Quantitative and Functional Imaging

BME 4420/7450

Graduate credit/undergraduate extra credit

1. There are several sources of **signal variance** that reduce the activation CNR. One of these is the slow change over time in scanner sensitivity—this is termed scanner drift. One way to reduce its effect is to **model and subtract the drift from the signal**. Estimate the signal drift in your ROI by fitting the signal during the ‘stimulus off’ blocks with a straight line (using *polyfit*, for example). Subtract this linear component (trend) from the signal at all time points (i.e., during stimulation and rest). Compare the activation CNR (for chords and words) before and after this ‘detrending’ operation. Does detrending improve CNR?

# Questions

1. Why does the signal increase when the subject hears the sound (words or chords)?
2. What is the contrast-to-noise ratio of the BOLD measurement for each stimulus? What are some strategies (beside step #12) that you could use to improve this?
3. Studies have shown that speech, like all sounds, is processed by the ‘primary’ auditory cortex, but unlike other stimuli, the information is then fed to a neighboring area farther back (i.e., posterior) in the temporal lobe. Are your measurements of the centers of activation consistent with this model? If the primary auditory area detects the frequency and timing of sounds, what do you think the neighboring area might do? The ‘words’ used in our experiment are comprised of standard English phonemes (i.e., sounds, for example ‘vos’), but have no meaning.
4. [Grad/extra credit] What activation CNR did you measure for each stimulus after removing the linear trend in signal? Did this step improve the CNR? Why does your result make sense?

# Assignment

Create a Word document that includes

1. A figure of an original and smoothed image.
2. A figure showing the ‘word’ correlation coefficient map with your ROIs (use the *line* command to show the border of your region).
3. A figure showing the ‘chord’ correlation coefficient map with your ROIs.
4. Your plots of ROI signal intensity versus time for both stimuli.
5. A figure showing the location of the center of Word and Chord activations in each hemisphere. Display these as dots (or crosses) on a single, unsmoothed image of the brain.
6. [Grad/extra credit] Your plots of ROI signal intensity versus time after trend removal (both stimuli).
7. Your answers to the questions above.
8. Your Matlab code.

Please submit your report (one per group) on Brightspace by Thursday, December 1.