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# Реализуйте высокочастотную фильтрацию на основе ядра Гаусса
# Реализуйте удаление периодического шума
import numpy as np
import cv2 as cv
from random import randint
from matplotlib import pyplot as plt
from skimage.feature import peak_local_max

img = cv.imread('periodic_noise.jpg', cv.IMREAD_GRAYSCALE)

dft = cv.dft(np.float32(img), flags=cv.DFT_COMPLEX_OUTPUT)
dft_shift = np.fft.fftshift(dft)

magnitude_spectrum = 20 * np.log(cv.magnitude(dft_shift[:, :, 0],
dft_shift[:, :, 1]))

plt.figure(figsize=(12, 6))
plt.subplot(121), plt.imshow(img, cmap='gray')
plt.title('Input Image'), plt.xticks([]), plt.yticks([])
plt.subplot(122), plt.imshow(magnitude_spectrum, cmap='gray')
plt.title('Magnitude Spectrum'), plt.xticks([]), plt.yticks([])
plt.show()


rows, cols = img.shape
crow, ccol = rows // 2, cols // 2
sigma = 30
x = np.arange(0, cols, 1)
y = np.arange(0, rows, 1)
X, Y = np.meshgrid(x, y)
gaussian_mask = np.exp(-((X - ccol)**2 + (Y - crow)**2) / (2 *
sigma**2))


high_pass_mask = 1 - gaussian_mask

dft_shift_high_pass = dft_shift * high_pass_mask[:, :, np.newaxis]
f_ishift_high_pass = np.fft.ifftshift(dft_shift_high_pass)
img_back_high_pass = cv.idft(f_ishift_high_pass)
img_back_high_pass = cv.magnitude(img_back_high_pass[:, :, 0],
img_back_high_pass[:, :, 1])

plt.figure(figsize=(12, 6))
plt.subplot(121), plt.imshow(img, cmap='gray')
plt.title('Input Image'), plt.xticks([]), plt.yticks([])
plt.subplot(122), plt.imshow(img_back_high_pass, cmap='gray')
plt.title('High Pass Filtered Image'), plt.xticks([]), plt.yticks([])
plt.show()

min_distance =  10
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threshold_abs =  270
noise_coords = peak_local_max(magnitude_spectrum,
min_distance=min_distance, threshold_abs=threshold_abs)
print(len(noise_coords))
radius = 81
mask_noise = np.ones_like(dft_shift)
cv.circle(mask_noise, (ccol, crow), radius + 12, (0, 0), -1)
cv.circle(mask_noise, (ccol, crow), radius - 12, (1, 1), -1)

dft_shift_noise_removed = dft_shift * mask_noise
f_ishift_noise_removed = np.fft.ifftshift(dft_shift_noise_removed)
img_back_noise_removed = cv.idft(f_ishift_noise_removed)
img_back_noise_removed = cv.magnitude(img_back_noise_removed[:, :, 0],
img_back_noise_removed[:, :, 1])

plt.figure(figsize=(12, 6))
plt.subplot(121), plt.imshow(img, cmap='gray')
plt.title('Input Image'), plt.xticks([]), plt.yticks([])
plt.subplot(122), plt.imshow(img_back_noise_removed, cmap='gray')
plt.title('Noise Removed Image'), plt.xticks([]), plt.yticks([])
plt.show()
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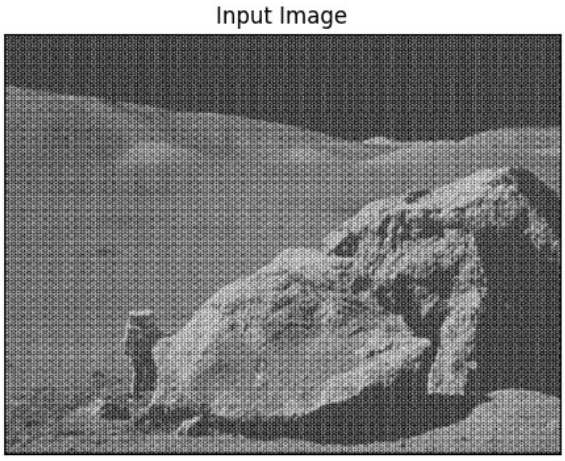

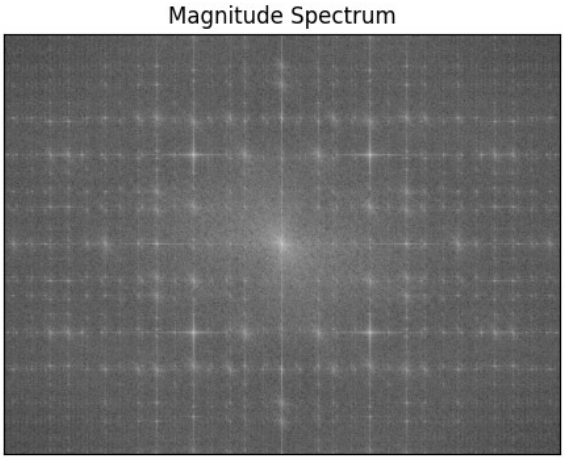

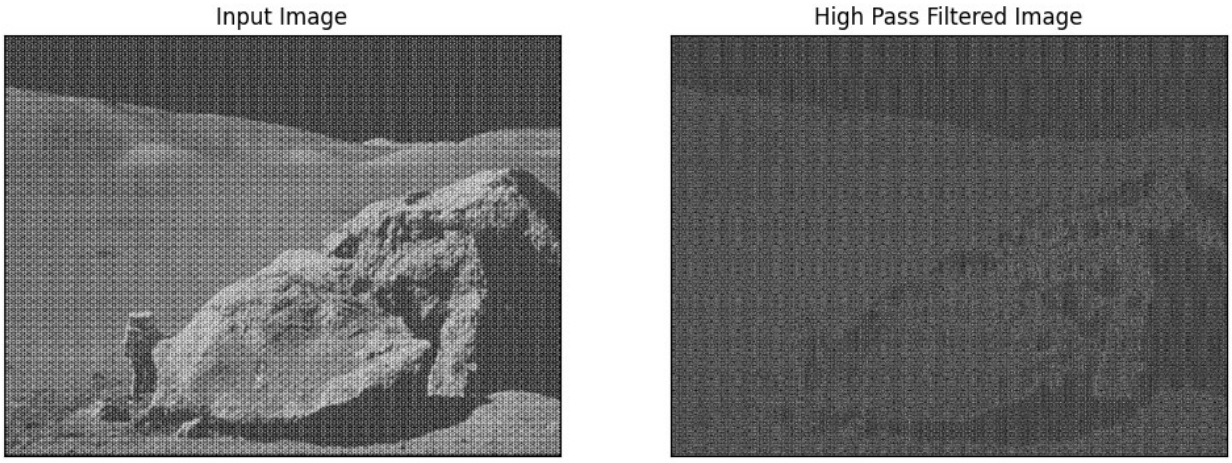
Input Image
High Pass Filtered Image

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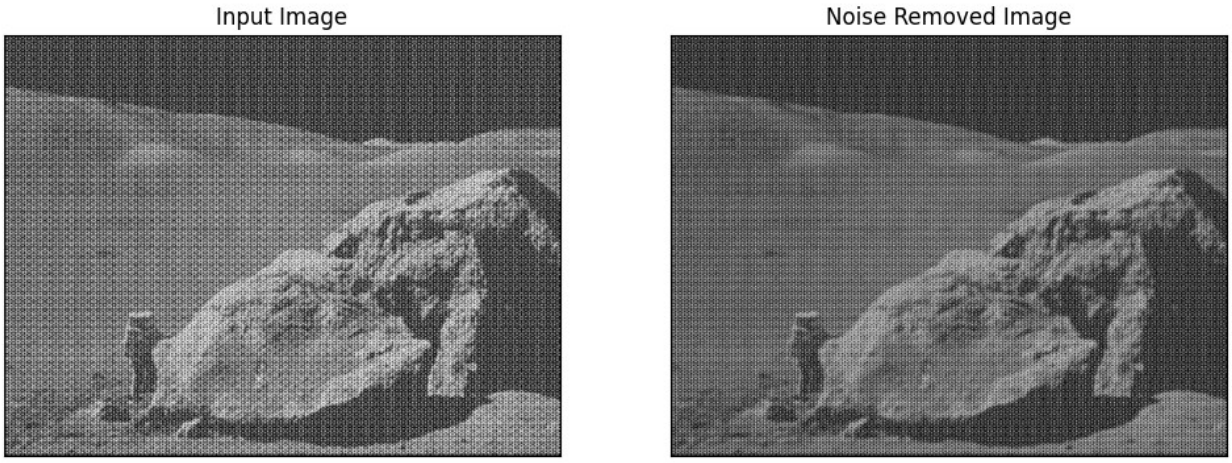
Input Image
Noise Removed Image