University of Massachusetts Lowell
Department of Electrical and Computer Engineering
16.543 Communication Theory I

Matlab Assignment II: "The three matched filter Bears", matched filtering, and probability of error in matched filtering.

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The purpose of this assignment is to provide insight into the functioning of the matched filter, and to use the results to compute probability of error.

1) Create a pulse waveform from 100 samples of "1"
2) Create 3 filter candidates, "baby bear", a pulse filter of length 50 samples, "moma-bear", by definition just right of 100 samples, and "papa-bear" who needs to loose some weight of 200 samples.

3) Calculate the noise variance at the output of each of the filter candidates by convolving a 100,000 sample Gaussian noise process with each of the filters, and measuring the noise variance at the input and the output.

1. Create a histogram of the values at the output of the matched filter and verify that it is indeed Gaussian.

4) Convolve each of the filters with the target pulse. Find the peak value, take the square and find the power signal to noise ratio, from 3.

5) Do the same thing theoretically (do the 3 convolutions and calculate the output signal to noise ratio)

6) Create a sequence of 10 million (you could do it 10k at a time) randomly chosen "plus and minus 1's.

7) Assuming a signal to noise ratio of 3,6,7,8,9,10,11, 12 dB, add noise to the bits, calculate the bit error rate and do a waterfall plot with x-axis SNR (dB) and the y-axis log10 if the bit error rate. On the same plot, calculate theoretically the probability of error from the Q function and plot the same.

8) Create two random streams of +3/-3s (say 10,000). Add two random Gaussian vectors (sigma=1), one to each. Plot x,y dots and note the cluster of points.