UTKU ACAR 250206062

LAB-8 REPORT

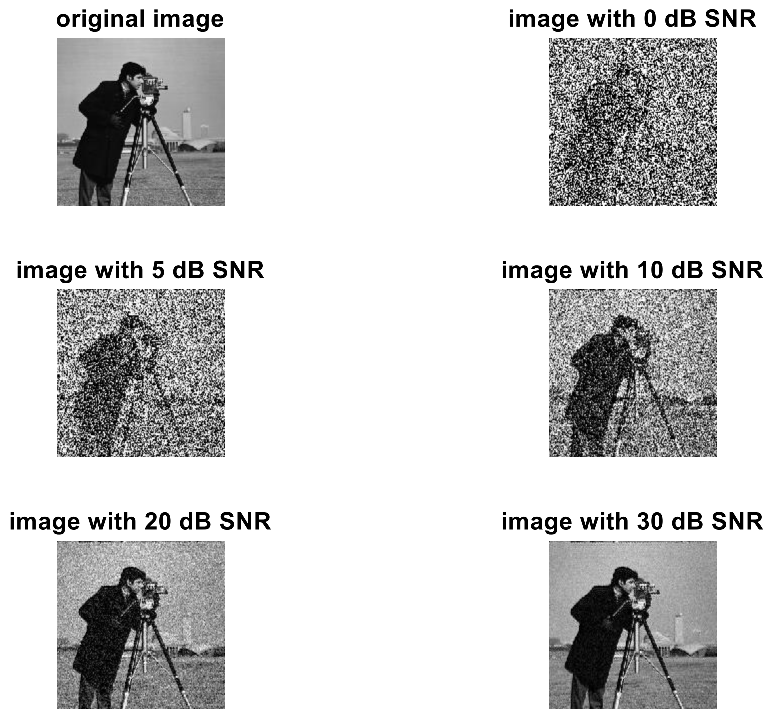

Figure 1: 9.4.a

dB to Magnitude (Energy)→ 1dB $==10^{0.1}$ Logic is pow (10, dB/10)

SNR (Signal to Noise Ratio) → Message Power/Noise power

We want to increase this ratio for quality

As we can see in Figure 1 first image is original signal without any gaussian white noise. Second image has SNR 0 dB which means that ratio of message signal power over the noise power is 1 (Equal which is bad) (10^0). Third image has 5dB SNR which means that the ratio which is stated before equals to $10^{0.5}$ which is equals to 3.16. Fourth image has 10dB SNR which is equal to 10(10^1). The fifth image has 20dB SNR which is equal to 100(10^2). The sixth figure has 30dB SNR which is equal to 1000(10^3). The general idea is while SNR increasing our filtered image is getting better (less noisy). I also multiplied the carrier amplitude while we are multiplying the modulated signal with it like I did before in Lab 4. The reason is adjusting brightness and matching this brightness with original image. (Message amplitude matching). I choose low pass butter filter order as 9 since its appropriate and cutoff as fc-fm which is equal to 19744. (Can be choose any value between [W,2*fc-W] (Simon Haykins book))

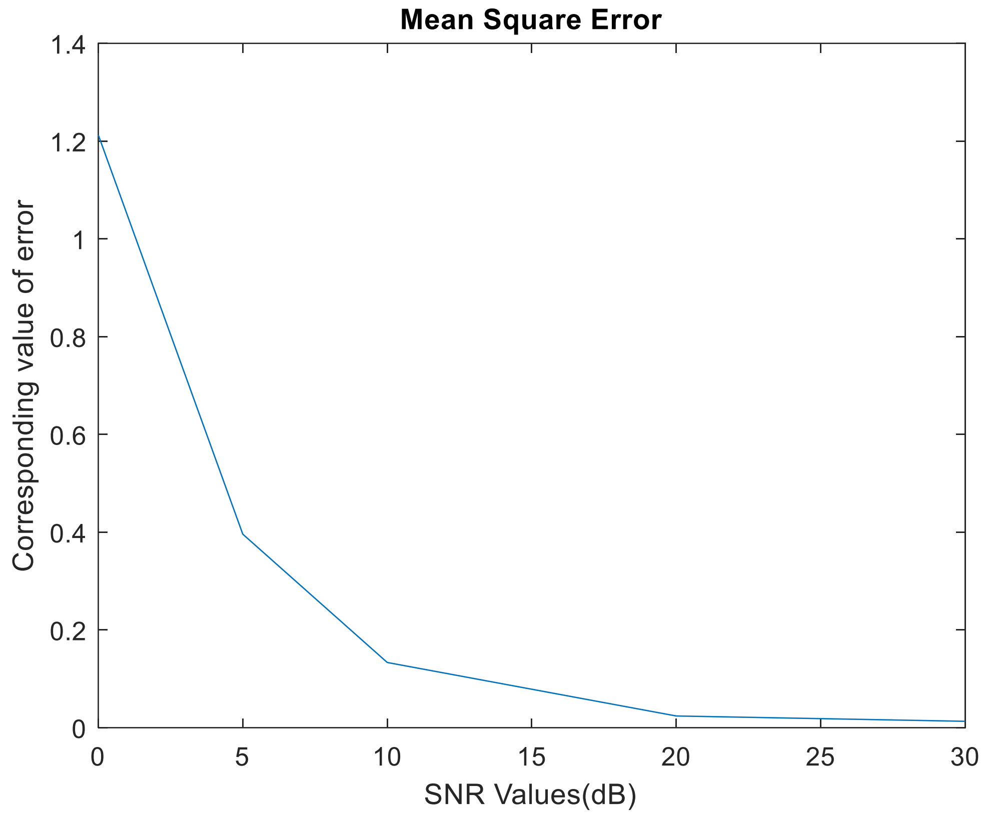

Figure 2: 9.5.b

As we can see in figure 2 when SNR values increased the corresponding cumulative error value decreases dramatically (high slope/derivative) while getting from 0dB to 5dB SNR. When we got from 5dB to 10dB the slope decreases slightly. At SNR equals to 10dB and going to 20dB we can clearly see that the change decreases rapidly and lastly while getting from 20dB to 30dB the slope is nearly zero if we compare this with 0dB SNR. These rapid changes can be explained Magnitude equality of dB (Look for previous figure description).

The functions which I have used and basic meaning:

1) numel(.): Number of array elements. Ex: If we have 2x2 matrix this function gives 4 as result
2) reshape(.): Changes dimension of an matrix. Ex: If we have 256x256 matrix(M) and we want to make it single dimensional vector than we use reshape(M,[1,256*256]) and then this function gives us 65536 elements of single dimensional array.
3) awgn(.): This function adds additive white gaussian noise to our signal due to given SNR. Ex: We want to make our signal(x) as 30 dB SNR signal we use awgn(x,30) the output will be noisy version of our signal with respect to 30dB SNR.
4) imread(.): Reads image and store its pixel values to the variable.
5) imshow(.): Shows array of pixels as image
6) im2double(.): Transforms class of image to double.
7) immse(.): MATLAB’s optional function for testing the correctness of my MSE function.