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

# Load the image in grayscale
image = cv2.imread('/content/WhatsApp Image 2025-03-11 at 11.48.50 PM.jpeg', cv2.IMREAD_GRAYSCALE)

# Check if image is loaded properly
if image is None:
    print("Error: Could not load image.")
    exit()

# Define the Roberts Cross kernels
kernel_x = np.array([[1, 0], [0, -1]], dtype=np.float32)
kernel_y = np.array([[0, 1], [-1, 0]], dtype=np.float32)

# Apply the Roberts Cross operator using convolution
gradient_x = cv2.filter2D(image, -1, kernel_x)
gradient_y = cv2.filter2D(image, -1, kernel_y)

# Compute the magnitude of the gradient
gradient_magnitude = np.sqrt(gradient_x**2 + gradient_y**2)

# Convert the magnitude to uint8 for display
gradient_magnitude = np.uint8(np.absolute(gradient_magnitude))

# Display the original image and gradient magnitude
plt.figure(figsize=(10, 5))

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

plt.subplot(1, 3, 2)
plt.title('Gradient in X direction (Roberts)')
plt.imshow(gradient_x, cmap='gray')

plt.subplot(1, 3, 3)
plt.title('Gradient Magnitude (Roberts)')
plt.imshow(gradient_magnitude, cmap='gray')

plt.show()

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