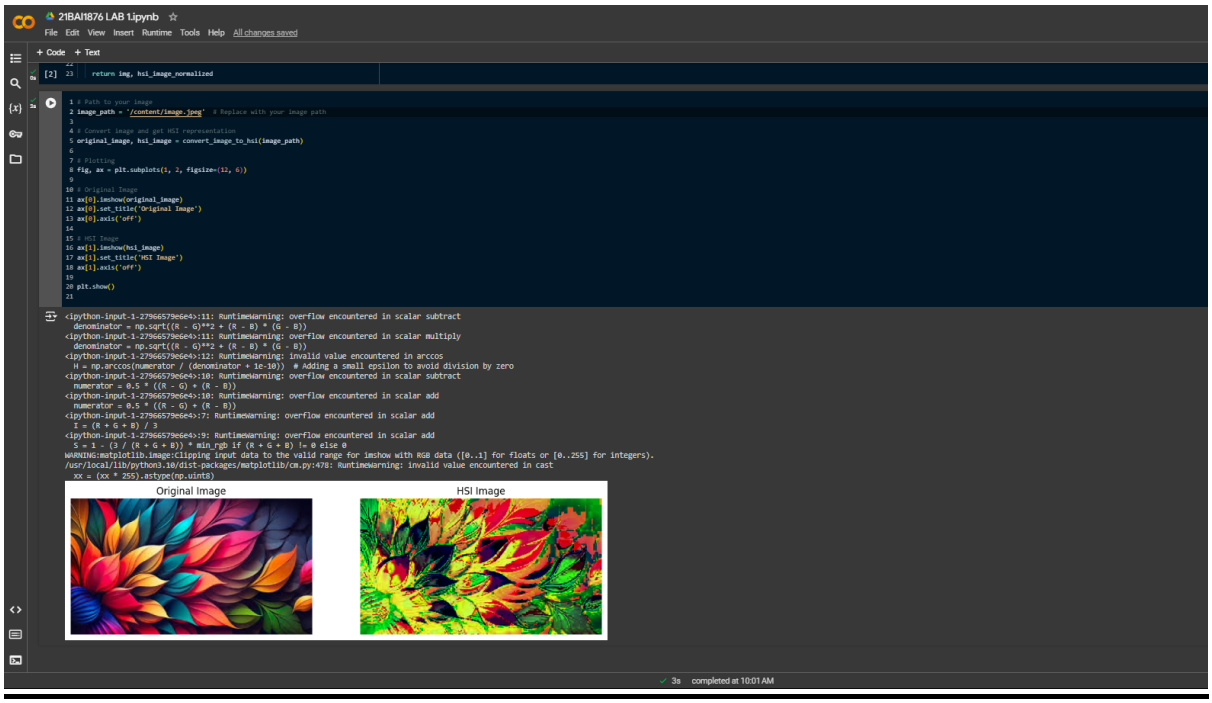
```
import numpy as np
from PIL import Image
import matplotlib.pyplot as plt


def rgb_to_hsi(rgb):
    R, G, B = rgb
    I = (R + G + B) / 3
    min_rgb = min(R, G, B)
    S = 1 - (3 / (R + G + B)) * min_rgb if (R + G + B) != 0 else
0
    numerator = 0.5 * ((R - G) + (R - B))
    denominator = np.sqrt((R - G)**2 + (R - B) * (G - B))
    H = np.arccos(numerator / (denominator + 1e-10))  # Adding a
small epsilon to avoid division by zero
    if B > G:
        H = 2 * np.pi - H
    H = np.degrees(H) % 360
    return I, S, H


def convert_image_to_hsi(image_path):
    # Load the image
    img = Image.open(image_path)
    img = img.convert('RGB')
    img_array = np.array(img)

    # Initialize HSI image
```

```
    hsi_image = np.zeros_like(img_array, dtype=float)

    # Convert each pixel from RGB to HSI
    for i in range(img_array.shape[0]):
        for j in range(img_array.shape[1]):
            R, G, B = img_array[i, j]
            I, S, H = rgb_to_hsi((R, G, B))
            hsi_image[i, j] = [H, S, I]

    # Normalize HSI image for visualization
    hsi_image_normalized = np.zeros_like(img_array, dtype=float)
    hsi_image_normalized[..., 0] = hsi_image[..., 0] / 360  # Hue normalization
    hsi_image_normalized[..., 1] = hsi_image[..., 1]  # Saturation normalization
    hsi_image_normalized[..., 2] = hsi_image[..., 2] / 255  # Intensity normalization
    return img, hsi_image_normalized

# Path to your image
image_path = '/content/moth.jpeg'  # Replace with your image path

# Convert image and get HSI representation
original_image, hsi_image = convert_image_to_hsi(image_path)

# Plotting
fig, ax = plt.subplots(1, 2, figsize=(12, 6))

# Original Image
ax[0].imshow(original_image)
ax[0].set_title('Original Image')
```

```
ax[0].axis('off')
# HSI Image
ax[1].imshow(hsi_image)
ax[1].set_title('HSI Image')
ax[1].axis('off')
plt.show()
```

OUTPUT:





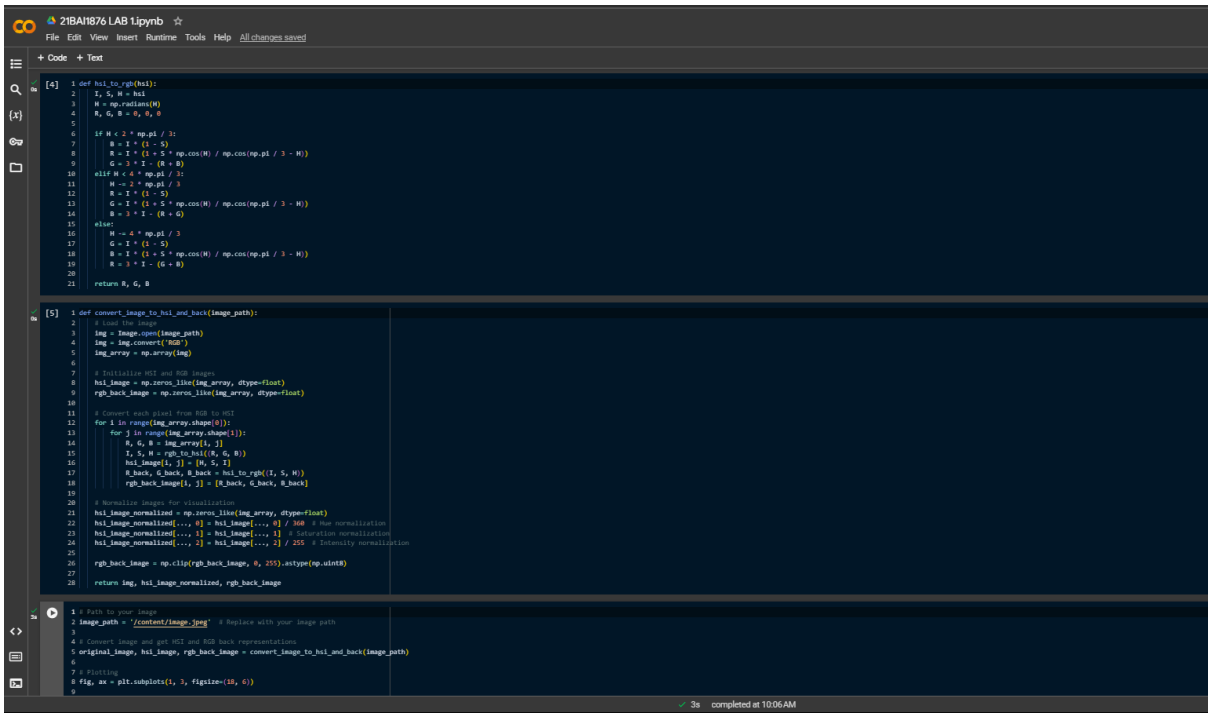
CODE FOR HIS TO RGB:

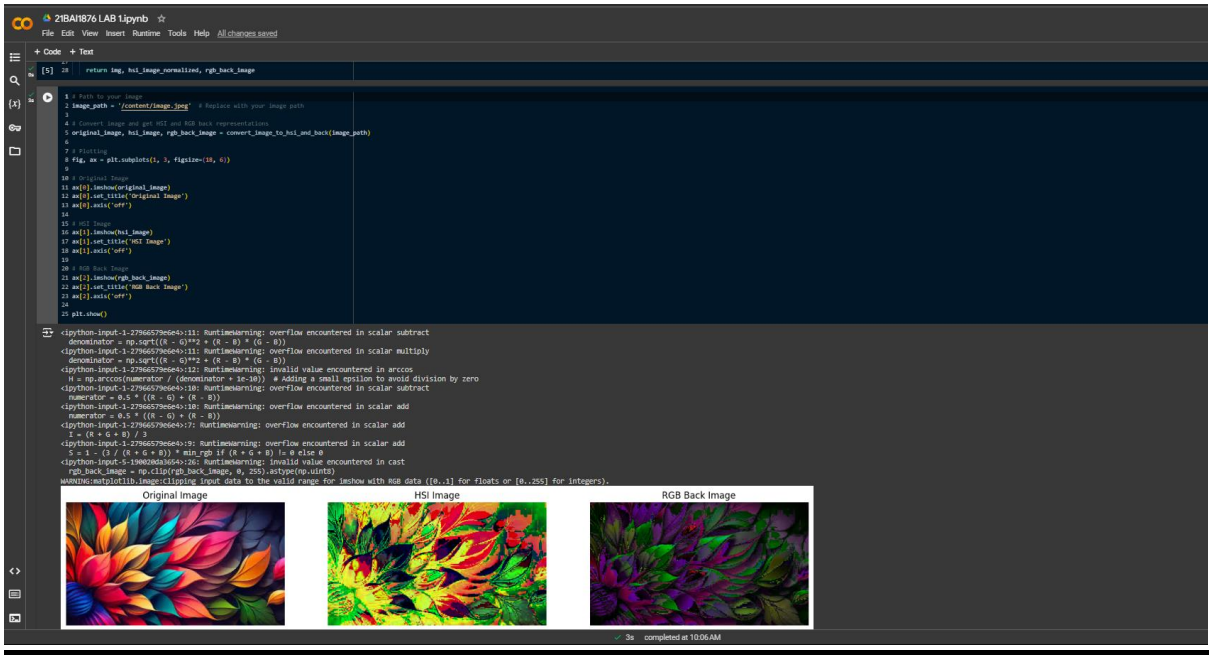
```
def hsi_to_rgb(hsi):
    I, S, H = hsi
    H = np.radians(H)
    R, G, B = 0, 0, 0

    if H < 2 * np.pi / 3:
        B = I * (1 - S)
        R = I * (1 + S * np.cos(H) / np.cos(np.pi / 3 - H))
        G = 3 * I - (R + B)
    elif H < 4 * np.pi / 3:
        H -= 2 * np.pi / 3
        R = I * (1 - S)
        G = I * (1 + S * np.cos(H) / np.cos(np.pi / 3 - H))
        B = 3 * I - (R + G)
    else:
        H -= 4 * np.pi / 3
        G = I * (1 - S)
        B = I * (1 + S * np.cos(H) / np.cos(np.pi / 3 - H))
        R = 3 * I - (G + B)

    return R, G, B

def convert_image_to_hsi_and_back(image_path):
    # Load the image
    img = Image.open(image_path)
    img = img.convert('RGB')
    img_array = np.array(img)
```

```
    # Initialize HSI and RGB images
    hsi_image = np.zeros_like(img_array, dtype=float)
    rgb_back_image = np.zeros_like(img_array, dtype=float)

    # Convert each pixel from RGB to HSI
    for i in range(img_array.shape[0]):
        for j in range(img_array.shape[1]):
            R, G, B = img_array[i, j]
            I, S, H = rgb_to_hsi((R, G, B))
            hsi_image[i, j] = [H, S, I]
            R_back, G_back, B_back = hsi_to_rgb((I, S, H))
            rgb_back_image[i, j] = [R_back, G_back, B_back]

    # Normalize images for visualization
    hsi_image_normalized = np.zeros_like(img_array, dtype=float)
    hsi_image_normalized[..., 0] = hsi_image[..., 0] / 360  #
Hue normalization
    hsi_image_normalized[..., 1] = hsi_image[..., 1]  #
Saturation normalization
    hsi_image_normalized[..., 2] = hsi_image[..., 2] / 255  #
Intensity normalization

    rgb_back_image = np.clip(rgb_back_image, 0,
255).astype(np.uint8)
    return img, hsi_image_normalized, rgb_back_image

# Path to your image
image_path = '/content/moth.jpeg'  # Replace with your image
path
```

```
# Convert image and get HSI and RGB back representations
original_image, hsi_image, rgb_back_image =
convert_image_to_hsi_and_back(image_path)


# Plotting
fig, ax = plt.subplots(1, 3, figsize=(18, 6))


# Original Image
ax[0].imshow(original_image)
ax[0].set_title('Original Image')
ax[0].axis('off')


# HSI Image
ax[1].imshow(hsi_image)
ax[1].set_title('HSI Image')
ax[1].axis('off')


# RGB Back Image
ax[2].imshow(rgb_back_image)
ax[2].set_title('RGB Back Image')
ax[2].axis('off')


plt.show()
```

OUTPUT:


21BAI1876 LAB 1.ipynb
File Edit View Insert Runtime Tools Help All changes saved
+ Code + Text
[4]
def hsi_to_rgb(hsi):
I, S, H = hsi
H = np.radians(H)
R, G, B = 0, 0, 0
if H < 2 * np.pi / 3:
B = I * (1 - S)
R = I * (1 + S * np.cos(H) / np.cos(np.pi / 3 - H))
G = 3 * I - (R + B)
elif H < 4 * np.pi / 3:
H -= 2 * np.pi / 3
R = I * (1 - S)
G = I * (1 + S * np.cos(H) / np.cos(np.pi / 3 - H))
B = 3 * I - (R + G)
else:
H -= 4 * np.pi / 3
G = I * (1 - S)
B = I * (1 + S * np.cos(H) / np.cos(np.pi / 3 - H))
R = 3 * I - (G + B)
return R, G, B
[5]
def convert_image_to_hsi_and_back(image_path):
# Load the image
img = Image.open(image_path)
img = img.convert('RGB')
img_array = np.array(img)
# Initialize HSI and RGB images
hsi_image = np.zeros_like(img_array, dtype=float)
rgb_back_image = np.zeros_like(img_array, dtype=float)
# Convert each pixel from RGB to HSI
for i in range(img_array.shape[0]):
for j in range(img_array.shape[1]):
R, G, B = img_array[i, j]
I, S, H = rgb_to_hsi((R, G, B))
hsi_image[i, j] = [H, S, I]
R_back, G_back, B_back = hsi_to_rgb((I, S, H))
rgb_back_image[i, j] = [R_back, G_back, B_back]
# Normalize images for visualization
hsi_image_normalized = np.zeros_like(img_array, dtype=float)
hsi_image_normalized[..., 0] = hsi_image[..., 0] / 360 # Hue normalization
hsi_image_normalized[..., 1] = hsi_image[..., 1] # Saturation normalization
hsi_image_normalized[..., 2] = hsi_image[..., 2] / 255 # Intensity normalization
rgb_back_image = np.clip(rgb_back_image, 0, 255).astype(np.uint8)
return img, hsi_image_normalized, rgb_back_image
# Path to your image
image_path = '/content/image.jpeg' # Replace with your image path
# Convert image and get HSI and RGB back representations
original_image, hsi_image, rgb_back_image = convert_image_to_hsi_and_back(image_path)
Plotting
fig, ax = plt.subplots(1, 3, figsize=(18, 6))
3s completed at 10:06 AM


21BAI1876 LAB 1.ipynb
File Edit View Insert Runtime Tools Help All changes saved
+ Code + Text
[5] return img, hsi_image_normalized, rgb_back_image
# Path to your image
image_path = '/content/image.jpeg' # Replace with your image path
# Convert image and get HSI and RGB back representations
original_image, hsi_image, rgb_back_image = convert_image_to_hsi_and_back(image_path)
Plotting
fig, ax = plt.subplots(1, 3, figsize=(18, 6))
Original Image
ax[0].imshow(original_image)
ax[0].set_title('Original Image')
ax[0].axis('off')
HSI Image
ax[1].imshow(hsi_image)
ax[1].set_title('HSI Image')
ax[1].axis('off')
RGB Back Image
ax[2].imshow(rgb_back_image)
ax[2].set_title('RGB Back Image')
ax[2].axis('off')
plt.show()
<ipython-input-1-27966579e6e4>:11: RuntimeWarning: overflow encountered in scalar subtract
denominator = np.sqrt((R - G)**2 + (R - B) * (G - B))
<ipython-input-1-27966579e6e4>:11: RuntimeWarning: overflow encountered in scalar multiply
denominator = np.sqrt((R - G)**2 + (R - B) * (G - B))
<ipython-input-1-27966579e6e4>:12: RuntimeWarning: invalid value encountered in arccos
H = np.arccos(numerator / (denominator + 1e-10)) # Adding a small epsilon to avoid division by zero
<ipython-input-1-27966579e6e4>:10: RuntimeWarning: overflow encountered in scalar subtract
numerator = 0.5 * ((R - G) + (R - B))
<ipython-input-1-27966579e6e4>:10: RuntimeWarning: overflow encountered in scalar add
numerator = 0.5 * ((R - G) + (R - B))
<ipython-input-1-27966579e6e4>:7: RuntimeWarning: overflow encountered in scalar add
I = (R + G + B) / 3
<ipython-input-1-27966579e6e4>:9: RuntimeWarning: overflow encountered in scalar add
S = 1 - (3 / (R + G + B)) * min_rgb if (R + G + B) != 0 else 0
<ipython-input-5-190020d3d654>:26: RuntimeWarning: invalid value encountered in cast
rgb_back_image = np.clip(rgb_back_image, 0, 255).astype(np.uint8)
WARNING:matplotlib.image:Clipping input data to the valid range for imshow with RGB data ([0..1] for floats or [0..255] for integers).
Original Image
HSI Image
RGB Back Image
3s completed at 10:06 AM

MACHINE VISION LAB

Lab Ex 2: Gray Level Transformation – Image Negative, Gamma Correction, Log transform, Image Enhancement - Low pass/High Pass spatial Filtering – Gaussian Filters, Noise Filtering.

NAME : OM SUBRATO DEY

REG NO.: 21BAI1876

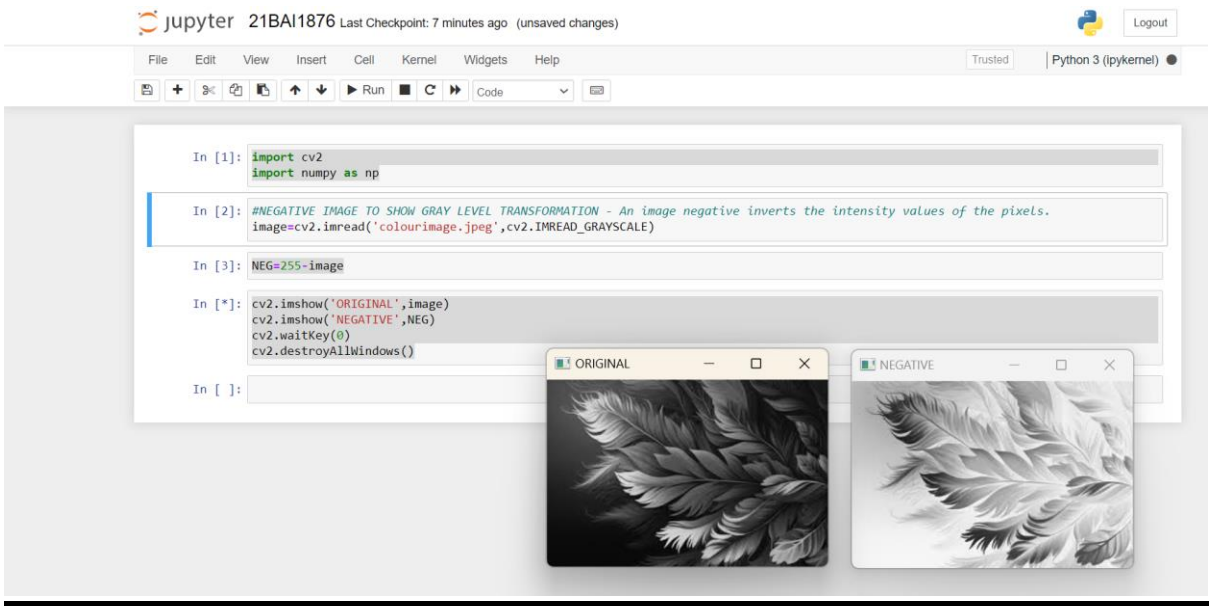
1. Gray Level Transformation – Image Negative

[An image negative inverts the intensity values of the pixels]

CODE:

```
import cv2

import numpy as np


#NEGATIVE IMAGE TO SHOW GRAY LEVEL TRANSFORMATION

image=cv2.imread('colourimage.jpeg',cv2.IMREAD_GRAYSCALE)

NEG=255-image

cv2.imshow('ORIGINAL',image)

cv2.imshow('NEGATIVE',NEG)

cv2.waitKey(0)

cv2.destroyAllWindows()
```

OUTPUT:



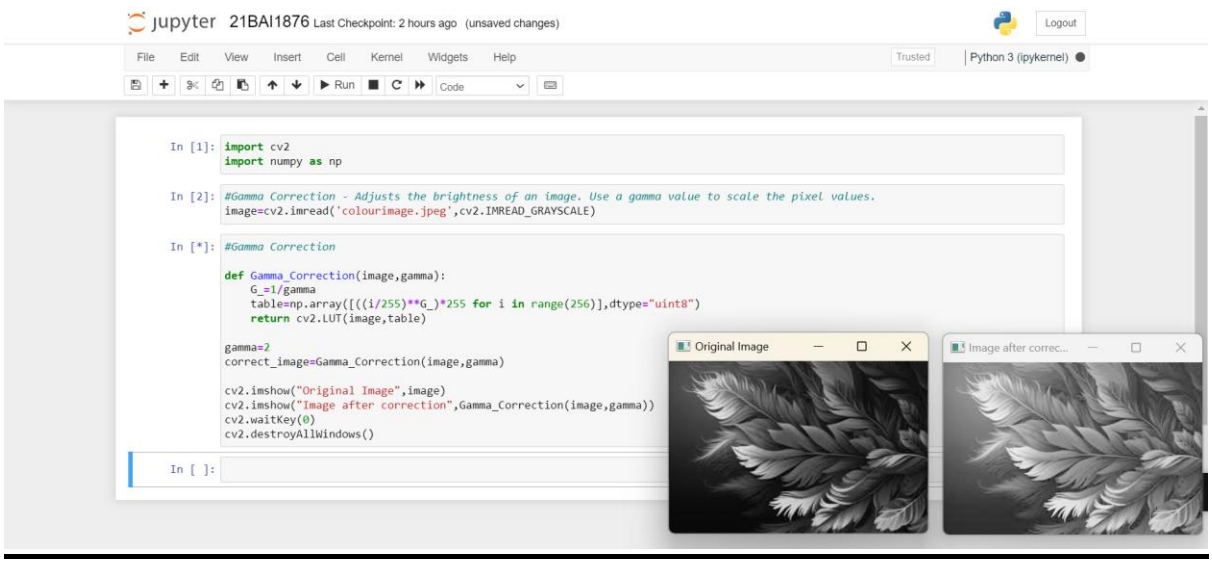
2. Gamma Correction – Modifying Brightness

[Adjusts the brightness of an image. Use a gamma value to scale the pixel values.]

CODE:

```
import cv2
import numpy as np
#reading image
image=cv2.imread('colourimage.jpeg',cv2.IMREAD_GRAYSCALE)


def Gamma_Correction(image,gamma):
    G_=1/gamma
    table=np.array([((i/255)**G_)*255 for i in range(256)],dtype="uint8")
    return cv2.LUT(image,table)


gamma=2
correct_image=Gamma_Correction(image,gamma)


cv2.imshow("Original Image",image)
cv2.imshow("Image after correction",Gamma_Correction(image,gamma))
cv2.waitKey(0)
cv2.destroyAllWindows()
```

OUTPUT:


jupyter 21BAI1876 Last Checkpoint: 2 hours ago (unsaved changes)
Logout
File Edit View Insert Cell Kernel Widgets Help
Trusted
Python 3 (ipykernel)
Run
Code
In [1]:
import cv2
import numpy as np
In [2]:
#Gamma Correction - Adjusts the brightness of an image. Use a gamma value to scale the pixel values.
image=cv2.imread('colourimage.jpeg',cv2.IMREAD_GRAYSCALE)
In [*]:
#Gamma Correction
def Gamma_Correction(image,gamma):
G_=1/gamma
table=np.array([((i/255)**G_)*255 for i in range(256)],dtype="uint8")
return cv2.LUT(image,table)
gamma=2
correct_image=Gamma_Correction(image,gamma)
cv2.imshow("Original Image",image)
cv2.imshow("Image after correction",Gamma_Correction(image,gamma))
cv2.waitKey(0)
cv2.destroyAllWindows()
In [ ]:
Original Image
Image after correc...

3. Log transform – For better dynamic range

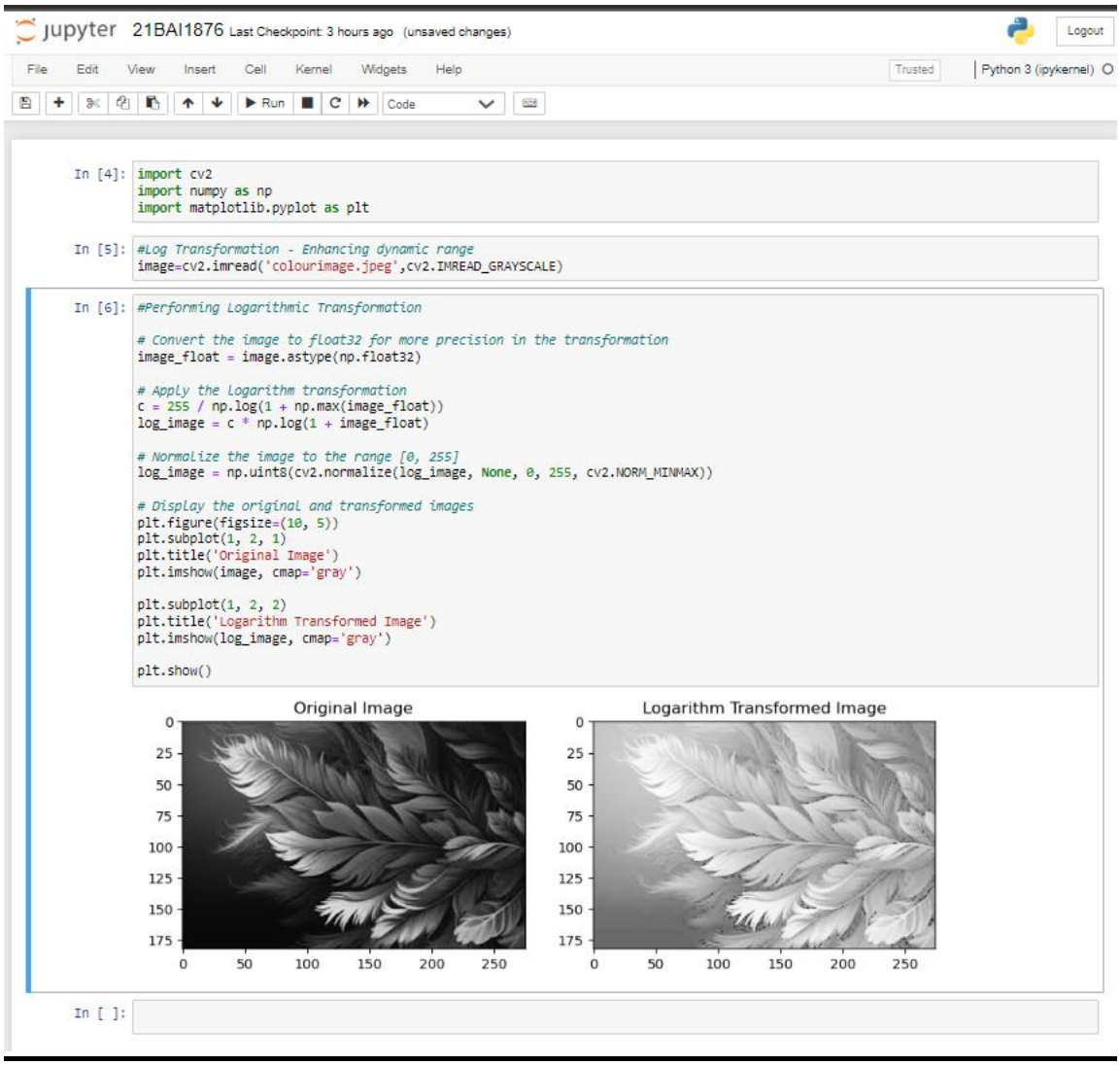
[Enhances the dynamic range of an image.]

CODE:

```
import cv2
import numpy as np
import matplotlib.pyplot as plt

#Log Transformation - Enhancing dynamic range
image=cv2.imread('colourimage.jpeg',cv2.IMREAD_GRAYSCALE)

#Performing Logarithmic Transformation
# Convert the image to float32 for more precision in the transformation
image_float = image.astype(np.float32)

# Apply the logarithm transformation
c = 255 / np.log(1 + np.max(image_float))
log_image = c * np.log(1 + image_float)

# Normalize the image to the range [0, 255]
log_image = np.uint8(cv2.normalize(log_image, None, 0, 255, cv2.NORM_MINMAX))

# Display the original and transformed images
plt.figure(figsize=(10, 5))
plt.subplot(1, 2, 1)
plt.title('Original Image')
```

```
plt.imshow(image, cmap='gray')


plt.subplot(1, 2, 2)
plt.title('Logarithm Transformed Image')
plt.imshow(log_image, cmap='gray')
plt.show()
```

OUTPUT:



4. Image Enhancement - Low Pass/High Pass Spatial Filtering

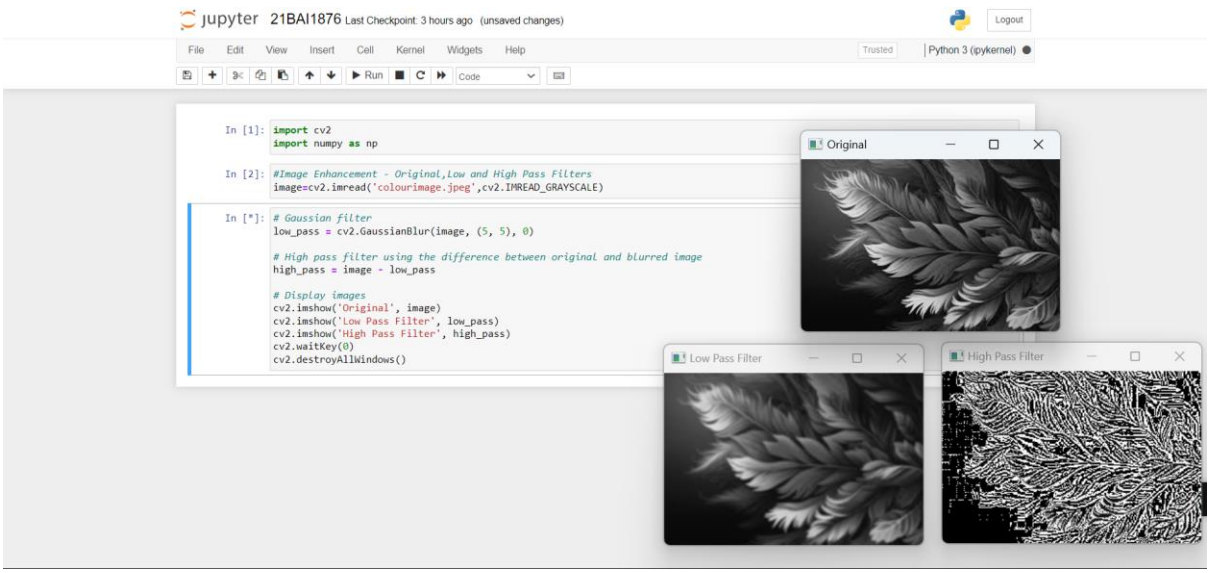
[Low Pass Filtering: Smooths the image, reduces high-frequency noise. High Pass Filtering: Enhances edges and fine details. Gaussian Filters are commonly used for both.]

CODE:

```
import cv2

import numpy as np

#Image Enhancement - Original,Low and High Pass Filters

image=cv2.imread('colourimage.jpeg',cv2.IMREAD_GRAYSCALE)

# Gaussian filter

low_pass = cv2.GaussianBlur(image, (5, 5), 0)



# High pass filter using the difference between original and blurred image

high_pass = image - low_pass



# Display images

cv2.imshow('Original', image)

cv2.imshow('Low Pass Filter', low_pass)

cv2.imshow('High Pass Filter', high_pass)

cv2.waitKey(0)
```

cv2.destroyAllWindows()

OUTPUT:



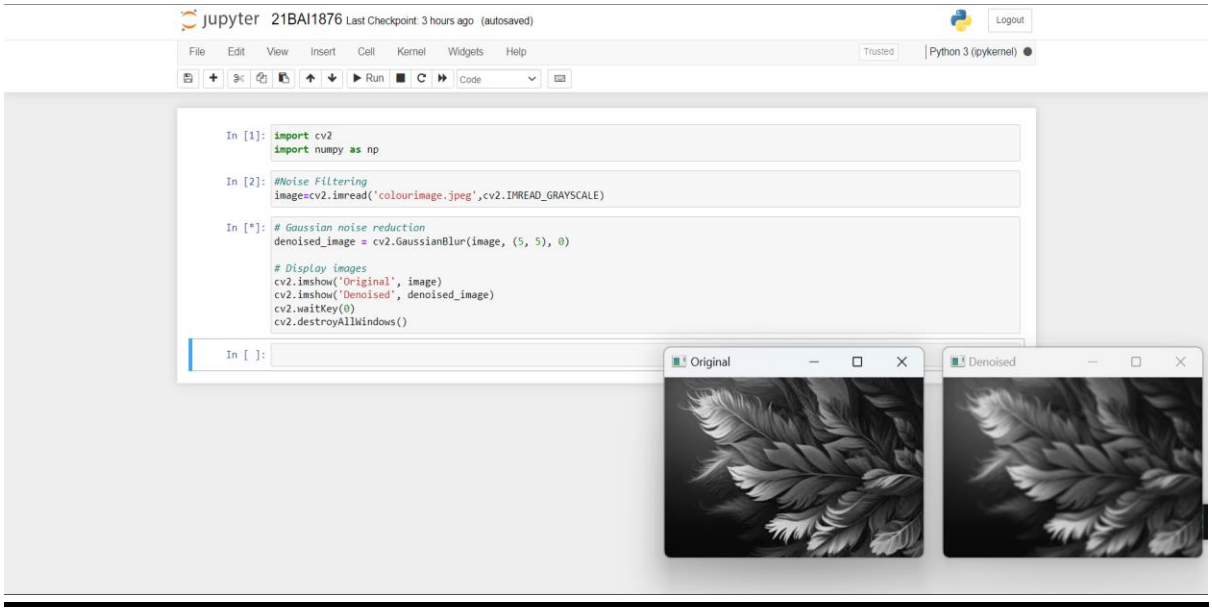
5. Noise Filtering – Gaussian Filters

[Gaussian filters are effective for reducing noise.]

CODE:

```
import cv2

import numpy as np

#Noise Filtering

image=cv2.imread('colourimage.jpeg',cv2.IMREAD_GRAYSCALE)

# Gaussian noise reduction

denoised_image = cv2.GaussianBlur(image, (5, 5), 0)

# Display images

cv2.imshow('Original', image)

cv2.imshow('Denoised', denoised_image)

cv2.waitKey(0)

cv2.destroyAllWindows()
```

OUTPUT:


jupyter 21BAI1876 Last Checkpoint: 3 hours ago (autosaved)
Logout
File Edit View Insert Cell Kernel Widgets Help
Trusted
Python 3 (ipykernel)
Run
Code
In [1]:
import cv2
import numpy as np
In [2]:
#Noise Filtering
image=cv2.imread('colourimage.jpeg',cv2.IMREAD_GRAYSCALE)
In [*]:
# Gaussian noise reduction
denoised_image = cv2.GaussianBlur(image, (5, 5), 0)
# Display images
cv2.imshow('Original', image)
cv2.imshow('Denoised', denoised_image)
cv2.waitKey(0)
cv2.destroyAllWindows()
In [ ]:
Original
Denoised

MACHINE VISION

LAB 3 : HISTOGRAM EQUALIZATION

NAME : OM SUBRATO DEY

REGISTER NUMBER: 21BAI1876

FACULTY : AMUTHA S

CODE:

```
import matplotlib.pyplot as plt
import numpy as np
import cv2

#As per given data on board
numbers = [10,15,5,6,21,37,41,17,54,65,27,33,3,64,2]

# Define the bins for the categories
divisions_along_x_axis = [0, 9, 19, 29, 39, 49, 59, 69, 79]

# Categorize the random numbers into the bins
counts, _ = np.histogram(numbers, bins=divisions_along_x_axis)

# Plotting the histogram using matplotlib
plt.hist(numbers, bins=divisions_along_x_axis,
edgecolor='black')
plt.title('Numbers Histogram')
plt.xlabel('Divisions along X Axis')
plt.ylabel('Frequency')
plt.xticks(bins)

# Plotting the line graph using matplotlib
plt.figure(figsize=(10, 6))
plt.plot(bin_centers, counts, marker='o', linestyle='-',
color='r')
plt.title('Numbers Line Graph')
plt.xlabel('Number Ranges')
plt.ylabel('Frequency')
```

OUTPUT:

jupyter 21BAI1876_LAB_3_HISTOGRAM_PLOTTING Last Checkpoint: 21 minutes ago (autosaved)

Logout

File Edit View Insert Cell Kernel Widgets Help

Trusted | Python 3 (ipykernel)

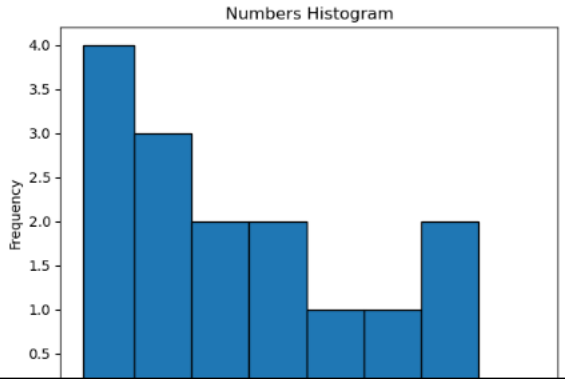
Run Code

In [19]:
```
import matplotlib.pyplot as plt
import numpy as np
import cv2
```

In [20]:
```
numbers = [10,15,5,6,21,37,41,17,54,65,27,33,3,64,2]

# Define the bins for the categories
divisions_along_x_axis = [0, 9, 19, 29, 39, 49, 59, 69, 79]

# Categorize the random numbers into the bins
counts, _ = np.histogram(numbers, bins=divisions_along_x_axis)
```

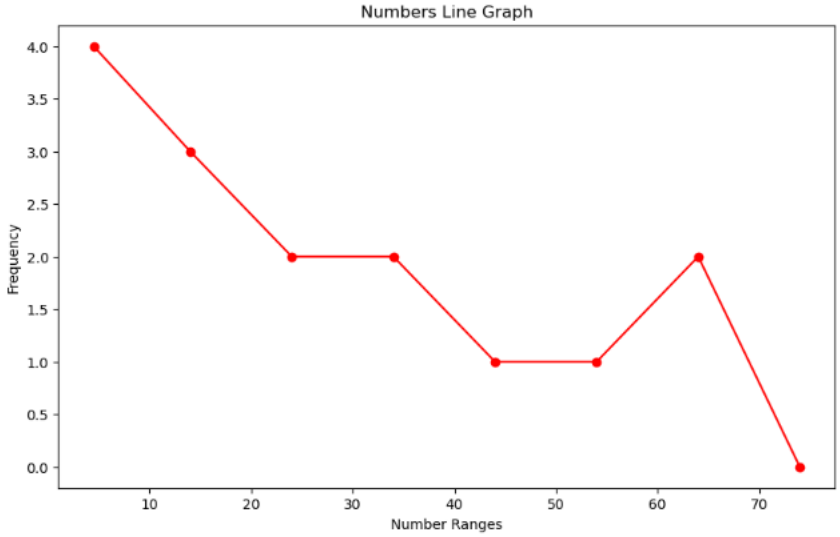
In [21]:
```
# Plotting the histogram using matplotlib
plt.hist(numbers, bins=divisions_along_x_axis, edgecolor='black')
plt.title('Numbers Histogram')
plt.xlabel('Divisions along X Axis')
plt.ylabel('Frequency')
plt.xticks(bins)
```

Out[21]:
```
([<matplotlib.axis.XTick at 0x214b3e209d0>,
  <matplotlib.axis.XTick at 0x214b3e20550>,
  <matplotlib.axis.XTick at 0x214b3e05950>,
  <matplotlib.axis.XTick at 0x214b40a39d0>,
  <matplotlib.axis.XTick at 0x214b40a2fd0>,
  <matplotlib.axis.XTick at 0x214b40af4d0>,
  <matplotlib.axis.XTick at 0x214b40b5610>,
  <matplotlib.axis.XTick at 0x214b40b7850>,
  <matplotlib.axis.XTick at 0x214b40b9ad0>],
 [Text(0, 0, '0'),
  Text(9, 0, '9'),
  Text(19, 0, '19'),
  Text(29, 0, '29'),
  Text(39, 0, '39'),
  Text(49, 0, '49'),
  Text(59, 0, '59'),
  Text(69, 0, '69'),
  Text(79, 0, '79')])
```



In [29]:
```
# Plotting the line graph using matplotlib
plt.figure(figsize=(10, 6))
plt.plot(bin_centers, counts, marker='o', linestyle='-', color='r')
plt.title('Numbers Line Graph')
plt.xlabel('Number Ranges')
plt.ylabel('Frequency')
```

Out[29]: Text(0, 0.5, 'Frequency')



In [ ]:

MACHINE VISION

LAB 4: Median filter, Min filter, Max filter

NAME : OM SUBRATO DEY

REGISTER NUMBER : 21BAI1876

1. Median Filter:

CODE:

```
import cv2
import numpy as np
import matplotlib.pyplot as plt

# Load the image
image_path = 'OMPHOTO.jpeg'  # Replace with your image path
image = cv2.imread(image_path, cv2.IMREAD_COLOR)

# Convert image to RGB (OpenCV loads images in BGR by default)
image_rgb = cv2.cvtColor(image, cv2.COLOR_BGR2RGB)

# Apply median filter
# kernel_size should be an odd integer (e.g., 3, 5, 7)
kernel_size = 5
filtered_image = cv2.medianBlur(image_rgb, kernel_size)

# Display the original and filtered images
plt.figure(figsize=(10, 5))

plt.subplot(1, 2, 1)
plt.title('Original Image')
plt.imshow(image_rgb)
plt.axis('off')

plt.subplot(1, 2, 2)
plt.title('Filtered Image')
plt.imshow(filtered_image)
```

```
plt.axis('off')
plt.show()
```

OUTPUT:

jupyter 21BAI1876_LAB_4 Last Checkpoint: 11 minutes ago (unsaved changes)

Logout

File Edit View Insert Cell Kernel Widgets Help

Trusted | Python 3 (ipykernel)

Run Code

In [1]:
```
#MEDIAN FILTER
```

In [2]:
```
import cv2
import numpy as np
import matplotlib.pyplot as plt
```

In [3]:
```
# Load the image
image_path = 'OMPHOTO.jpeg'  # Replace with your image path
image = cv2.imread(image_path, cv2.IMREAD_COLOR)
```

In [4]:
```
# Convert image to RGB (OpenCV loads images in BGR by default)
image_rgb = cv2.cvtColor(image, cv2.COLOR_BGR2RGB)
```

In [5]:
```
# Apply median filter
# kernel_size should be an odd integer (e.g., 3, 5, 7)
kernel_size = 5
filtered_image = cv2.medianBlur(image_rgb, kernel_size)
```

In [6]:
```
# Display the original and filtered images
plt.figure(figsize=(10, 5))

plt.subplot(1, 2, 1)
plt.title('Original Image')
plt.imshow(image_rgb)
plt.axis('off')

plt.subplot(1, 2, 2)
plt.title('Filtered Image')
plt.imshow(filtered_image)
plt.axis('off')

plt.show()
```

2. Min Filter:

CODE:

```
import cv2
import numpy as np
import matplotlib.pyplot as plt


def min_filter(image, kernel_size):
    # Pad the image to handle border effects
    pad_size = kernel_size // 2
    padded_image = np.pad(image, ((pad_size, pad_size), (pad_size, pad_size), (0, 0)), mode='edge')


    # Output image
    filtered_image = np.zeros_like(image)


    for i in range(image.shape[0]):
        for j in range(image.shape[1]):
            # Extract the neighborhood
            neighborhood = padded_image[i:i+kernel_size, j:j+kernel_size]
            # Apply min filter
            filtered_image[i, j] = np.min(neighborhood, axis=(0, 1))


    return filtered_image


# Load the image
image_path = 'OMPHOTO.jpeg'  # Replace with your image path
image = cv2.imread(image_path, cv2.IMREAD_COLOR)
```

```
# Convert image to RGB
image_rgb = cv2.cvtColor(image, cv2.COLOR_BGR2RGB)

# Apply min filter
kernel_size = 5
min_filtered_image = min_filter(image_rgb, kernel_size)

# Display the original and min filtered images
plt.figure(figsize=(10, 5))

plt.subplot(1, 2, 1)
plt.title('Original Image')
plt.imshow(image_rgb)
plt.axis('off')

plt.subplot(1, 2, 2)
plt.title('Min Filtered Image')
plt.imshow(min_filtered_image)
plt.axis('off')

plt.show()
```

OUTPUT:

jupyter 21BAI1876_LAB_4 Last Checkpoint: 12 minutes ago (autosaved)

Logout

File Edit View Insert Cell Kernel Widgets Help Trusted Python 3 (ipykernel)

Run

In [7]:
```
# MIN FILTER
```

In [8]:
```
def min_filter(image, kernel_size):
    # Pad the image to handle border effects
    pad_size = kernel_size // 2
    padded_image = np.pad(image, ((pad_size, pad_size), (pad_size, pad_size), (0, 0)), mode='edge')

    # Output image
    filtered_image = np.zeros_like(image)

    for i in range(image.shape[0]):
        for j in range(image.shape[1]):
            # Extract the neighborhood
            neighborhood = padded_image[i:i+kernel_size, j:j+kernel_size]
            # Apply min filter
            filtered_image[i, j] = np.min(neighborhood, axis=(0, 1))

    return filtered_image
```

In [9]:
```
# Load the image
image_path = 'OMPHOTO.jpeg'  # Replace with your image path
image = cv2.imread(image_path, cv2.IMREAD_COLOR)

# Convert image to RGB
image_rgb = cv2.cvtColor(image, cv2.COLOR_BGR2RGB)
```

In [10]:
```
# Apply min filter
kernel_size = 5
min_filtered_image = min_filter(image_rgb, kernel_size)
```

In [11]:
```
# Display the original and min filtered images
plt.figure(figsize=(10, 5))

plt.subplot(1, 2, 1)
plt.title('Original Image')
plt.imshow(image_rgb)
plt.axis('off')

plt.subplot(1, 2, 2)
plt.title('Min Filtered Image')
plt.imshow(min_filtered_image)
plt.axis('off')

plt.show()
```

3. Max Filter

CODE:

```
import cv2
import numpy as np
import matplotlib.pyplot as plt


def max_filter(image, kernel_size):
    # Pad the image to handle border effects
    pad_size = kernel_size // 2
    padded_image = np.pad(image, ((pad_size, pad_size), (pad_size, pad_size), (0, 0)), mode='edge')


    # Output image
    filtered_image = np.zeros_like(image)


    for i in range(image.shape[0]):
        for j in range(image.shape[1]):
            # Extract the neighborhood
            neighborhood = padded_image[i:i+kernel_size, j:j+kernel_size]
            # Apply max filter
            filtered_image[i, j] = np.max(neighborhood, axis=(0, 1))


    return filtered_image


# Load the image
image_path = 'OMPHOTO.jpeg'  # Replace with your image path
image = cv2.imread(image_path, cv2.IMREAD_COLOR)
```

```
# Convert image to RGB
image_rgb = cv2.cvtColor(image, cv2.COLOR_BGR2RGB)

# Apply max filter
kernel_size = 5
max_filtered_image = max_filter(image_rgb, kernel_size)

# Display the original and max filtered images
plt.figure(figsize=(10, 5))

plt.subplot(1, 2, 1)
plt.title('Original Image')
plt.imshow(image_rgb)
plt.axis('off')

plt.subplot(1, 2, 2)
plt.title('Max Filtered Image')
plt.imshow(max_filtered_image)
plt.axis('off')

plt.show()
```

OUTPUT:

jupyter 21BAI1876_LAB_4 Last Checkpoint: a minute ago (unsaved changes)

Logout

File Edit View Insert Cell Kernel Widgets Help

Trusted | Python 3 (ipykernel)

Run Code

```
    for i in range(image.shape[0]):
        for j in range(image.shape[1]):
            # Extract the neighborhood
            neighborhood = padded_image[i:i+kernel_size, j:j+kernel_size]
            # Apply max filter
            filtered_image[i, j] = np.max(neighborhood, axis=(0, 1))

    return filtered_image
```

In [15]:
```
# Load the image
image_path = 'OMPHOTO.jpeg'  # Replace with your image path
image = cv2.imread(image_path, cv2.IMREAD_COLOR)

# Convert image to RGB
image_rgb = cv2.cvtColor(image, cv2.COLOR_BGR2RGB)
```

In [16]:
```
# Apply max filter
kernel_size = 5
max_filtered_image = max_filter(image_rgb, kernel_size)
```

In [17]:
```
# Apply max filter
kernel_size = 5
max_filtered_image = max_filter(image_rgb, kernel_size)

# Display the original and max filtered images
plt.figure(figsize=(10, 5))

plt.subplot(1, 2, 1)
plt.title('Original Image')
plt.imshow(image_rgb)
plt.axis('off')

plt.subplot(1, 2, 2)
plt.title('Max Filtered Image')
plt.imshow(max_filtered_image)
plt.axis('off')

plt.show()
```

In [ ]:

MACHINE VISION LAB 5

Ex. Edge Detection Using Sobel, Robert and Prewitt.

NAME : OM SUBRATO DEY

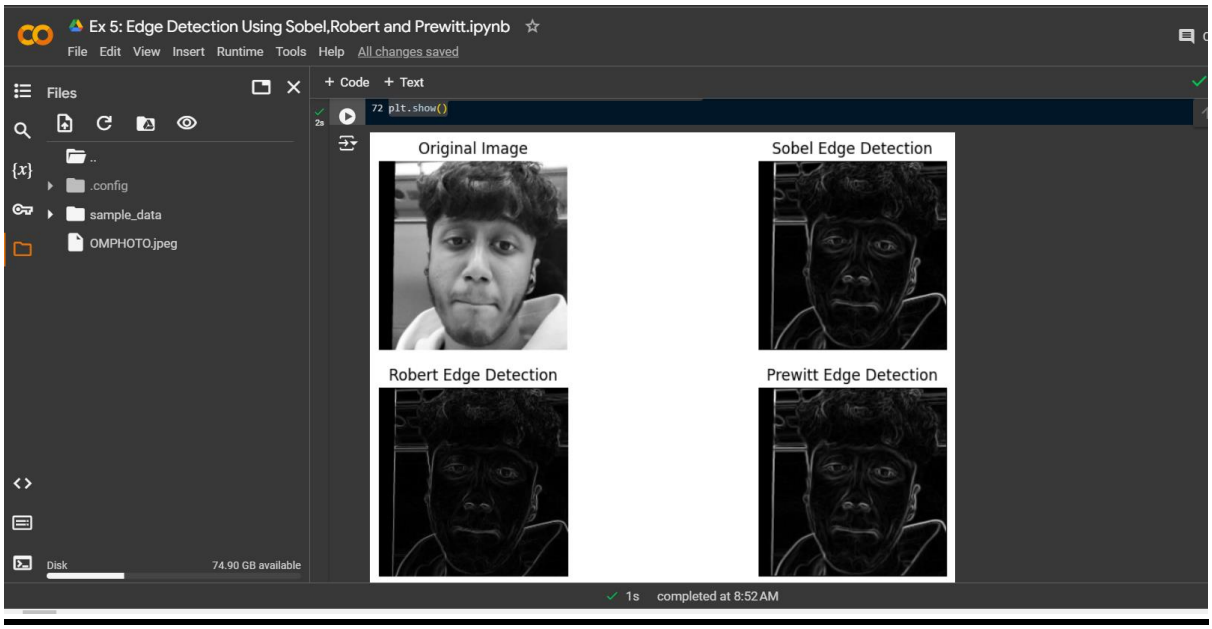
REGISTER NUMBER : 21BAI1876

CODE:

```
import cv2
import numpy as np
import matplotlib.pyplot as plt

# Load the image
img = cv2.imread('/content/OMPHOTO.jpeg', 0)

# Define the Sobel operators
sobel_x = np.array([[-1, 0, 1],[-2, 0, 2],[-1, 0, 1]])
sobel_y = np.array([[-1, -2, -1],[0, 0, 0],[1, 2, 1]])

# Define the Robert operators
robert_x = np.array([[1, 0],[0, -1]])
robert_y = np.array([[0, 1],[-1, 0]])

# Define the Prewitt operators
prewitt_x = np.array([[-1, 0, 1],[-1, 0, 1],[-1, 0, 1]])
prewitt_y = np.array([[-1, -1, -1],[0, 0, 0],[1, 1, 1]])

# Function to apply the operators
def apply_operator(img, operator):
    rows, cols = img.shape
    result = np.zeros((rows, cols))
    operator_rows, operator_cols = operator.shape
    for i in range(rows - operator_rows + 1):
        for j in range(cols - operator_cols + 1):
            sum = 0
            for k in range(operator_rows):
                for l in range(operator_cols):
```

```
                    sum += img[i + k, j + l] * operator[k, l]
            result[i + 1, j + 1] = sum
    return result

# Apply the Sobel operators
sobel_x_img = apply_operator(img, sobel_x)
sobel_y_img = apply_operator(img, sobel_y)
sobel_img = np.sqrt(sobel_x_img**2 + sobel_y_img**2)

# Apply the Robert operators
robert_x_img = apply_operator(img, robert_x)
robert_y_img = apply_operator(img, robert_y)
robert_img = np.sqrt(robert_x_img**2 + robert_y_img**2)

# Apply the Prewitt operators
prewitt_x_img = apply_operator(img, prewitt_x)
prewitt_y_img = apply_operator(img, prewitt_y)
prewitt_img = np.sqrt(prewitt_x_img**2 + prewitt_y_img**2)

# Display the results
plt.figure(figsize=(10, 6))
plt.subplot(2, 2, 1), plt.imshow(img, cmap='gray')
plt.title('Original Image'), plt.axis('off')
plt.subplot(2, 2, 2), plt.imshow(sobel_img, cmap='gray')
plt.title('Sobel Edge Detection'), plt.axis('off')
plt.subplot(2, 2, 3), plt.imshow(robert_img, cmap='gray')
plt.title('Robert Edge Detection'), plt.axis('off')
plt.subplot(2, 2, 4), plt.imshow(prewitt_img, cmap='gray')
plt.title('Prewitt Edge Detection'), plt.axis('off')
plt.show()
```

OUTPUT:


Ex 5: Edge Detection Using Sobel,Robert and Prewitt.ipynb
File Edit View Insert Runtime Tools Help All changes saved
Files
+ Code + Text
72 plt.show()
.config
sample_data
OMPHOTO.jpeg
Disk 74.90 GB available
Original Image
Sobel Edge Detection
Robert Edge Detection
Prewitt Edge Detection
1s completed at 8:52 AM

MACHINE VISION LAB 6

Ex. Image Segmentation (Thresholding and Region Growing)

NAME : OM SUBRATO DEY

REGISTER NUMBER : 21BAI1876

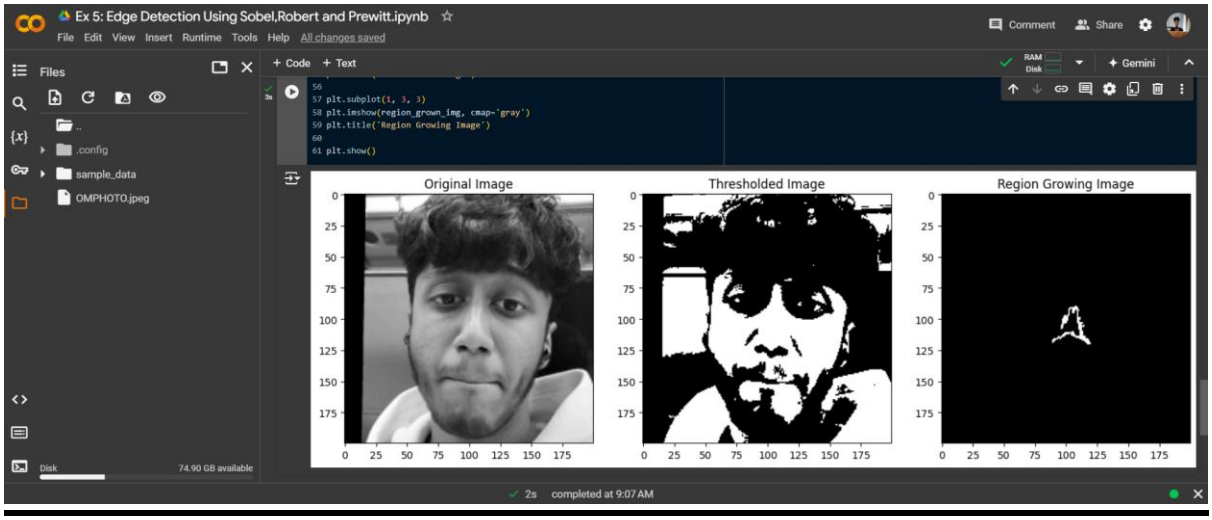
CODE:

```
import cv2
import numpy as np
import matplotlib.pyplot as plt

# Load the image in grayscale
image_path = '/content/OMPHOTO.jpeg'
img = cv2.imread(image_path, 0)  # 0 for grayscale

# Thresholding (binary segmentation)
_, thresh_img = cv2.threshold(img, 127, 255, cv2.THRESH_BINARY)

# Region Growing function
def region_growing(img, seed, threshold=10):
    height, width = img.shape
    segmented_img = np.zeros_like(img)
    visited = np.zeros_like(img, dtype=bool)

    # Initialize the region with the seed point
    region_pixels = [seed]
    region_intensity = img[seed]
    segmented_img[seed] = 255
    visited[seed] = True

    # Define the 4-connectivity (up, down, left, right)
    directions = [(-1, 0), (1, 0), (0, -1), (0, 1)]

    while region_pixels:
        current_pixel = region_pixels.pop(0)
```

```
        for direction in directions:
            x = current_pixel[0] + direction[0]
            y = current_pixel[1] + direction[1]

            if 0 <= x < height and 0 <= y < width and not
visited[x, y]:
                if abs(int(img[x, y]) - int(region_intensity)) <
threshold:
                    segmented_img[x, y] = 255
                    visited[x, y] = True
                    region_pixels.append((x, y))

    return segmented_img

# Seed point for region growing (you can adjust this)
seed_point = (100, 100)  # Example: manually set a seed
region_grown_img = region_growing(img, seed_point, threshold=10)

# Plot original, thresholded, and region growing images
plt.figure(figsize=(15, 5))

plt.subplot(1, 3, 1)
plt.imshow(img, cmap='gray')
plt.title('Original Image')

plt.subplot(1, 3, 2)
plt.imshow(thresh_img, cmap='gray')
plt.title('Thresholded Image')

plt.subplot(1, 3, 3)
plt.imshow(region_grown_img, cmap='gray')
```

```
plt.title('Region Growing Image')
plt.show()
```

OUTPUT:



COLAB NOTEBOOK LINK:

https://colab.research.google.com/drive/1QThx-6z5IP0Ux9SDSUZPih0YkHE_zjPl?usp=sharing

MACHINE VISION LAB 7 AND LAB 8

COLAB NOTEBOOK LINK:

[https://colab.research.google.com/drive/1KLBZ139Cd7m0XIt4JCfKxF__rQf9TCfj?usp=sharing]

NAME : OM SUBRATO DEY

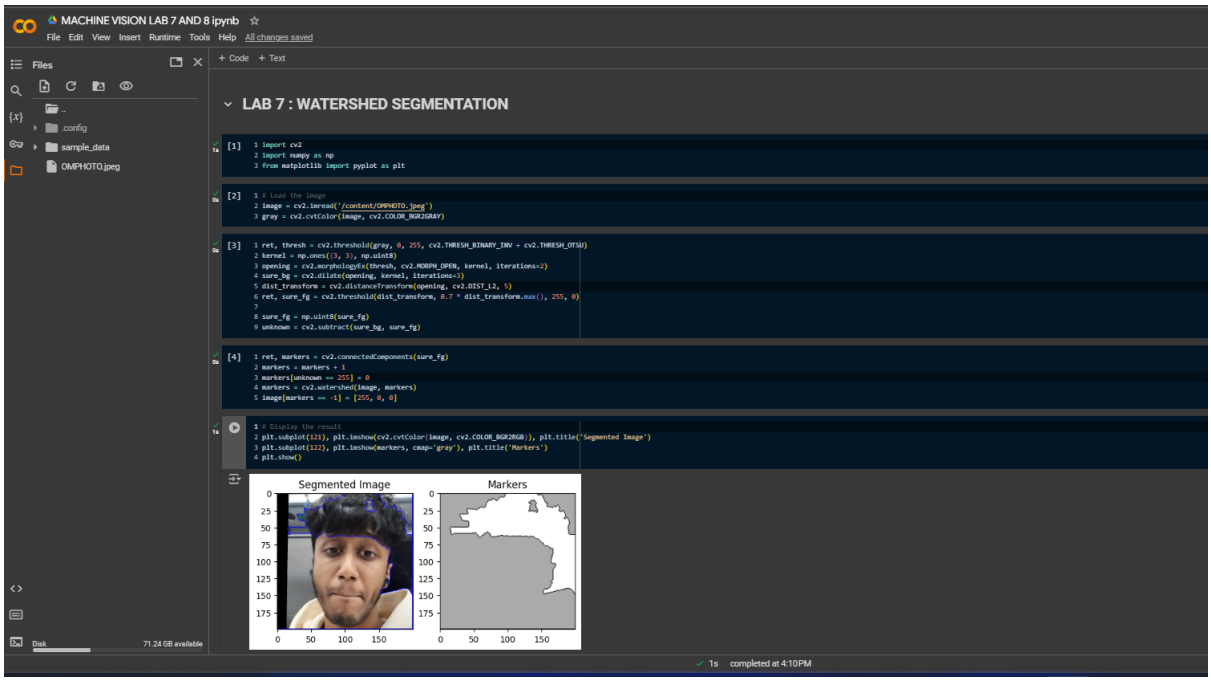
REGISTER NO. 21BAI1876

LAB 7: WATERSHED SEGMENTATION

CODE:

```
import cv2

import numpy as np

from matplotlib import pyplot as plt


# Load the image

image = cv2.imread('/content/OMPHOTO.jpeg')

gray = cv2.cvtColor(image, cv2.COLOR_BGR2GRAY)


ret, thresh = cv2.threshold(gray, 0, 255, cv2.THRESH_BINARY_INV +
cv2.THRESH_OTSU)

kernel = np.ones((3, 3), np.uint8)

opening = cv2.morphologyEx(thresh, cv2.MORPH_OPEN, kernel, iterations=2)

sure_bg = cv2.dilate(opening, kernel, iterations=3)

dist_transform = cv2.distanceTransform(opening, cv2.DIST_L2, 5)

ret, sure_fg = cv2.threshold(dist_transform, 0.7 * dist_transform.max(), 255,
0)


sure_fg = np.uint8(sure_fg)

unknown = cv2.subtract(sure_bg, sure_fg)


ret, markers = cv2.connectedComponents(sure_fg)

markers = markers + 1

markers[unknown == 255] = 0

markers = cv2.watershed(image, markers)

image[markers == -1] = [255, 0, 0]


# Display the result

plt.subplot(121), plt.imshow(cv2.cvtColor(image, cv2.COLOR_BGR2RGB)),
plt.title('Segmented Image')

plt.subplot(122), plt.imshow(markers, cmap='gray'), plt.title('Markers')

plt.show()
```

OUTPUT:


MACHINE VISION LAB 7 AND 8.ipynb
File Edit View Insert Runtime Tools Help All changes saved
Files
.config
sample_data
OMPHOTO.jpeg
Disk 71.24 GB available
+ Code + Text
LAB 7 : WATERSHED SEGMENTATION
[1] 1 import cv2
2 import numpy as np
3 from matplotlib import pyplot as plt
[2] 1 # Load the image
2 image = cv2.imread('/content/OMPHOTO.jpeg')
3 gray = cv2.cvtColor(image, cv2.COLOR_BGR2GRAY)
[3] 1 ret, thresh = cv2.threshold(gray, 0, 255, cv2.THRESH_BINARY_INV + cv2.THRESH_OTSU)
2 kernel = np.ones((3, 3), np.uint8)
3 opening = cv2.morphologyEx(thresh, cv2.MORPH_OPEN, kernel, iterations=2)
4 sure_bg = cv2.dilate(opening, kernel, iterations=3)
5 dist_transform = cv2.distanceTransform(opening, cv2.DIST_L2, 5)
6 ret, sure_fg = cv2.threshold(dist_transform, 0.7 * dist_transform.max(), 255, 0)
7
8 sure_fg = np.uint8(sure_fg)
9 unknown = cv2.subtract(sure_bg, sure_fg)
[4] 1 ret, markers = cv2.connectedComponents(sure_fg)
2 markers = markers + 1
3 markers[unknown == 255] = 0
4 markers = cv2.watershed(image, markers)
5 image[markers == -1] = [255, 0, 0]
1 # Display the result
2 plt.subplot(121), plt.imshow(cv2.cvtColor(image, cv2.COLOR_BGR2RGB)), plt.title('Segmented Image')
3 plt.subplot(122), plt.imshow(markers, cmap='gray'), plt.title('Markers')
4 plt.show()
Segmented Image
Markers
1s completed at 4:10PM

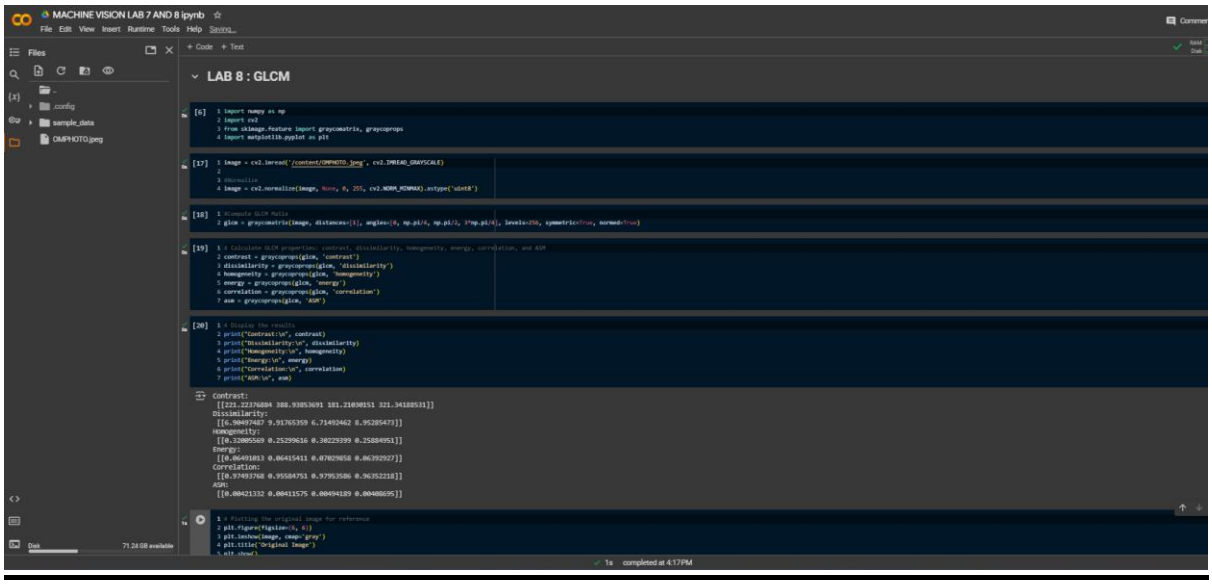
LAB 8: GLCM (Gray Level Co-occurrence Matrix)

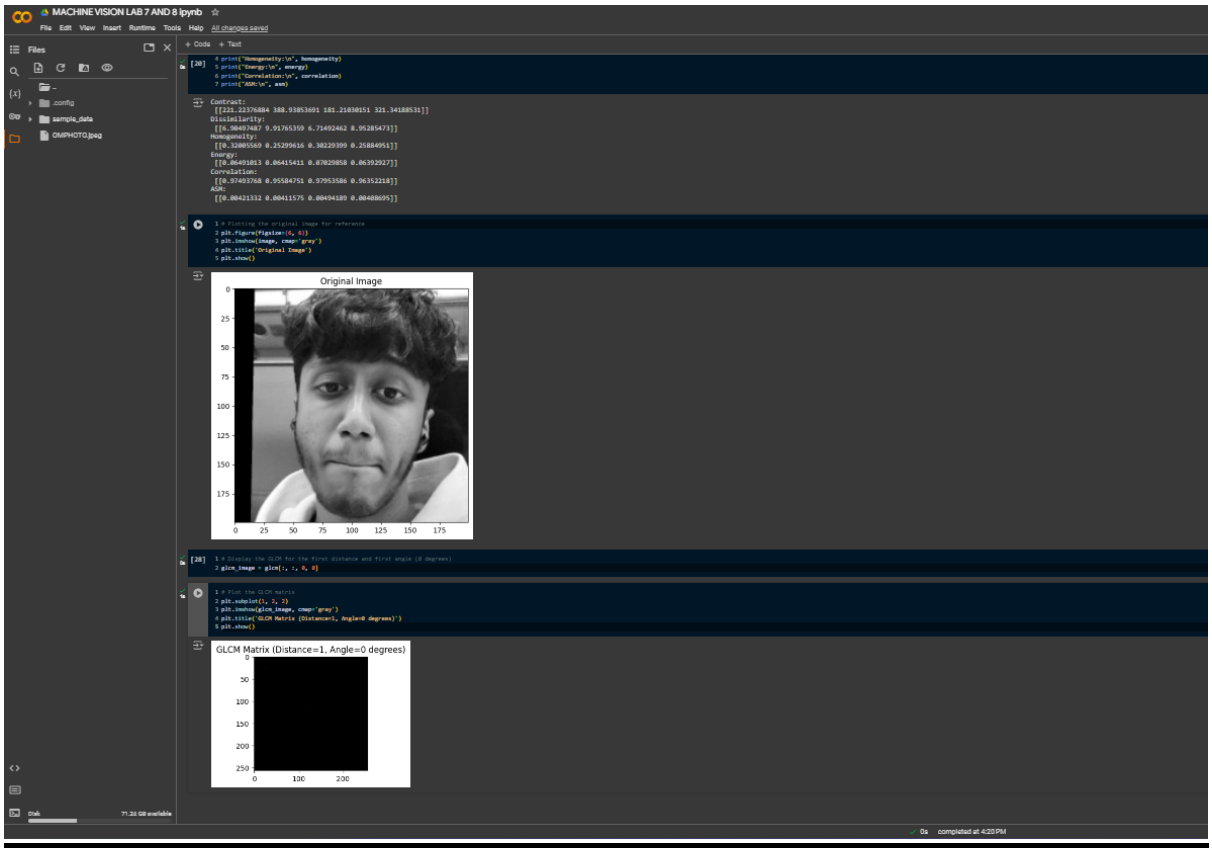
CODE:

```
import numpy as np

import cv2

from skimage.feature import graycomatrix, graycoprops

import matplotlib.pyplot as plt


image = cv2.imread('/content/OMPHOTO.jpeg', cv2.IMREAD_GRAYSCALE)


#Normalize

image = cv2.normalize(image, None, 0, 255, cv2.NORM_MINMAX).astype('uint8')


#Compute GLCM Matix

glcm = graycomatrix(image, distances=[1], angles=[0, np.pi/4, np.pi/2,
3*np.pi/4], levels=256, symmetric=True, normed=True)


# Calculate GLCM properties: contrast, dissimilarity, homogeneity, energy,
correlation, and ASM

contrast = graycoprops(glcm, 'contrast')

dissimilarity = graycoprops(glcm, 'dissimilarity')

homogeneity = graycoprops(glcm, 'homogeneity')

energy = graycoprops(glcm, 'energy')

correlation = graycoprops(glcm, 'correlation')

asm = graycoprops(glcm, 'ASM')


# Display the results

print("Contrast:\n", contrast)

print("Dissimilarity:\n", dissimilarity)

print("Homogeneity:\n", homogeneity)

print("Energy:\n", energy)

print("Correlation:\n", correlation)

print("ASM:\n", asm)
```

```
# Plotting the original image for reference
plt.figure(figsize=(6, 6))
plt.imshow(image, cmap='gray')
plt.title('Original Image')
plt.show()

# Display the GLCM for the first distance and first angle (0 degrees)
glcm_image = glcm[:, :, 0, 0]

# Plot the GLCM matrix
plt.subplot(1, 2, 2)
plt.imshow(glcm_image, cmap='gray')
plt.title('GLCM Matrix (Distance=1, Angle=0 degrees)')
plt.show()
```

OUTPUT:


MACHINE VISION LAB 7 AND 8.ipynb
LAB 8 : GLCM
Contrast:
[[221.22376884 388.93053691 181.21030151 321.34188531]]
Dissimilarity:
[[6.90497487 9.91765359 6.71492462 8.95285473]]
Homogeneity:
[[0.32005569 0.25299616 0.38229399 0.25884951]]
Energy:
[[0.06491813 0.06415411 0.07029858 0.06392927]]
Correlation:
[[0.97493768 0.95584751 0.97953586 0.96352218]]
ASM:
[[0.00421332 0.00411575 0.00494189 0.00408695]]


MACHINE VISION LAB 7 AND 8.ipynb
Original Image
GLCM Matrix (Distance=1, Angle=0 degrees)