# Step 1: Install OpenCV

!pip install opencv-python-headless

# Step 2: Import required libraries

import cv2

import numpy as np

from matplotlib import pyplot as plt

from google.colab import files

# Step 3: Upload a binary or grayscale image

print("Upload a binary or grayscale image:")

uploaded = files.upload()

image\_path = next(iter(uploaded))

# Step 4: Read the image

img = cv2.imread(image\_path, cv2.IMREAD\_GRAYSCALE)

# Step 5: Threshold to ensure binary format (optional for clean input)

\_, binary = cv2.threshold(img, 127, 255, cv2.THRESH\_BINARY)

# Step 6: Define kernel

kernel = np.ones((5, 5), np.uint8)

# Step 7: Apply Morphological Gradient

gradient = cv2.morphologyEx(binary, cv2.MORPH\_GRADIENT, kernel)

# Step 8: Show original and gradient images

plt.figure(figsize=(10, 5))

plt.subplot(1, 2, 1)

plt.imshow(binary, cmap='gray')

plt.title('Original Binary Image')

plt.axis('off')

plt.subplot(1, 2, 2)

plt.imshow(gradient, cmap='gray')

plt.title('Morphological Gradient')

plt.axis('off')

plt.show()

# Step 9: Save the result

cv2.imwrite("gradient\_output.jpg", gradient)

print("Saved as gradient\_output.jpg")

