EE4820: Biomedical Signal Processing
Problem Set 3: Correlation

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DUE: Monday 2/21

1. Semmlow P2.28
2. Semmlow P2.32
3. In this problem, we will look at the correlation between oxygen consumption, as measured by VO_2, and heart rate as well as with muscle EMG signals. We need to first align the data in time.

   (a) Load the data in `corrData.mat`. The heart rate and VO2 were collected synchronously on one system; four channels of EMG on another. These data were collected while the subject was performing exercises.

   (b) Create a figure to show how well the raw heart rate is aligned with VO2 and how well EMG channel 4 is aligned with VO2: A) one subplot should show the VO2 and HR vs time superimposed. B) the second subplot should show VO2 and EMG Ch. 4 superimopsed. Visually, how well are the HR and EMG aligned to VO2?

   (c) Now compute the Pearson's correlation coefficients in a matrix which shows how VO2 is correlated to heart rate as well as each of the four EMG channels, and how all those signals correlate with each other.

   (d) Let's focus on VO2's relationship with EMG Ch. 4. How correlated do they appear visually?

   (e) Using MATLAB's `xcorr` command, try to find the time shift that would be applied to either the HR or EMG to best align the signals in time..

   (f) Apply that time shift to the signals. What is the correlation coefficient between VO2 and EMG channel 4 now, after the time shift? Plot the signals after shifting, and discuass whether and how your signals visually agree with the change you saw quantitatively in the change in correlation coefficient.