Assignments_3

November 24, 2024

```
[1]: import cv2
     import numpy as np
     import matplotlib.pyplot as plt
```
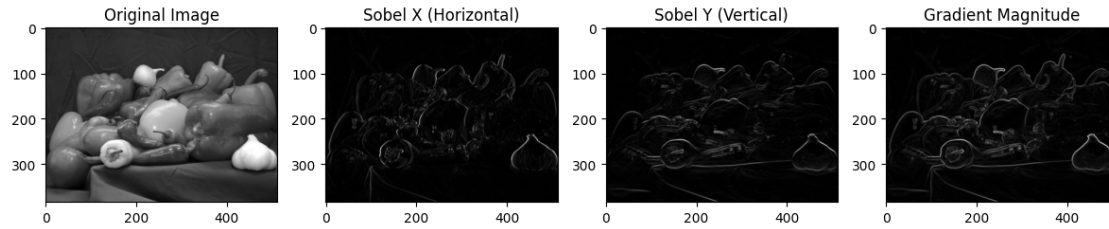
0.0.1 Sobel Filters and Magnitude

```
[2]: # Load the grayscale image
     image = cv2.imread('img.png', cv2.IMREAD_GRAYSCALE)

     # Apply Sobel filters
     sobel_x = cv2.Sobel(image, cv2.CV_64F, 1, 0, ksize=3)  # Horizontal
     sobel_y = cv2.Sobel(image, cv2.CV_64F, 0, 1, ksize=3)  # Vertical

     # Compute magnitude
     magnitude = np.sqrt(sobel_x**2 + sobel_y**2)
     magnitude = np.uint8(255 * magnitude / np.max(magnitude))  # Normalize to 0-255

     # Display results
     plt.figure(figsize=(12, 6))
     plt.subplot(1, 4, 1)
     plt.imshow(image, cmap='gray')
     plt.title("Original Image")
     plt.subplot(1, 4, 2)
     plt.imshow(np.abs(sobel_x), cmap='gray')
     plt.title("Sobel X (Horizontal)")
     plt.subplot(1, 4, 3)
     plt.imshow(np.abs(sobel_y), cmap='gray')
     plt.title("Sobel Y (Vertical)")
     plt.subplot(1, 4, 4)
     plt.imshow(magnitude, cmap='gray')
     plt.title("Gradient Magnitude")
     plt.tight_layout()
     plt.show()
```
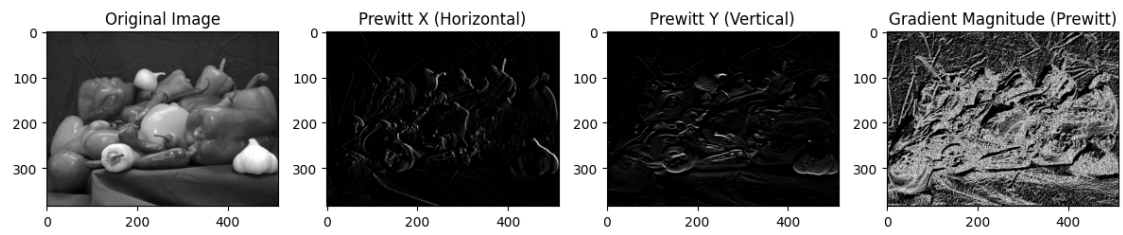
0.0.2 Prewitt Filters and Magnitude

```
[3]: # Define Prewitt kernels
     prewitt_x_kernel = np.array([[1, 0, -1], [1, 0, -1], [1, 0, -1]])
     prewitt_y_kernel = np.array([[1, 1, 1], [0, 0, 0], [-1, -1, -1]])

     # Apply Prewitt filters
     prewitt_x = cv2.filter2D(image, -1, prewitt_x_kernel)  # Horizontal
     prewitt_y = cv2.filter2D(image, -1, prewitt_y_kernel)  # Vertical

     # Compute magnitude
     magnitude_prewitt = np.sqrt(prewitt_x**2 + prewitt_y**2)
     magnitude_prewitt = np.uint8(255 * magnitude_prewitt / np.
      ↪max(magnitude_prewitt))  # Normalize to 0-255

     # Display results
     plt.figure(figsize=(12, 6))
     plt.subplot(1, 4, 1)
     plt.imshow(image, cmap='gray')
     plt.title("Original Image")
     plt.subplot(1, 4, 2)
     plt.imshow(prewitt_x, cmap='gray')
     plt.title("Prewitt X (Horizontal)")
     plt.subplot(1, 4, 3)
     plt.imshow(prewitt_y, cmap='gray')
     plt.title("Prewitt Y (Vertical)")
     plt.subplot(1, 4, 4)
     plt.imshow(magnitude_prewitt, cmap='gray')
     plt.title("Gradient Magnitude (Prewitt)")
     plt.tight_layout()
     plt.show()
```

Original Image | Prewitt X (Horizontal) | Prewitt Y (Vertical) | Gradient Magnitude (Prewitt)

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