

## AFNI Jazzercise

Please read the following questions and use your AFNI know-how to answer them. Hints to answering these questions are available in the “Hints” handout. The answers to these questions can be found in the “Answers” handout.

1. The dataset **AFNI\_data1/afni/func\_slim+orig** contains 7 sub-bricks of statistical data. Use **3dbucket** to create a smaller version of this dataset that contains only the sub-bricks: #0, 3-6. Name this new dataset **some\_stats**.
2. In directory **AFNI\_data1/afni** you will find three anatomical datasets: **anat1+orig**, **anat2+orig**, **anat3+orig**. These datasets are 3 separate anatomical scans of a single subject. They have already been aligned. Average them together into a single dataset called **anat\_mean+orig**. Notice that the result looks ‘cleaner’, since the noise has been reduced.
3. Use AFNI’s two skull-stripping programs, **3dIntracranial** and **3dSkullStrip**, to remove the skull from dataset **AFNI\_data1/afni/anat+orig**. Name the output file from 3dIntracranial **anat\_3dIntra+orig** and the output file from 3dSkullStrip **anat\_3dSkull+orig**. Compare the two output datasets. Did one program do a better job at skull stripping or are the results similar? (Note: 3dSkullStrip may take a few minutes to run so be patient).
4. Creating and Playing with ROI Masks:
  - a. The dataset **AFNI\_data1/afni/func\_slim+orig** has beta values and F-stats for 2 stimulus classes, Actions and Tools. Use **3dcalc** to create a mask called **AT\_mask** that is **1** everywhere that both the Actions F-stat and the Tools F-stat values are greater than 50, and **0** everywhere else.
  - b. Similar to part a, create a conjunction mask that is **1** wherever  $a > 50$  (from Actions F-stat sub-brick), **2** wherever  $b > 50$  (from Tools F-stat sub-brick), **3** wherever both are true, and **0** otherwise. Name this dataset **AT\_mask\_4+orig** (since it contains 4 values).
  - c. Use the afni GUI to display this mask, **AT\_mask\_4+orig**, so that each mask value gets its own color. What does each color mean?
  - d. Use **3dROIstats** to store the average time series from **epi\_r1+orig** into the text file **AT\_mean.1D**, where the mean is over the voxels in the mask (from part a), **AT\_mask+orig**.
5. Fun with 1D files:
  - a. Create three 1-column files with the numbers 1-10 in one column of the first file, 11-20 in the second file, and 21-30 in the third file. (note: you might use 2 different AFNI programs to create each file)
  - b. Catenate these 3 files into one 3-column file. Call this 1D file **3\_cols.1D**.
  - c. Create a new file that contains columns 1, 2, 3, 3, 2,1, from part b (i.e., there will be a total of 6 columns in this new 1D file). Call this new 1D file **6\_cols.1D**.
  - d. Now take the 6 columns from question 7b and average them together to create a new file with a single column. Call that new file **ex\_mean.1D**.

6. Fun with the AFNI GUI:
  - a. Open **AFNI\_data1/afni/anat+orig** and in any one of the views (sagittal, axial, or coronal), change the gray-scale intensity range to be 50 minimum and 150 maximum.
  - b. Open **AFNI\_data1/afni/func\_slim+orig** and set the Full-F as the Olay and Threshold. Set the Threshold to F=8.0. Show only Positive values and set the color scale to show only 4 colors. Edit the color scale so that F-values between 226.22-339.32 are shown in lime green.
  - c. View the above settings you created from part b in a sagittal slice. Make a jpeg file from sagittal slice #86 and name it **cool\_slide**.
  - d. Switch to Talairach view and Talairach to the **right uncus**.
  - e. Change the display to show 5 sagittal slices all at once.
  - f. Can you find the AFNI Mission statement hidden in the AFNI GUI?
7. Doing Calculations in AFNI:
  - a. Determine what type of data (short, float, etc) makes up dataset **AFNI\_data1/afni/func\_slim+orig**.
  - b. Calculate  $22.3 * 44.5$  using the simple calculating program in AFNI.
8. Image Filtering:
  - a. Smooth **AFNI\_data1/afni/epi\_r1+orig** with a 8mm FWHM filter. Name the output file **ex\_blur8**.
  - b. Enhance **AFNI\_data1/afni/anat+orig** by emphasizing the minimum-valued voxels across +/- 3 voxels in the sagittal (z) direction. Name the output dataset **ex\_minz3**.
  - c. Enhance dataset **ex\_minz3+orig** from part b by removing the noise with program **3danissmooth**. Name the output dataset **ex\_aniso**. Use the **-viewer** option in this program to select the number of noise-removing iterations.
  - d. Use AFNI's Winsorizing program to apply a 3D Winsorizing filter to dataset **AFNI\_data1/afni/anat+orig**. This filter is used to improve the gray-white matter contrast in an anat volume. Add an option on the command line to repeat the filter 5 times (the default runs the filter only once). Give the output file the prefix name **anat\_winsor**. Compare the original and the Winsorized datasets to see if there is any difference in the gray-white matter contrast.
9. Random Exercises with AFNI Datasets:
  - a. Open dataset **AFNI\_data1/afni/anat+orig** dataset and find the storage order (i.e., xyz-orientation). Re-orient it to RAI orientation and name the new output dataset **exRAI**.
  - b. Open dataset **AFNI\_data1/afni/func\_slim+orig** and create 2 separate datasets: one with the 4<sup>th</sup> sub-brick only and one with the 5<sup>th</sup> sub-brick only. Call the former dataset **ex\_toolcoeff** and the latter **ex\_toolfstat**.

- c. Combine **ex\_toolcoeff+orig** and **ex\_toolfstat+orig** from part b into a single dataset called **ex\_tool**, having the Tool Coef for sub-brick 0, and Tool F-stat for sub-brick 1.
- d. Convert dataset **AFNI\_data1/afni/func\_slim+orig** to Talairach coordinates with a 4mm<sup>3</sup> resolution. Use dataset **anat+tlrc** in the same directory as the data parent to perform the transformation on **func\_slim+orig**. Name the output file **func\_slim4mm**.
- e. Locate the maximum “Full-F” stat voxel value in dataset **func\_slim4mm+tlrc** and find the name of the Talairach atlas region that corresponds to that voxel’s position.
- f. Dataset **AFNI\_data1/afni/anat+orig** was acquired sagittally and contains 124 slices. Create a new dataset that contains only slices 40-90 of anat+orig. Provide the new dataset with the prefix name **anat\_40\_90**.