Communication Systems

Lab – 8

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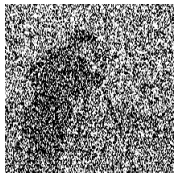
Figure 1

While adding white gaussian noise to the signal, awgn() function generates noise according to given SNR value. Greater SNR results in lesser noise rate. Because SNR is the rate of signal power to the noise power. Thus, at higher SNR values we obtain clearer result because rate of noise which distorts the image is so much lesser.

Original

SNR 0



$$SNR = \frac{Power\ of\ Signal}{Power\ of\ Noise}$$

$$SNR\ 0 = 1$$
$$SNR\ 5 = 3.16228$$
$$SNR\ 10 = 10$$
$$SNR\ 20 = 100$$
$$SNR\ 30 = 1000$$

SNR 5

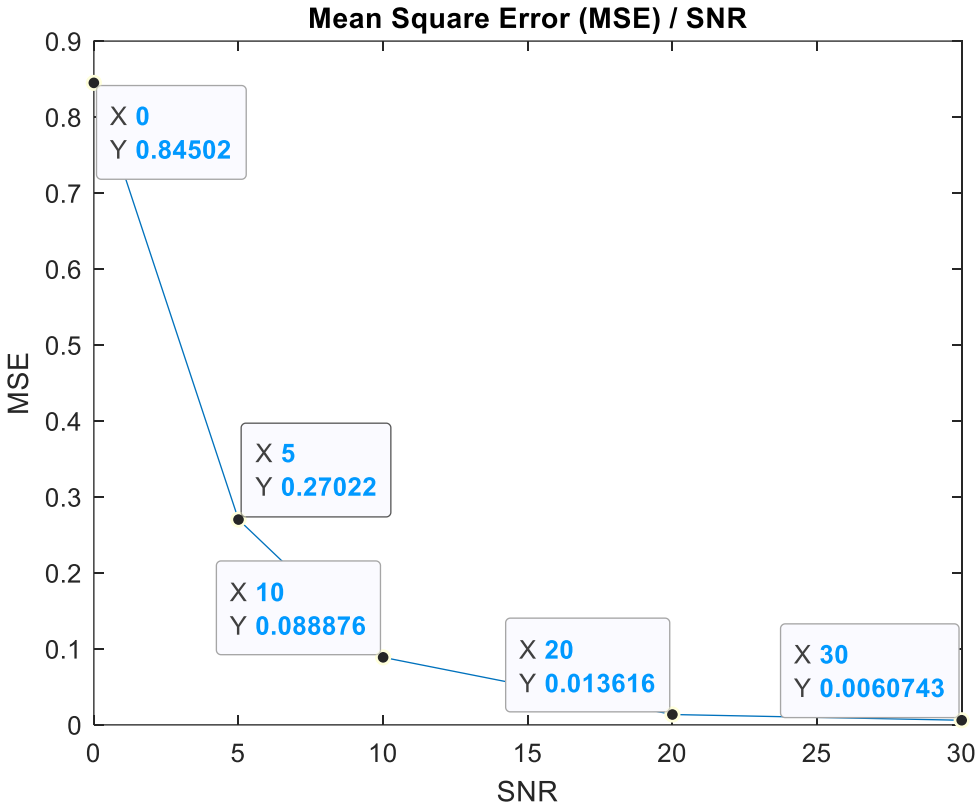
SNR 10

SNR 20

SNR 30

Figure 2

Means Square Error formula gives as the average deviation between the generated signal and the original signal. Simply, it is used for calculating the error. Just like figure 1, It is expected to see lesser MSE at higher SNR values, because greater SNR results in lesser noise according to the singal. Thus, low noise rate results in less error. Lastly, acceleration of the MSE goes down while the SNR values goes up. Because SNR has logoritmic input instead of linear.



Comment on choosing filter parameters.

I have designed my butter filter with order 2 and cutoff frequency at 13500Hz. The order is 2. Because while filtering the image signals, it is not necessary to use high orders to have steep transition band. Their frequency responses are not concentrated, instead outspread to quite wide frequency range.

Also, while filtering the signal, we want to eliminate higher frequency components that comes from multiplication of local oscillator and noise which has greater power than the signal. It is possible to observe the frequency components of the signal by taking FFT of it. Besides, when we have greater cutoff frequency than 14000 and less than 13000, I observed increase in MSE for 30db. I only observed that MSE value, because it is easier to see when the noise has greater power than signal. Cutoff frequency is supposed to be greater than fm and less than 2*fc-fm.