

Lab7

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Section: A

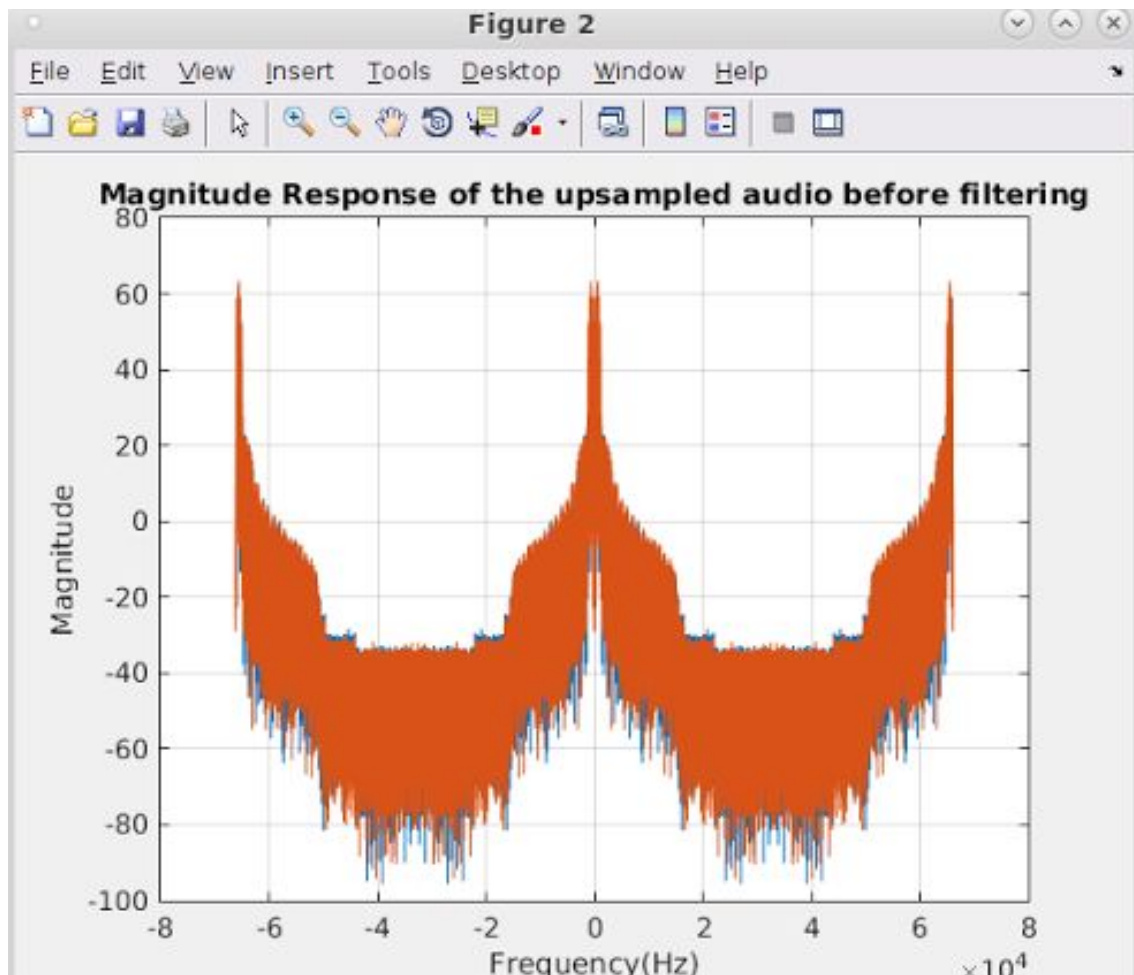
1. Discussion
2. Upsampling and Downsampling

Report Item 1:

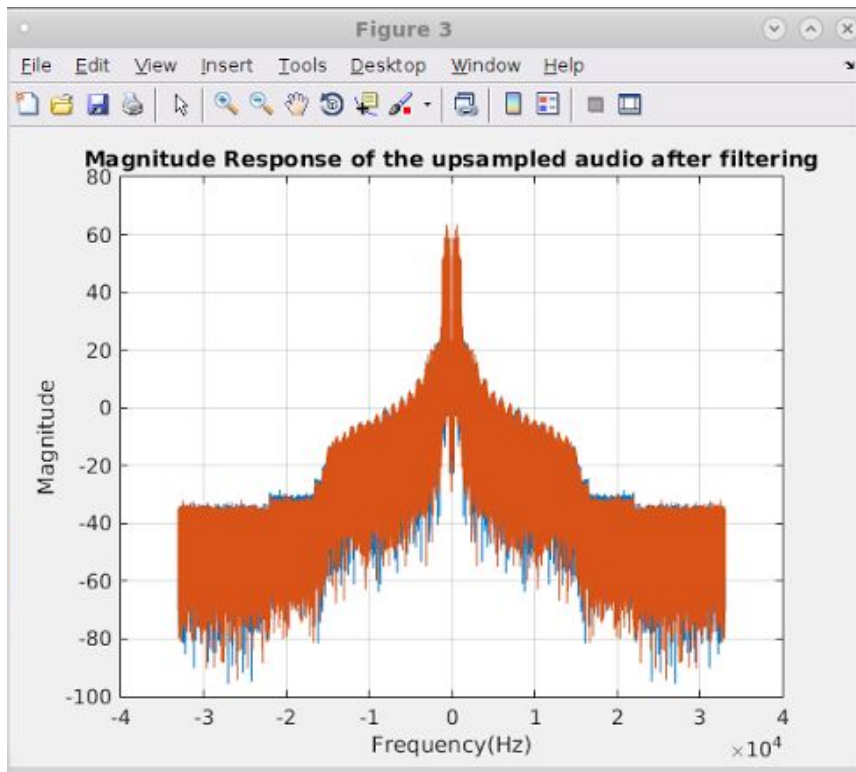
U and D

Choose U to be 2 and D to be 3 will give to the final sampling rate of 44,100 Hz.

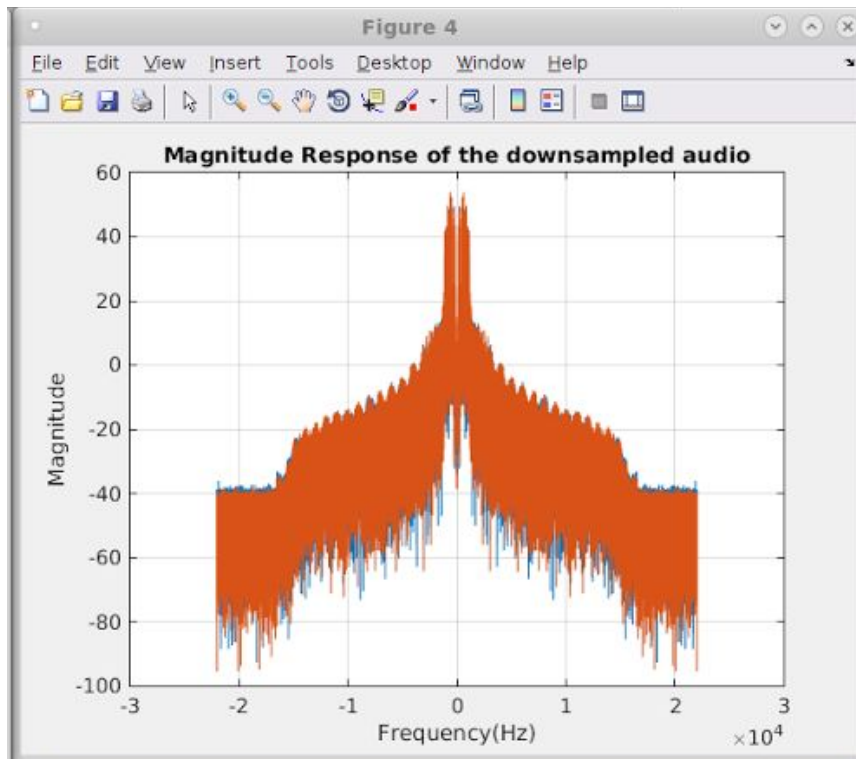
Magnitude Response of the upsampled audio before filtering



Magnitude Response of the upsampled audio after filtering



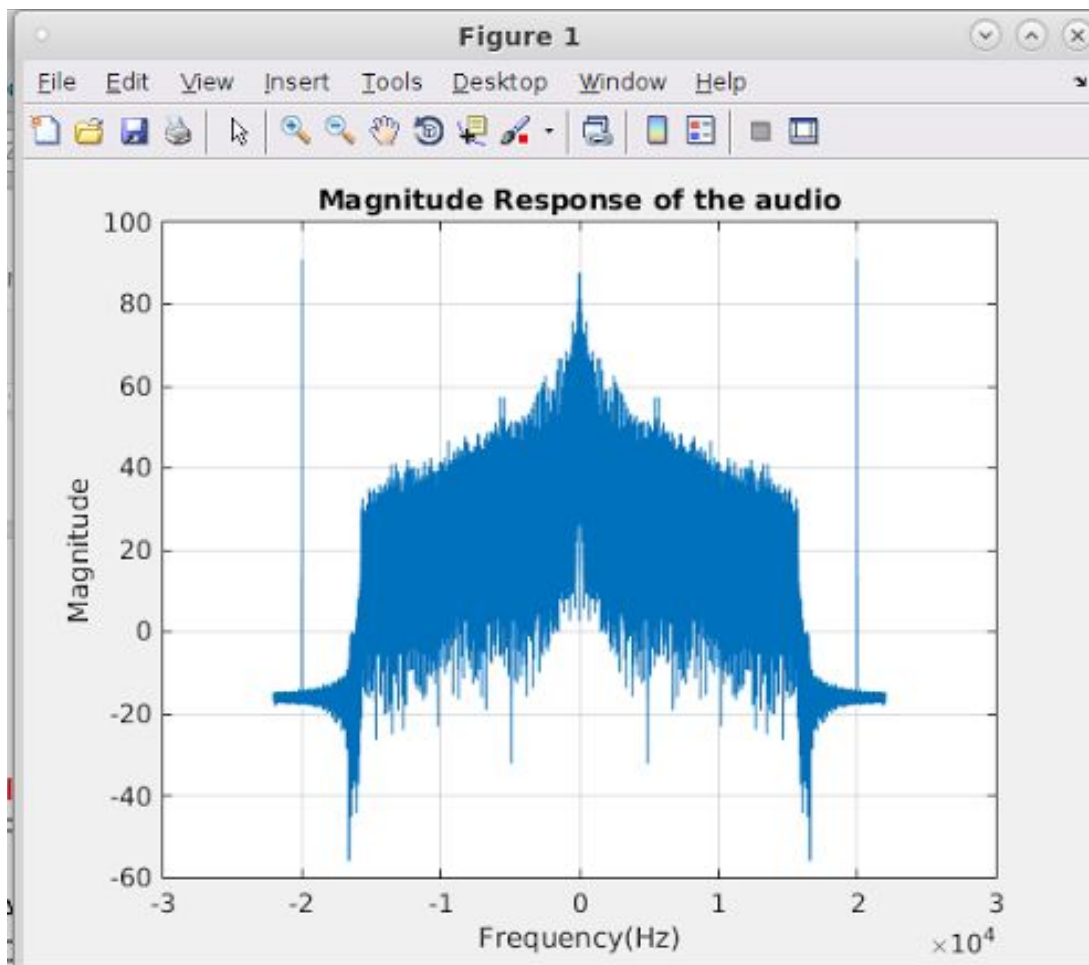
Magnitude Response of the downsampled audio



Sound: The difference could not be distinguished.

Report Item 2:

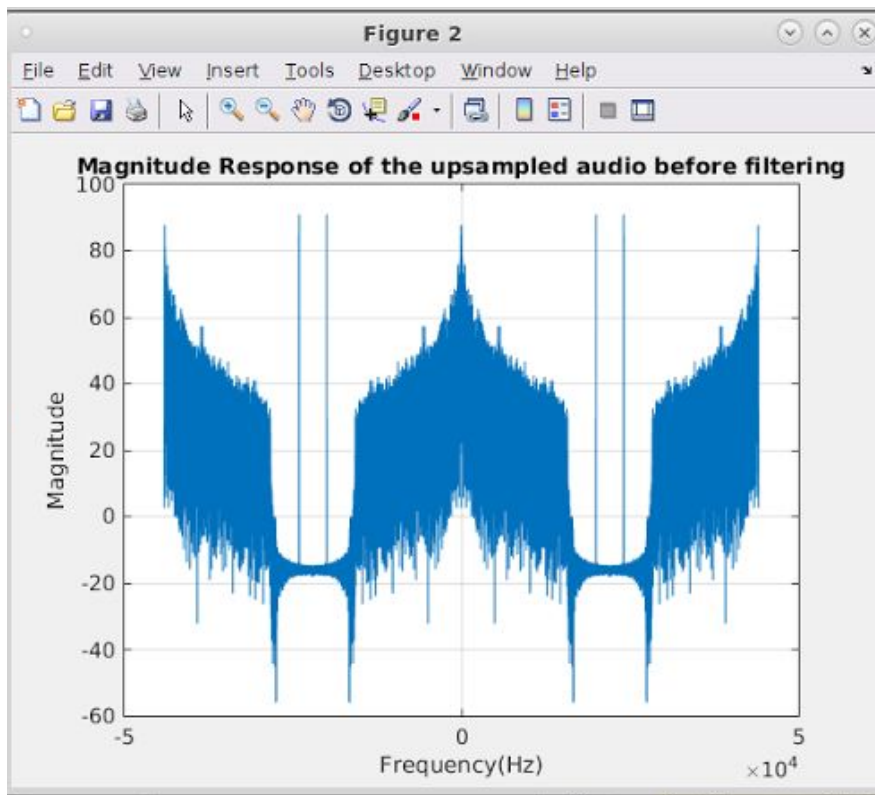
- a. FFT of song1_corrupt



At about 20 kHz, there is an impulse. It could be the sound of the bat because human hearing limit is 20 kHz.

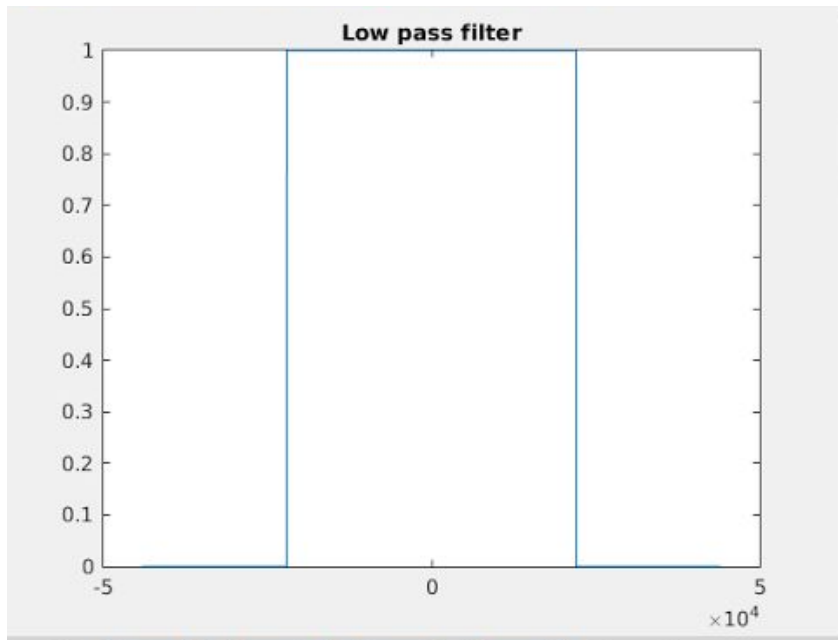
- b. I could not hear the bat because has already out of human hearing range which is 20 Hz to 20 kHz.

- c. Upsample without filter ($U = 2$)

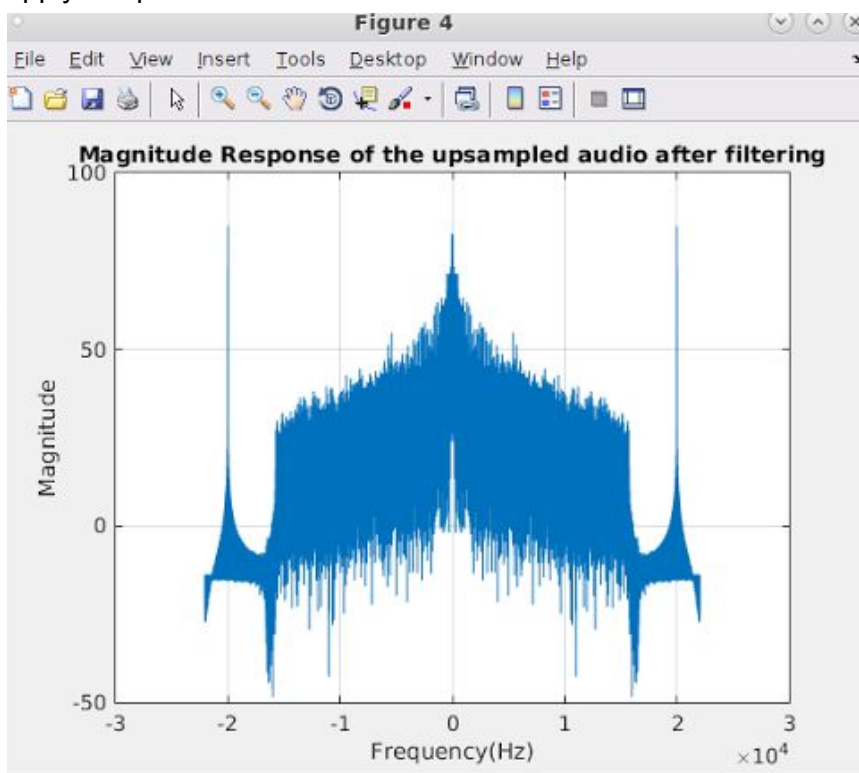


There is a constant noise throughout the sound. That sound probably is the bat sound. We shrink the the spectrum horizontally and duplicates the data. Probably that's the reason we hear the bat sound, because its frequency is lowered to human hearing range.

- d. Design low pass filter.



e. Apply low pass filter

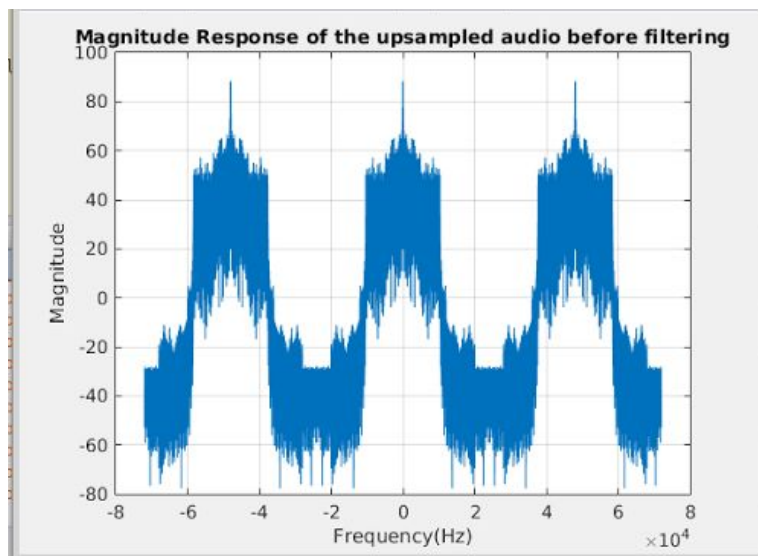
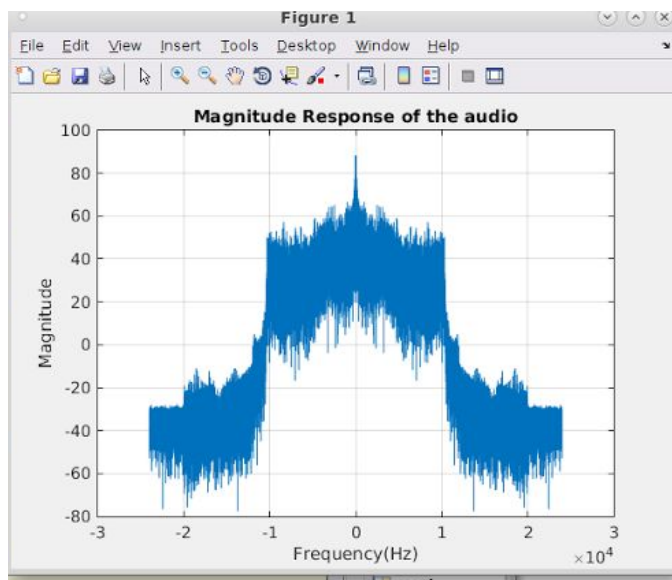


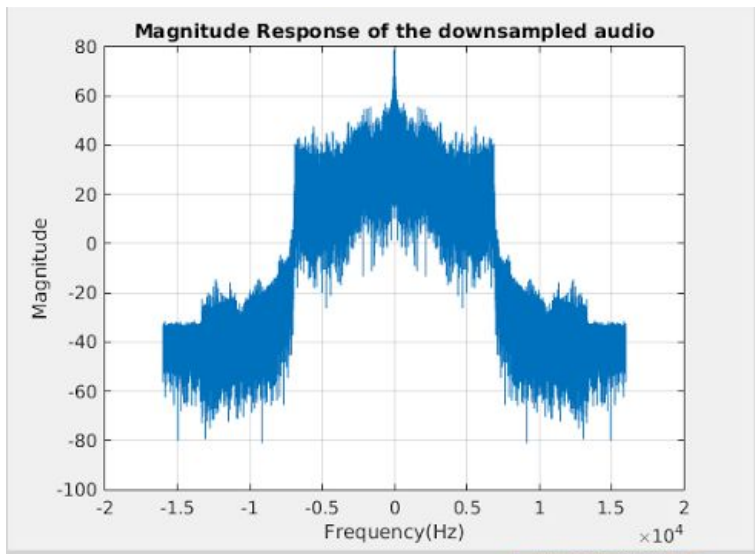
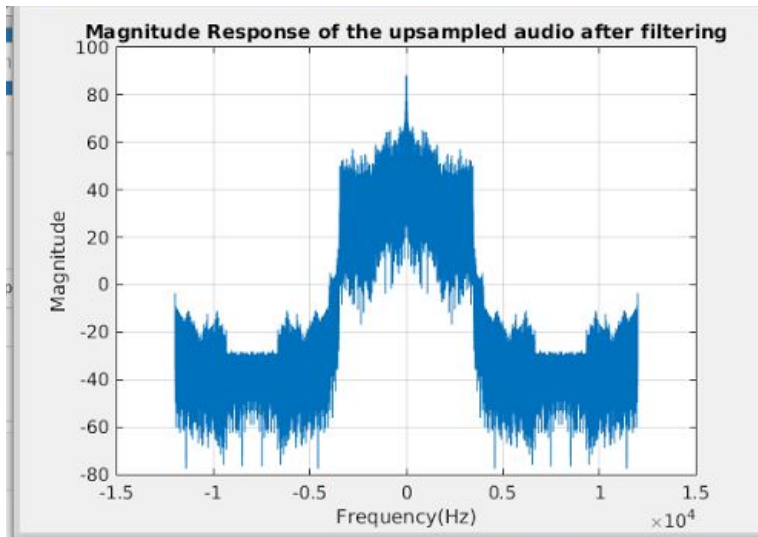
Bat sound cannot be heard this time.

3. Spotify Data Transfer Issue

Report Item 3:

For this problem, I tried $U = 3 / D = 2$ and $U = 2 / D = 2$. Both sounds and the original sound are clear enough. If I need to choose one option. It will be $U = 3$ and $D = 2$. The plots are shown below.

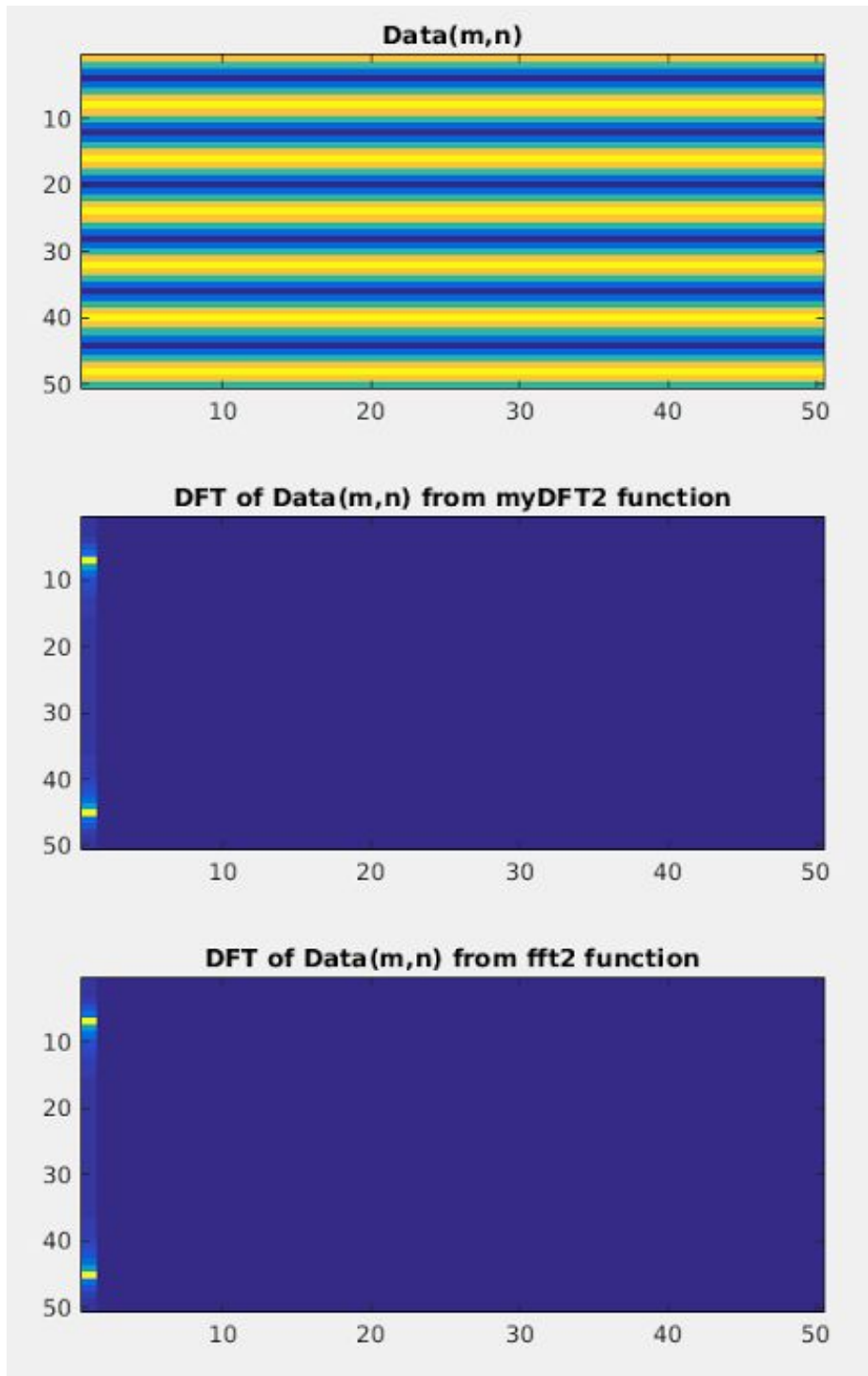




4. 2_D DFT

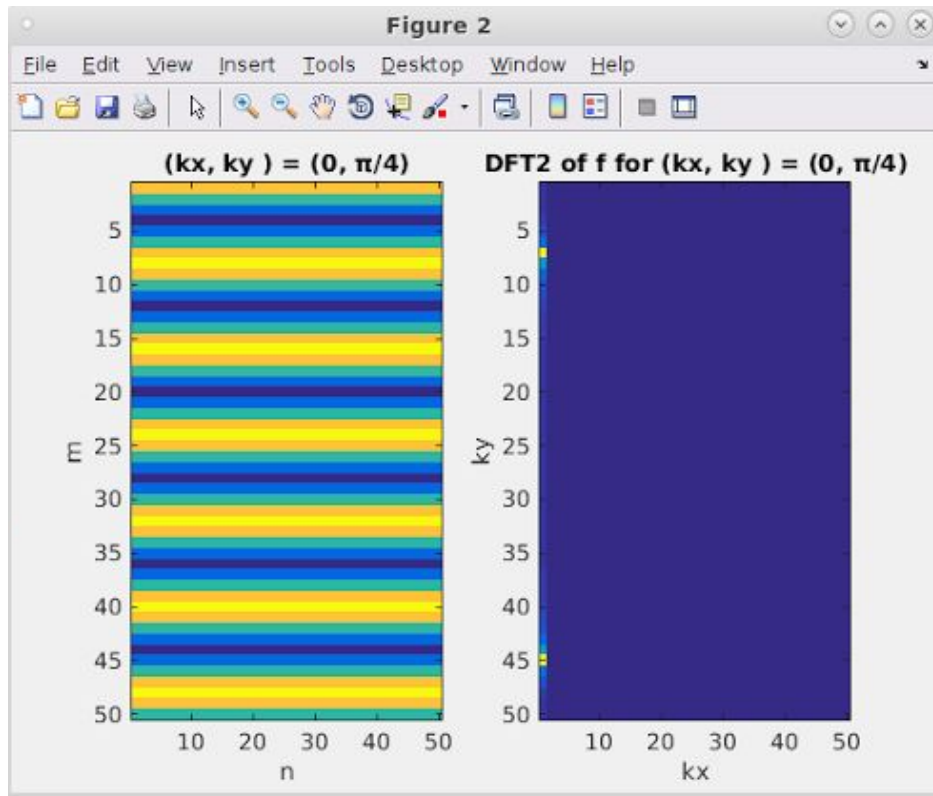
Report Item 4:

Verify myDFT2 with dft2 function:

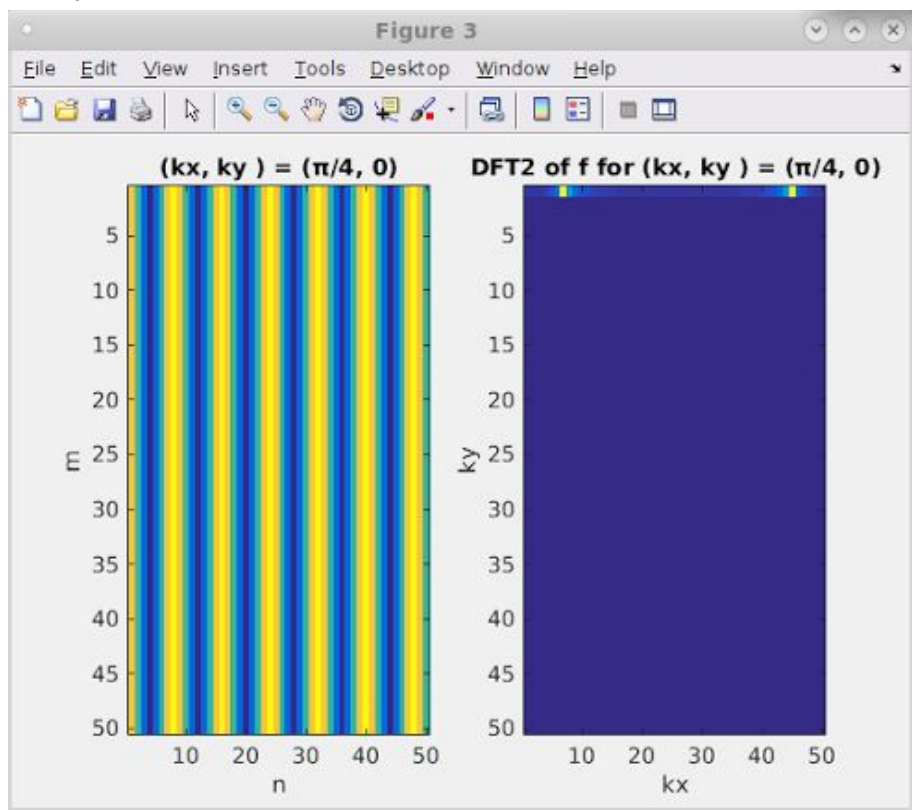


myDFT2 function gives the same result as the fft2 function.

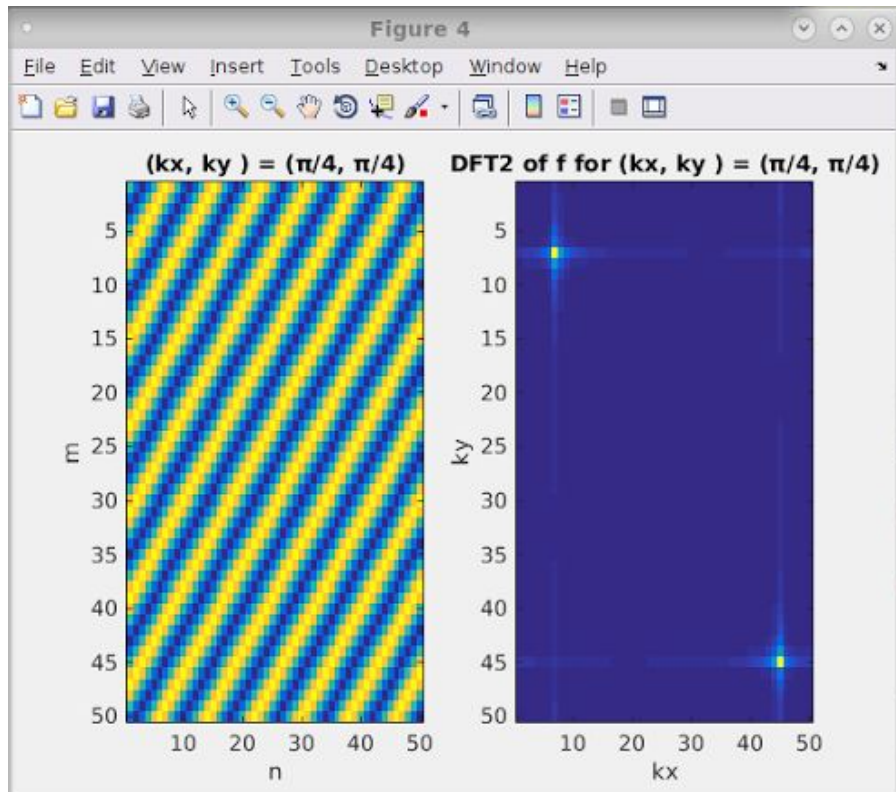
$(k_x, k_y) = (0, \pi/4)$



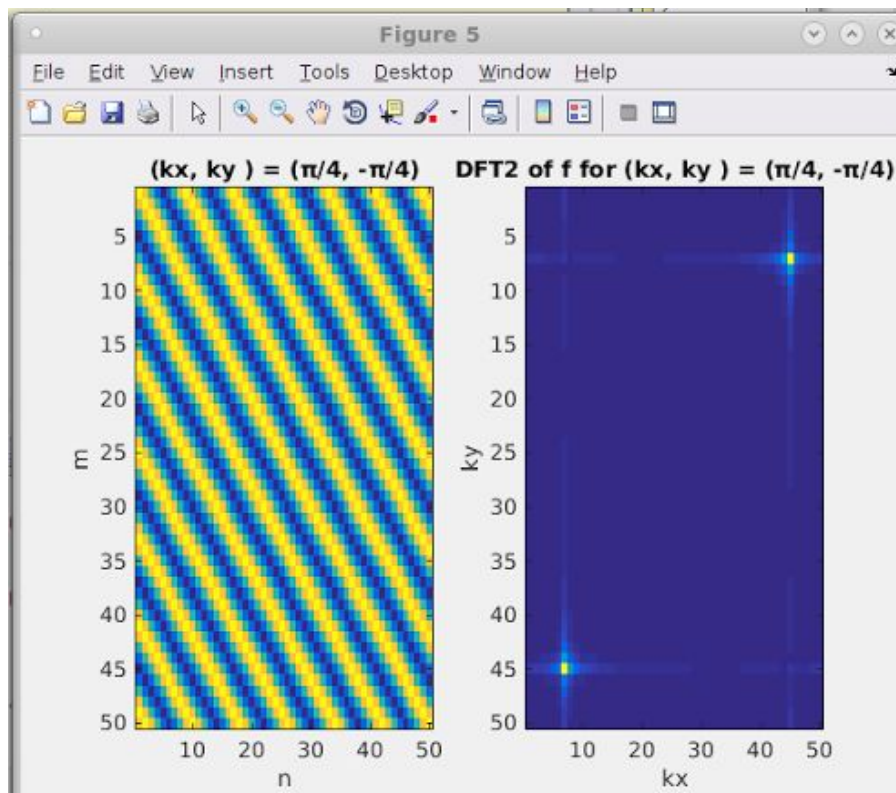
$(k_x, k_y) = (0, \pi/4)$



$(k_x, k_y) = (\pi/4, \pi/4)$



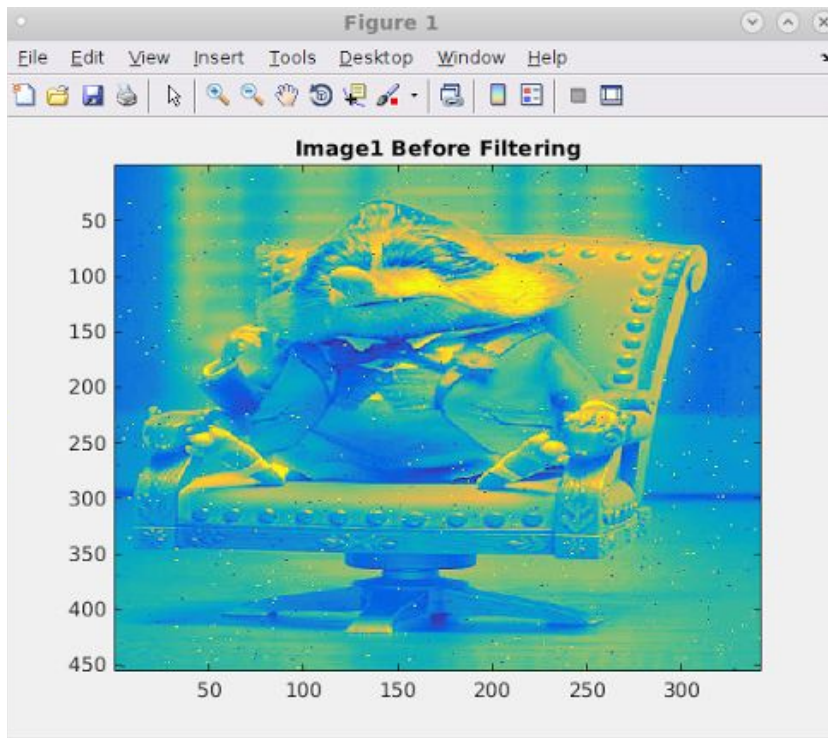
$(kx, ky) = (\pi/4, -\pi/4)$



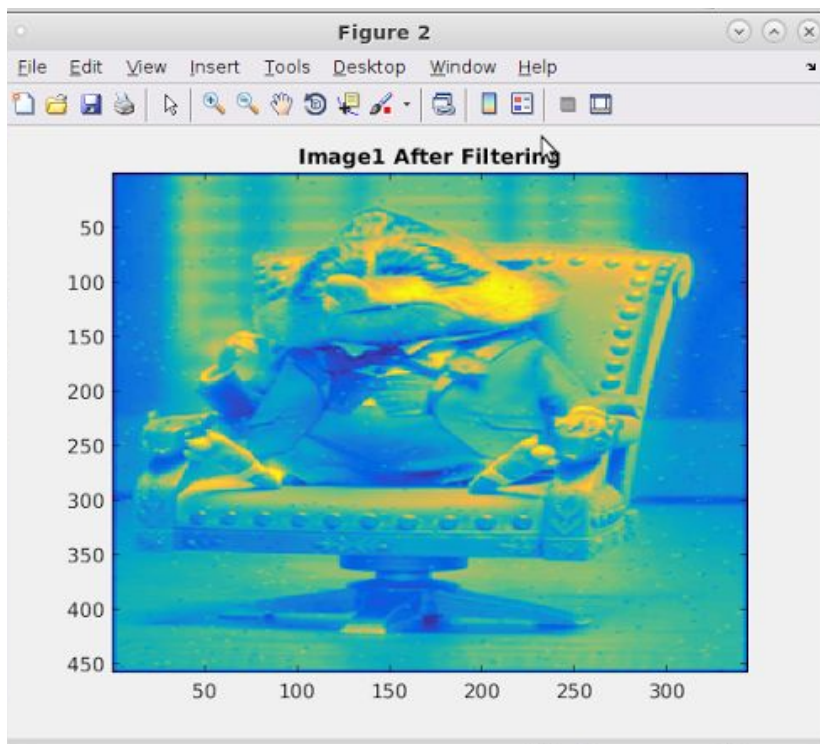
5. Image Filtering

Report Item 5:

Before filtering:

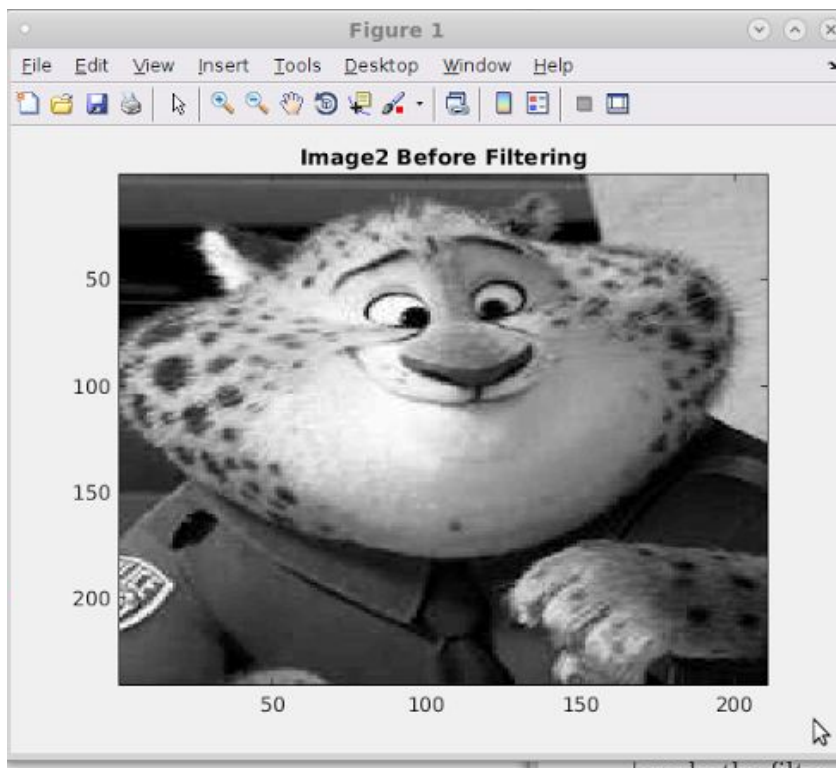


After filtering:

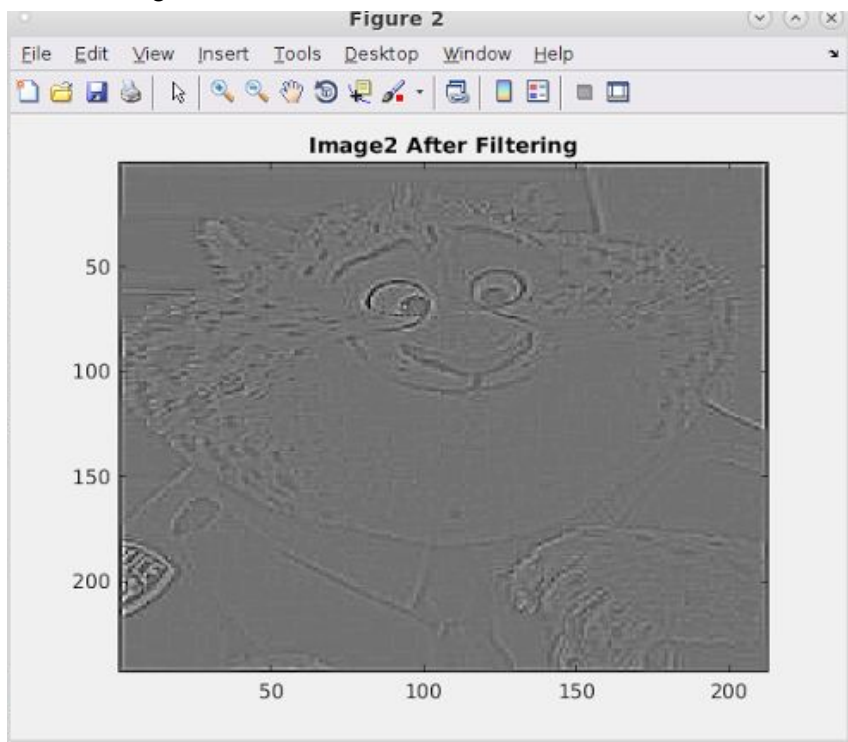


Report Item 6:

Before filtering:



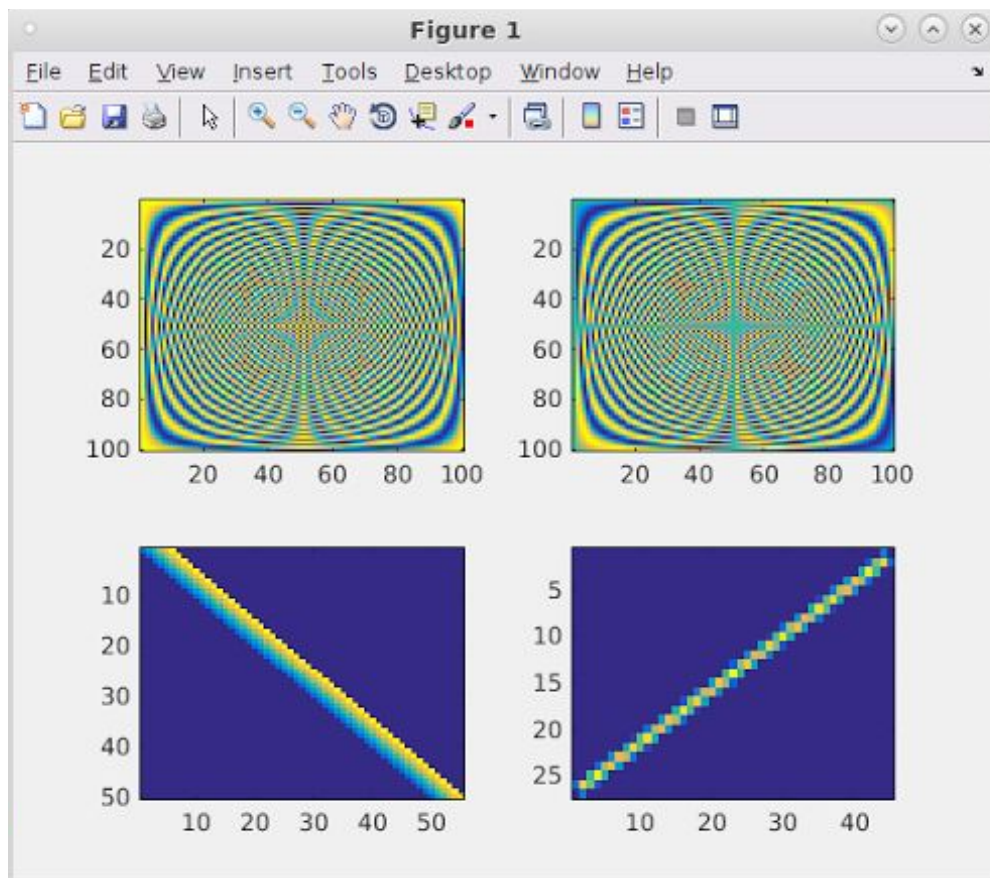
After filtering:



6. Listening to a Picture, Looking at Sound

Report Item 7:

Plot of four matrices:



Sound of four matrices:

Real part of DFT matrix: feels like electroshocked.

Imag part of DFT matrix: feels like electroshocked.

Convolution matrix: a very short beep

'Motion' filter matrix: I hear nothing.

Using the frequency of 44100, I feel like shock when hearing the DFT matrix (both Real part and Imag part).

Philosophically, both image and sound are constructed by data. Therefore, "listen to a picture" is the same as looking at a picture and "look at a sound" is the same as listen to a sound.