# 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 an image

print("Upload a grayscale image:")

uploaded = files.upload()

image\_path = next(iter(uploaded))

# Step 4: Read the image in grayscale

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

# Step 5: Define the structuring element (kernel)

kernel = np.ones((15, 15), np.uint8)

# Step 6: Apply Black-Hat transformation

blackhat = cv2.morphologyEx(img, cv2.MORPH\_BLACKHAT, kernel)

# Step 7: Display the results

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

plt.subplot(1, 2, 1)

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

plt.title('Original Image')

plt.axis('off')

plt.subplot(1, 2, 2)

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

plt.title('Black-Hat Result')

plt.axis('off')

plt.show()

# Step 8: Save the result

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

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

