Signal Project

Overview: for this project you will use 3 different signal files provided by the instructor and perform signal processing techniques to analyze and help identify characteristics in the frequency domain that might differentiate these 3 signals. Consider this a set of real data collected recently on “targets” of interest using a microphone and a digital recorder.

Details:

1. Unzip the file provided with the signal project assignment and using Octave, plot each of the 3 signals. For plotting and analysis purposes you can assume the signals were sampled at 1024 Hz. Be sure to include axis labels, legends, and a title on your plots.
2. Perform a 1024 point Power Spectrum for each second of data, using Welch’s method within Octave. (Note: this means if you were provided **n** seconds of data, you need to perform **n** Power Spectrums). Use a Hanning window function and 50% overlap for your Power Spectrum calculations.
3. Using Octave, plot each of the signals by plotting the frequency on the x-axis and Power Spectral value on the y-axis. You should have a separate plot for each second of data and target. For example, if you have n seconds of signal 1, m seconds of signal 2, and v seconds of signal 3 you would have n+m+v different plots. Be sure to include axis labels, legends, and a title on your plots.
4. Using visualization, observation and experimentation, describe similarities and differences you see in the resultant power spectrums between the signals and within the signals. You should also discuss the time domain signals. Discuss what features you believe you could use to differentiate and identify the Spectral components. Note: this will be new for most of you. Don’t worry. The idea is to look for characteristics that might be unique to the signals. (Hints: If you had a 100 and 126 Hz sinewave and you calculated an FFT where would the peaks occur? Do the distances between the main peaks in the frequency domain form a pattern? Is one peak always bigger than others? …. What else do you see?) Can you give a general guess on what type of target the signals might have originated (e.g. animal, gun, tank, a plane, jet, truck …). (Don’t worry you aren’t graded on the guess, just curious what you may think)

Deliverables: You should include one Octave m file that solves all of the above parts for this homework. You should name it yournamesignal.m. Be sure your m file works without issue and accurately provides the outputs and plots as needed for this assignment.

In a word document, describe the results and your analysis and observations. Discuss any analysis techniques you performed and their results to support the differences (or similarities) you discovered. Your word document should be named yournamesignal.doc (or yournamesignal.docx) and will include analysis and discussions supporting your results.

Be sure to submit your homework in the WebTycho assignments folder no later than the due date listed in the syllabus.