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Project2 report

source code

```
import numpy as np
import matplotlib.pyplot as plt
import cv2
import math
import pandas as pd


def get_norm_magnitude(ft):
    mg = np.abs(ft)
    scale = 255/np.log(np.max(mg))
    mg = scale*np.log(mg)
    mg = np.clip(np.uint8(mg), 0, 255)
    return mg


# read image
img = plt.imread('Bird 2.tif')
img = np.float32(img)

# dtft
ftimage = np.fft.fft2(img)
ftimage = np.fft.fftshift(ftimage)

# magnitude of dtft
magnitude = get_norm_magnitude(ftimage)
cv2.imwrite('magnitude.png', magnitude)


# ideal high, low pass filter
rows, cols = img.shape
crow, ccol = rows//2, cols//2

mask_low = np.zeros((rows, cols), np.uint8)
for x in range(rows):
    for y in range(cols):
        dist = np.linalg.norm(np.array([x, y]) - np.array([crow, ccol]))
        if dist < 30:
            mask_low[x, y] = 1

mask_high = 1 - mask_low

cv2.imwrite('low_pass_mask.png', mask_low*255)
cv2.imwrite('high_pass_mask.png', mask_high*255)

# low pass image
```

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```
ftimage_low_mask = ftimage*mask_low
iftimage_low = np.fft.ifftshift(ftimage_low_mask)
iftimage_low = np.fft.ifft2(iftimage_low)
iftimage_low = np.clip(np.uint8(np.abs(iftimage_low)), 0, 255)

ftimage_low_mask = get_norm_magnitude(ftimage_low_mask)
cv2.imwrite('ftimage_low.png', ftimage_low_mask)
cv2.imwrite('iftimage_low.png', iftimage_low)

# high pass image
ftimage_high_mask = ftimage*mask_high
iftimage_high = np.fft.ifftshift(ftimage_high_mask)
iftimage_high = np.fft.ifft2(iftimage_high)
iftimage_high = np.clip(np.uint8(np.abs(iftimage_high)), 0, 255)

ftimage_high_mask = get_norm_magnitude(ftimage_high_mask)
cv2.imwrite('ftimage_high.png', ftimage_high_mask)
cv2.imwrite('iftimage_high.png', iftimage_high)

# top 25 frequency
magnitude = np.abs(ftimage)
mag_l, _ = np.hsplit(magnitude, 2)
mag = np.hstack((mag_l, np.zeros((512, 256), dtype=np.uint8)))
leftmag = get_norm_magnitude(mag)
cv2.imwrite('magnitude_left.png', leftmag)

for i in range(25):
    idx = np.unravel_index(mag.argmax(), mag.shape)
    v = mag[idx]
    mag[idx] = 0
    print("%02d, %.3f" % (i+1, v), idx)
```

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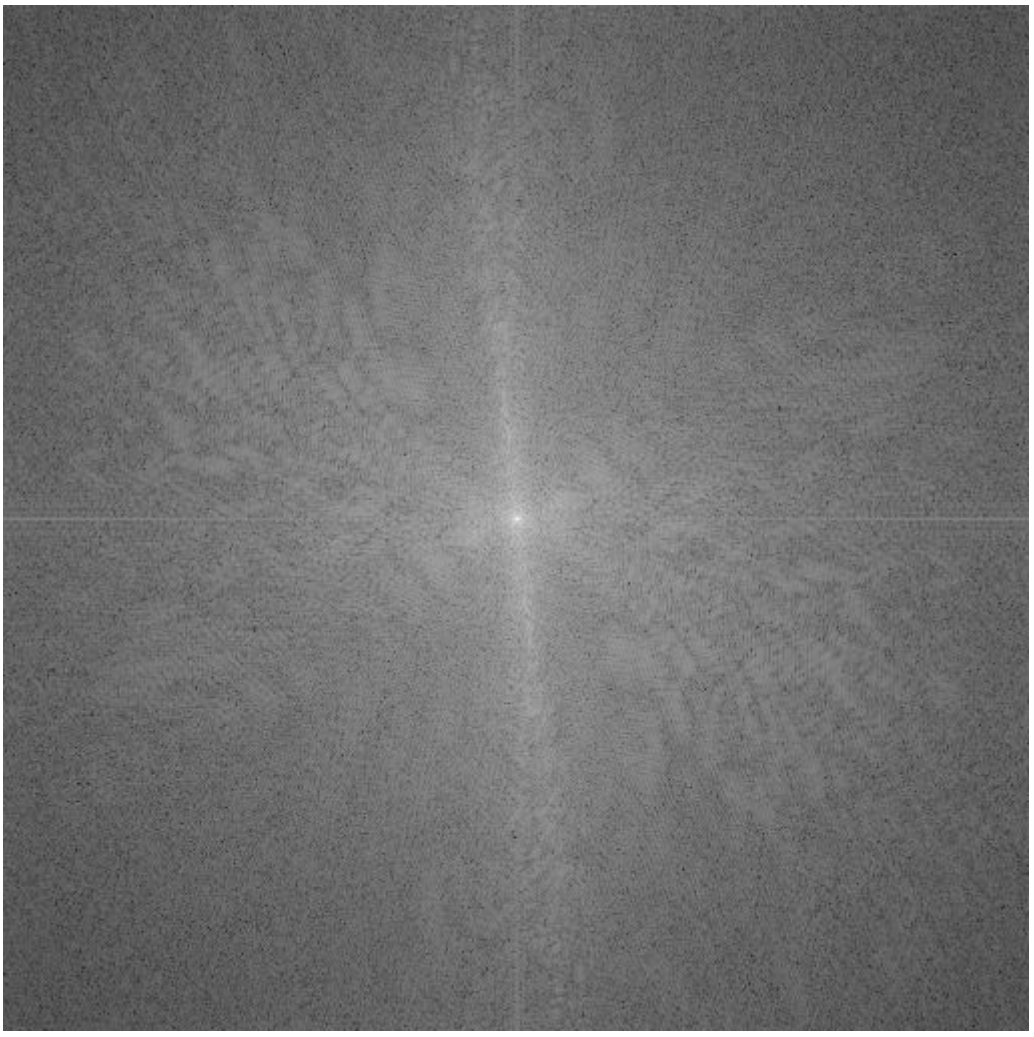
DFT magnitude in log scale



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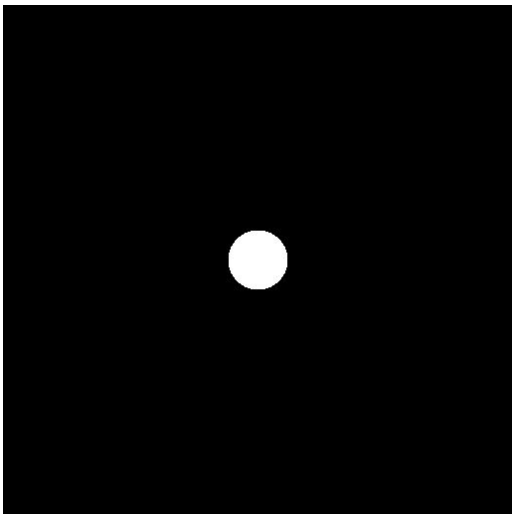
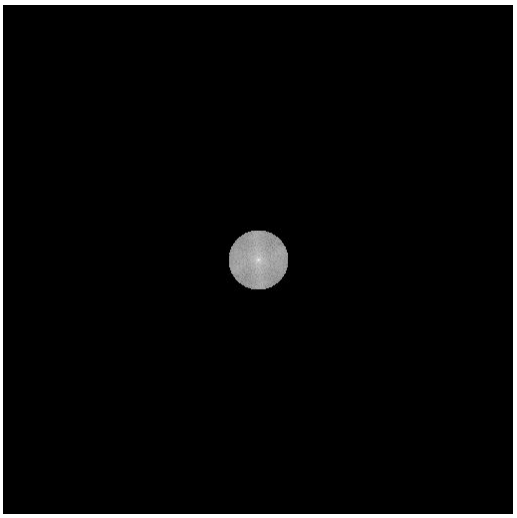
Low pass filter

ideal low pass filter



filtered frequencies



inververse DFT image

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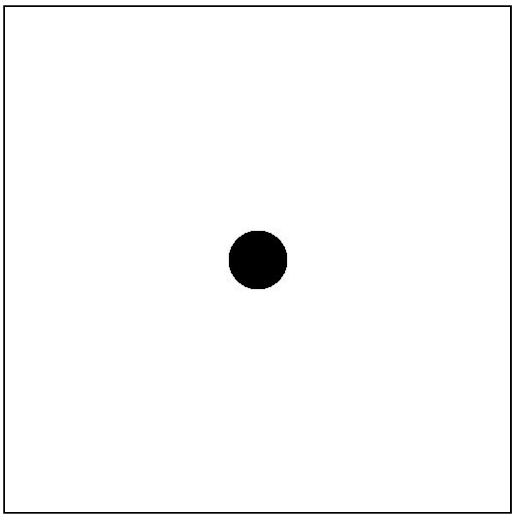
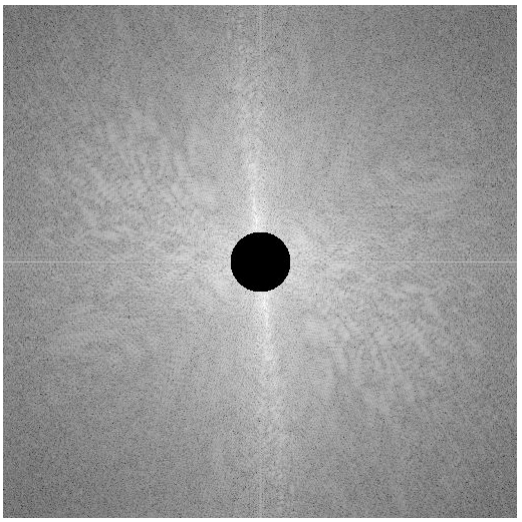
High pass filter

ideal high pass filter



filtered frequencies



inverse DFT image

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Top 25 frequencies

left side magnitude

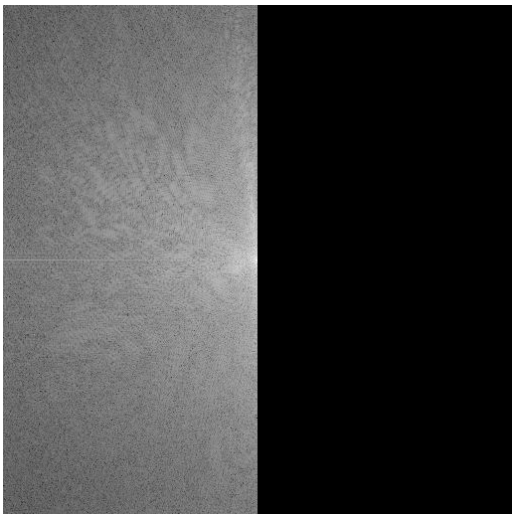

table of top 25 frequencies

#	magnitude	(u, v)
01	3353201.026	(256, 254)
02	3153898.624	(256, 255)
03	1911080.227	(255, 255)
04	1763699.345	(257, 255)
05	1389293.497	(257, 254)
06	1295463.995	(253, 255)
07	1126762.521	(259, 254)
08	965729.917	(258, 255)
09	810353.144	(259, 255)
10	685227.770	(253, 254)
11	680877.275	(256, 253)
12	646195.721	(258, 252)
13	633484.345	(254, 254)
14	616688.109	(258, 253)
15	592982.050	(252, 253)
16	579739.474	(248, 255)
17	544777.894	(254, 255)
18	540892.333	(254, 252)
19	524469.412	(260, 254)
20	523638.812	(262, 255)
21	507827.765	(254, 253)
22	484987.833	(255, 252)
23	477167.100	(255, 254)
24	459230.016	(252, 255)
25	448247.705	(261, 254)