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**[Homework #2]** Provided on November 17 (Tuesday) and due on December 3 (midnight, Thursday).

Please send (1) your report in **pdf** file format and (2) **script/code** files that were generated to conduct each of the following analyses as one zipped file via an email to the TA (Changha Lee, [ckdgk44@gmail.com](mailto:ckdgk44@gmail.com) ) and instructor (Jong-Hwan Lee, [jhlee.jonghwanlee@gmail.com](mailto:jhlee.jonghwanlee@gmail.com))

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[**Goals**] Perform (a) preprocessing of raw BOLD fMRI data measured from the four sensorimotor tasks and general linear model (GLM) to estimate neuronal activations and (b) statistical analysis using AFNI.

As you know, the sensorimotor data were obtained from event-related task-paradigm (one 3 s event per task in one run). Please refer to the lecture note for a bit more details (“*Description on our sample fMRI data*” page in the “*afni\_intro slides*”). For the homework, please use the data from four tasks (i.e., auditory attention [ad], left-hand clenching [lh], right-hand clenching [rh], and visual stimulation [vs]) from 12 subjects.

Raw BOLD fMRI data can be downloaded from the following links:

<http://bspl.korea.ac.kr/Lecture/fall2020/BRI609/sbj_all_raw.tgz>

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**[1]** Preprocessing and GLM

**(a)** Perform the preprocessing and GLM using the ‘afni\_proc.py’ script. Please include the following steps for your preprocessing: (i) despiking, (ii) slice timing correction, (iii) motion correction, (iv) spatial normalization to the MNI space with 3 mm isotropic voxel size, (v) spatial smoothing using 8 mm isotropic full-width at half-maximum Gaussian kernel, (vi) scaling of the voxel intensity to an average of 100, and (vii) temporal detrending. Use subjects’ EPI and anatomical files for alignment.

**(b)** Review your overall results including the estimated neuronal activations from the GLM as summarized in the afni\_proc.py QC (APQC) with a html format.

Evaluate your results by rating the quality of the result from each step shown on top of the html page. Re-analyze the problematic steps based on your review and rating your results again. Save your rating in the html page and send it together with your pdf report. Refer to the following webpage:

<https://afni.nimh.nih.gov/pub/dist/doc/htmldoc/tutorials/apqc_html/apqc_ex1.html>

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**[2]** Statistical analysis

**(a)** Perform one-sample t-test for each of the four tasks.

**(b)** Perform all the paired t-tests for the pairs of the tasks (e.g., ‘ad’ vs. ‘lh’, ‘ad’ vs. ‘rh’, and so on)

**(c)** Perform one-way repeated measures ANOVA using the results from all the four tasks (i.e., suppose there are four factors [i.e., ‘ad’, ‘lh’, ‘rh’, and ‘vs’] and one group).

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**[3]** Discuss overall results obtained from [1] to [2]

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**[Note]** Common to all of the problems

- Note that TR = 2 s, so measured BOLD signals were acquired in every 2 s

- Remove the first 5 volumes for the analysis to allow T1-effect equilibrated

- Order of slice acquisitions are [1, 3, 5, …, 35, 0, 2, 4, …, 34] (0 being most inferior slice)

- Discuss your results/figures at least with a few lines of text

- Use AFNI (mainly for the analyses) and MATLAB/Python (for visualization if needed)