EE4820: Biomedical Signal Processing
The Spectrogram and STFT

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DUE: Wed 04/13

1 Textbook problems

1. Semmlow P6.4
2. Semmlow P6.8 - *Estimate the times to the nearest millisecond. Compare not only different window sizes when carrying out the STFT, but also compare Hamming window vs. rectangular.*

2 The STFT

- Go to the course canvas page.
- Download the 8 **eeg1-xx.mat** files and save to an appopriate directory.
- These are each EEG signals recorded from eight different electrode locations and were sampled at 100 samples per second.

1. Create a plot to view all 8 EEG signals in one plot. (*Tip*: Try using `axis off` to make the subplots fit nicely.)
2. Create the *truth* output by visually determining when alpha rhythms are occuring and using `ginput`. This will be your "gold standard" event time set.
3. Compute the STFT of using 2.56-s segments.
4. Using the STFT, write your own function to detect alpha rhythms. Explore different segment lengths and overlap percentages.
5. Show how well your STFT-based detection function performs. In other words, how well are you able to automatically detect alpha rhythms using your function, compared to your gold standard event times.

3 Extra Credit: The Spectrogram

- Go to the course canvas page
- Download the data **speechSignal.m4a** and save to an appopriate directory.
- This was an audio recording of someone saying "Signals and systems are so cool!"

1. Play the recording using Matlab's `sound` function.
2. Create and view the spectrogram of this speech signal.
3. Downsample the original recording by a factor of 20.
4. Play the downsampled signal and describe the characteristics of the speech signal now. How does it sound compared to the original speech signal?
5. Using the spectrogram of the downsampled signal, explain the changes in the way the downsampled signal sounds compared to the original.
6. Detect the portion of the spectrogram that is the short vowel "i" sound. Show the spectrogram for this phoneme.
7. Detect the portion of the spectrogram that is the short vowel "s" sound. Show the spectrogram for this phoneme.
8. Describe how the content of these phonemes is different.