

## ECE 594C: Lab 2 (fMRI modeling)

**Assigned:** October 22

**Due:** November 1 (in class)

**Preparation:** Get fMRI data from Ben (already done)

As we have already seen in class, there are two data sets, each consisting of time courses for a  $3 \times 3 \times 3$  array of voxels, as well as the timing of the corresponding stimuli. From our work in class on October 20, we know that Dataset 2 contains voxels that are “known” to be active using other methods, and Dataset 1 contains voxels “known” to be inactive. The goal of this lab is to consolidate the work done on October 20, as well as to explore the data a little more.

(a) Find the autocorrelations of the time courses for the voxels in each data set. Discuss whether you see different patterns for the “active” and “inactive” voxels, and illustrate your discussion with plots and numbers.

(b) Find the crosscorrelation between the time courses for neighboring voxels in each data set. Discuss whether you see different patterns for the “active” and “inactive” voxels, and illustrate your discussion with plots and numbers. Is there a difference between what happens for (x,y) and z neighbors?

(c) Apply the standard correlation method and the General Linear Model to these data sets (the Psychology students need to guide the signal processing students as needed). Discuss the results with plots (including plots of the estimated hemodynamic response function).

(d) Speculate on whether the results in (a) and (b) point to possible methods for coarse decisions on whether a cluster of voxels is active or not. How might you calibrate such methods? What could be a possible agenda for future research?

(e) (Optional) Speculate on how to use the known stimulus pattern to enhance detection (and possibly time resolution of onset of neural activity) with minimalistic assumptions on linearity and the nature of the hemodynamic response. If possible, use plots and numerical results to make your point.

Please feel free to discuss questions or difficulties across groups and with the instructor.