import cv2

import numpy as np

import matplotlib.pyplot as plt

def ideal\_high\_pass\_filter(image, cutoff\_frequency):

rows, cols = image.shape

crow, ccol = rows // 2, cols // 2

mask = np.zeros((rows, cols), np.uint8)

for x in range(rows):

for y in range(cols):

if np.sqrt((x - crow) \*\* 2 + (y - ccol) \*\* 2) > cutoff\_frequency:

mask[x, y] = 1

return mask

image\_path = 'car.jpg'

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

image = cv2.resize(image, (256, 256))

dft = cv2.dft(np.float32(image), flags=cv2.DFT\_COMPLEX\_OUTPUT)

dft\_shift = np.fft.fftshift(dft)

cutoff\_frequency = 30

mask = ideal\_high\_pass\_filter(image, cutoff\_frequency)

filtered\_dft\_shift = dft\_shift \* mask[..., np.newaxis]

f\_ishift = np.fft.ifftshift(filtered\_dft\_shift)

img\_back = cv2.idft(f\_ishift)

img\_back\_magnitude = cv2.magnitude(img\_back[:, :, 0], img\_back[:, :, 1])

plt.figure(figsize=(12, 8))

plt.subplot(1, 3, 1)

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

plt.title('Original Image')

plt.axis('off')

plt.subplot(1, 3, 2)

plt.imshow(np.log(np.abs(dft\_shift[:, :, 0]) + 1), cmap='gray')

plt.title('Magnitude Spectrum')

plt.axis('off')

plt.subplot(1, 3, 3)

plt.imshow(img\_back\_magnitude, cmap='gray')

plt.title('Image after Ideal HPF')

plt.axis('off')

plt.tight\_layout()

plt.show()