Histogram Equalization of Low Contrast Images

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1 Aim

The aim of this project is to enhance the contrast of a low contrast image using histogram equalization. This process will involve generating histograms for both the original and equalized images to observe the distribution of pixel intensity values.

2 Source Code

The following Python code demonstrates the process of loading a low contrast image, applying histogram equalization, and generating histograms for both the original and equalized images in Google Colab.

```
import cv2
import numpy as np
import matplotlib.pyplot as plt
from google.colab.patches import cv2_imshow  # Import cv2_imshow
    for displaying images in Colab

# Step 1: Load the Image
image = cv2.imread('low_contrast_image.jpg')  # Replace with your
    image path
gray_image = cv2.cvtColor(image, cv2.COLOR_BGR2GRAY)

# Generate Histogram for Original Image
plt.figure(figsize=(12, 6))

plt.subplot(1, 2, 1)
plt.title('Original␣Image␣Histogram')
plt.xlabel('Pixel␣Intensity')
plt.ylabel('Frequency')
plt.hist(gray_image.ravel(), bins=256, range=[0, 256], color='black
    ')

# Step 2: Apply Histogram Equalization
equalized_image = cv2.equalizeHist(gray_image)

# Generate Histogram for Equalized Image
plt.subplot(1, 2, 2)
plt.title('Equalized␣Image␣Histogram')
```

```
plt.xlabel('Pixel Intensity')
plt.ylabel('Frequency')
plt.hist(equalized_image.ravel(), bins=256, range=[0, 256], color='
    black')

# Show the histograms
plt.show()

# Optionally, display the images using cv2_imshow
cv2_imshow(gray_image)  # Display original grayscale image
cv2_imshow(equalized_image)  # Display equalized image
```

3 Output

The output of the code includes the original low contrast image, the equalized image, and their respective histograms.

Figure 1: Original Image

Figure 2: Equalized Image

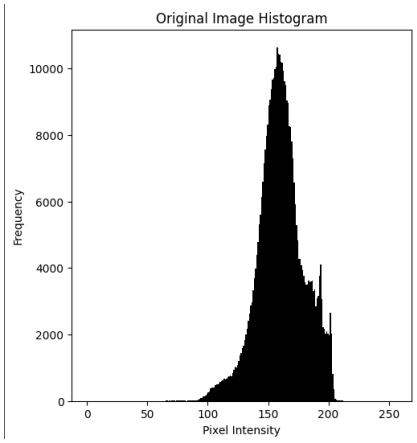

Figure 3: Original Image Histogram

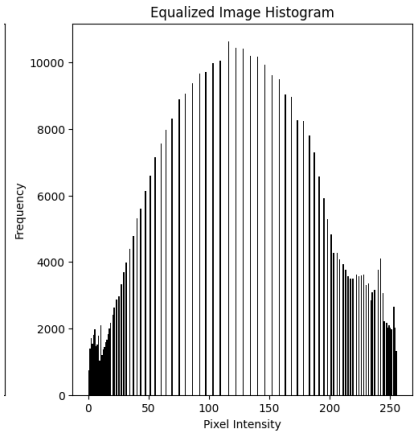

Figure 4: Equalized Image Histogram

4 Results

The histogram of the original image shows a concentrated distribution of pixel intensities, indicating low contrast. After applying histogram equalization, the histogram of the equalized image is more spread out across the intensity range, indicating improved contrast. This enhancement allows for better visibility of features in the image.