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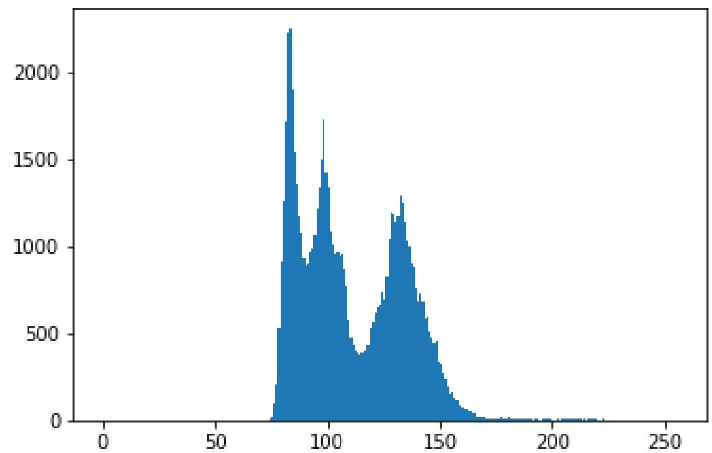
CSCE460301 - Fundamental of Computer Vision

Assignment #1

Problem 1:

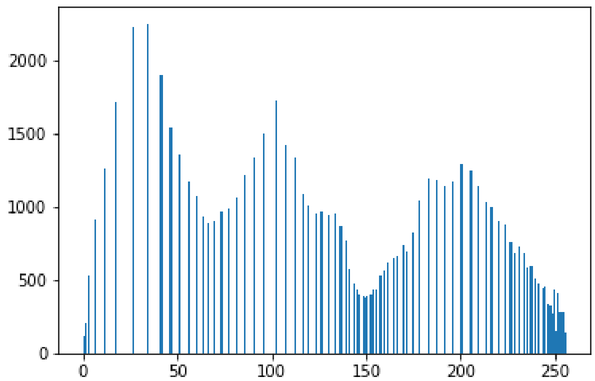
For a higher contrast, that means we need to equalize the histogram of the image. Equalizing the histogram means better frequency distribution.

- The histogram of the input image was:



- The image to the left is the image before the histogram equalization and the image to the right is the one with the higher contrast after the equalization

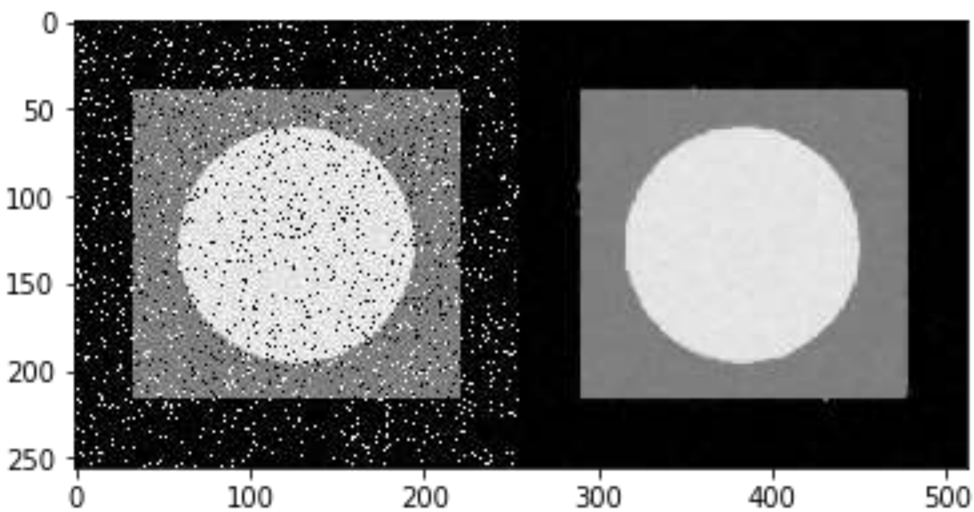
- The image below is the histogram after the equalization



Problem 2:

To remove salt and pepper noise for the image, I used the medianBlur filter from OpenCV library. I used the kernel size of 5 and it worked perfectly fine, removing all the salt and pepper noise in the input image

- The image below shows the image before and after the median blur filter



Problem 3:

1) Gaussian high pass filter:

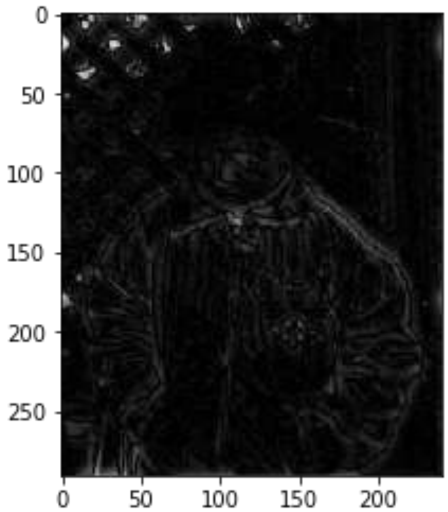
- To build the high pass filter I used the equation:

$$H(u,v) = 1 - e^{-D^2(u,v)/2D_0^2}$$

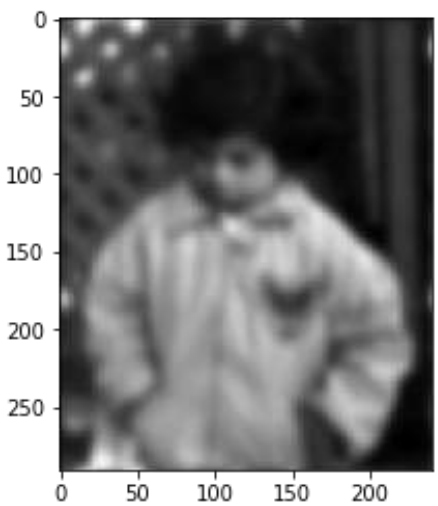
Then I used different values for D0 to experiment the output image

a) D0 = 12

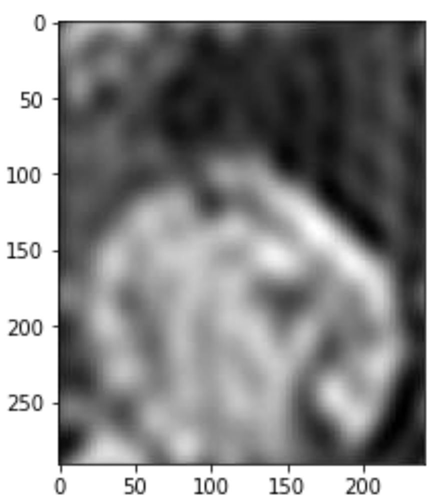
GHLF output image



GLPF output image

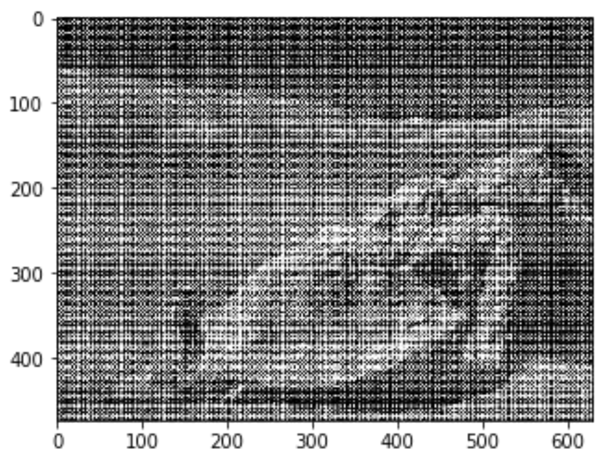


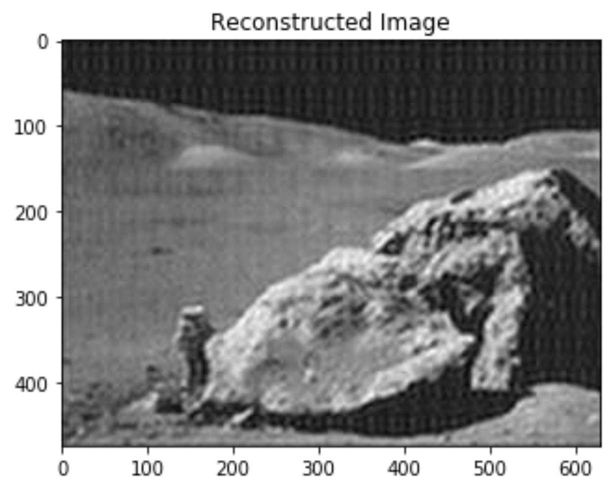
ILPF



Notes: From the two images, we can see that ideal lowpass filter resulted the ringing effect when D0=10 used. On the other hand the Gaussian lowpass filter did the blurring function perfectly with any ringing. The ringing effect in the ideal pass filter occurs because the ideal low pass filter is a rectangular function and the inverse Fourier transform of a rectangular function in a sinc function. See the image below of the sinc function. So in brief, the Gaussian low pass filter is better than ideal low pass filter.

Question 4:
To remove the repeating pattern from the image, I got the fft of the image and I did calculations on it.
The input image:





Question 5:

To extract the image of the moon, I did some operations. Those were in order: medianblur, erosion, dilation, closing, mask.

Medianblud removed the noise in the image, erosion and closing resulted figure 2 and the mask was the multiplication of figure 2 and the original image

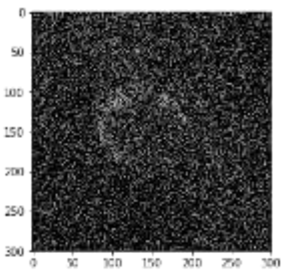


Fig1

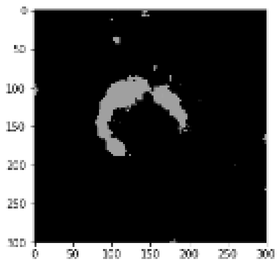


fig2

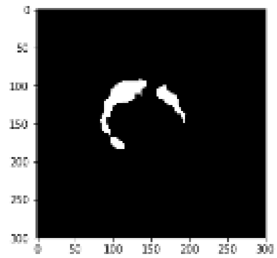


fig3

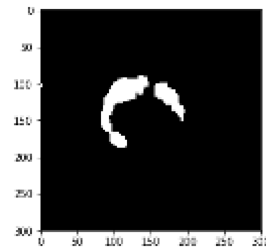


fig4

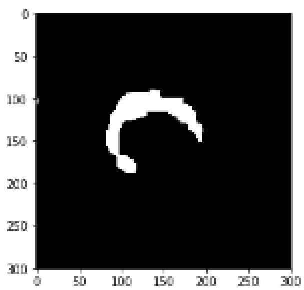


Fig5

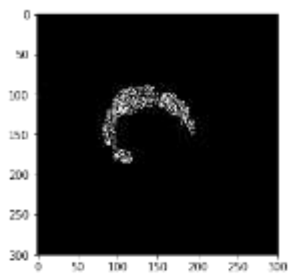


fig5

Fig1 – the original image

Fig2 – the output of the median blur

Fig3 – the output of erosion

Fig 4 – the output of closing

Fig 5 – the output of the dilation

Fig6 – the output of the mask

Question 6:

For question 6, I implemented two functions. I check on the f0 of the fourier transform image since f0 has the dc component of the image of the brightness indicator of each image.

- The function:

```
def detectrightness2(img):
    f = np.fft.fft2(img) ## Fourier Transform
    fshift = np.fft.fftshift(f) ## Shifting zero frequency to center
    freq_spec = 20*np.log(np.abs(fshift))  ## Take absolute and log only for displaying purpo
    mean = freq_spec[0][0]
    if mean [0] == mean [2]:
        print ("The image is taken at night")
    else:
        print ("The image is in daylight")
```

- A sample output would be:

```
detectrightness2(src3)
Run this cell
The image is in daylight
```

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