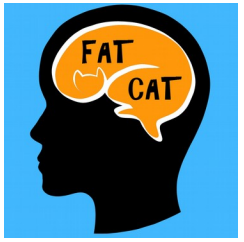
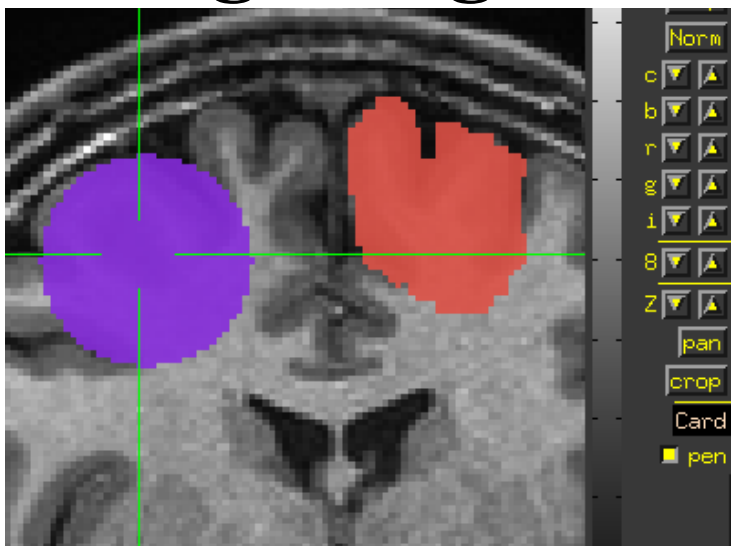
AFNI



Didactics and Demonstrations

Regions of Interest (ROIs)
Tools - Doing things with ROIs



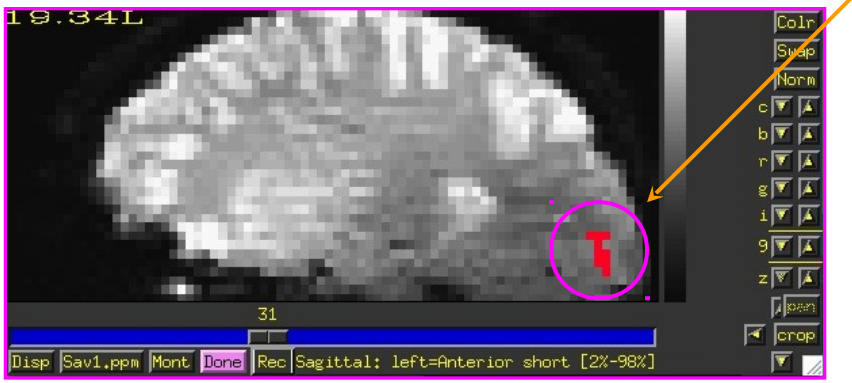
Looking at values inside the ROI

3dmaskave

This ROI program computes the average of voxels (usually from a functional or time-series dataset), that are selected from an ROI mask

Class Example:

```
3dmaskave   -mask anat_roi_resam+orig  -q  \
            rall_vr+orig > epi_avg.1D
```



The above command takes the voxels that fall within the ROI mask, and computes a mean for every time point/volume.

In this example, there are 450 time-points in this dataset, so the output will be a column of 450 means.

-q : Suppresses the voxel-count output (e.g., "[9 voxels] make up the ROI mask") from appearing next to each mean.

Alternatively, instead of having the results of **3dmaskave** spewed into the shell, you can redirect (**>**) the results into a text file (**epi_avg.1D**) and save them for later use.

Output will look like this (450 means in the column):

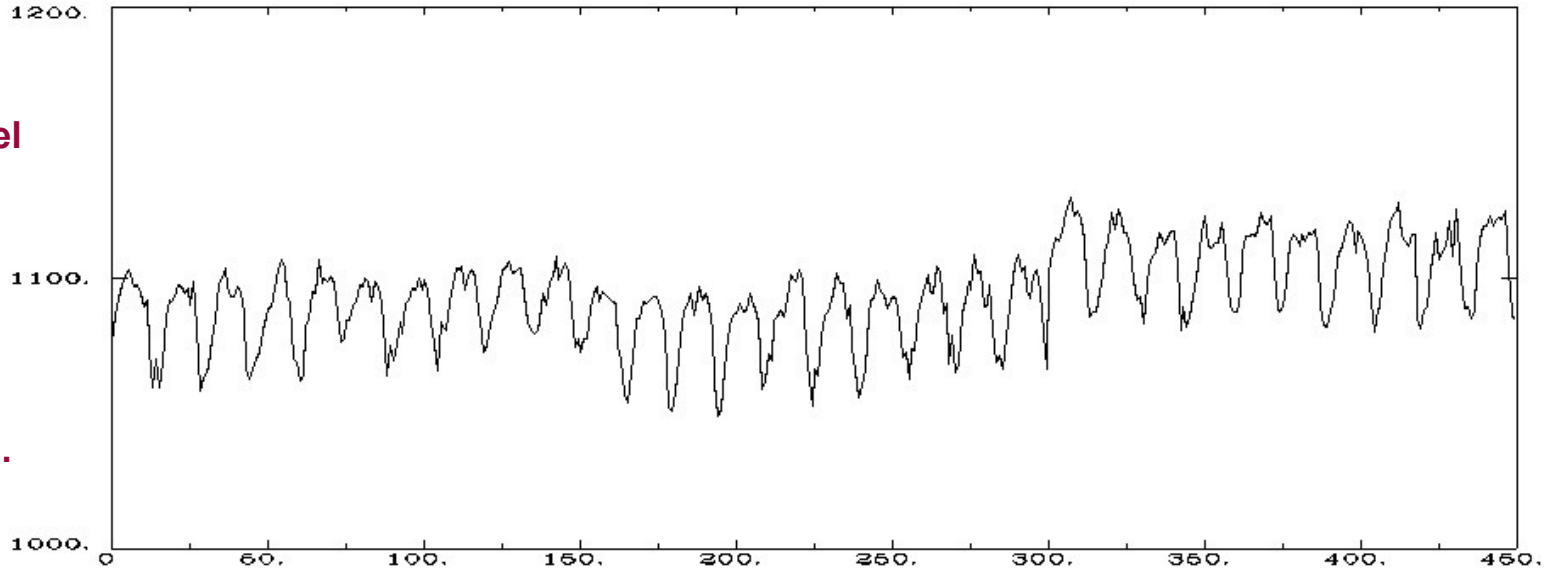
```
1076.11
1086.11
1092.33
1097.33
  ...
1084.76
```

```
less epi_avg.1D
```

Data can also be plotted out using **`1dplot`**:

```
1dplot epi_avg.1D
```
or…
```
1dplot -yaxis 1000:1200:2:1 epi_avg.1D
```

Mean voxel intensity for voxels falling within the ROI mask (at each timepoint).



3 concatenated EPI runs, Timepoints (0-449)

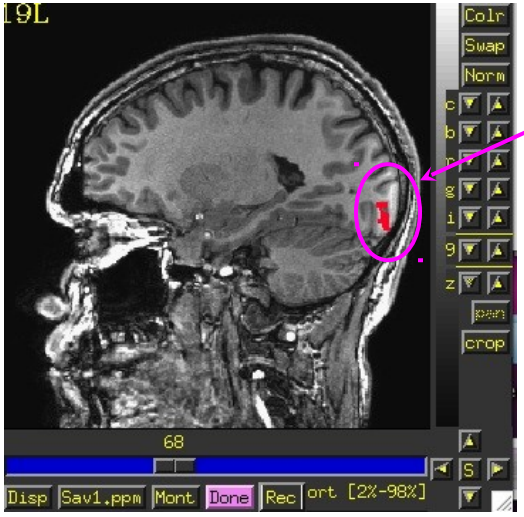
3dmaskdump

Program that dumps out all voxel values in a dataset inside the mask ROI

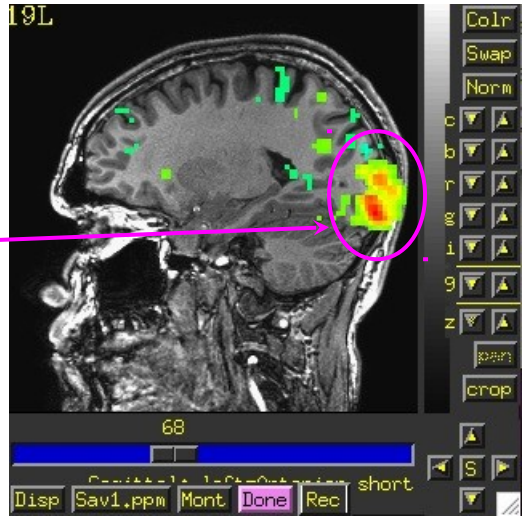
Class example:

```
3dmaskdump -noijk -mask anat_roi_resam+orig      \
      'func_slim+orig[2]' > Vrel-tstats.txt
```

The output appears in the shell (unless you redirect it '>' into a text file). This example shows one column of numbers, representing the voxel values for functional sub-brick #2 ('Visual-reliable' t-values) that fall within the ROI mask:



Dump out the voxel values from the functional dataset, sub-brick #2, but only for those voxels that fall within the ROI mask.

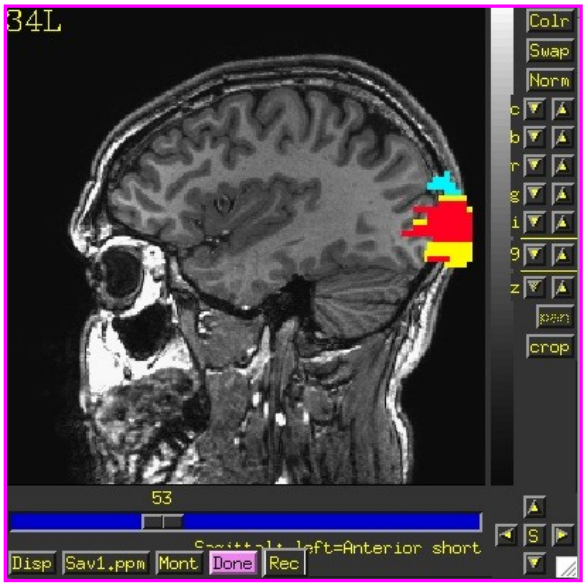


3dUndump can do the opposite – take a text file (ijk/xyz and values) to make a dataset

3dROIstats

Program to compute separate statistics for each ROI in a dataset

Means, medians, std. devs., ... can be computed separately for *multiple* ROIs in the same dataset



3rois+orig

Example:

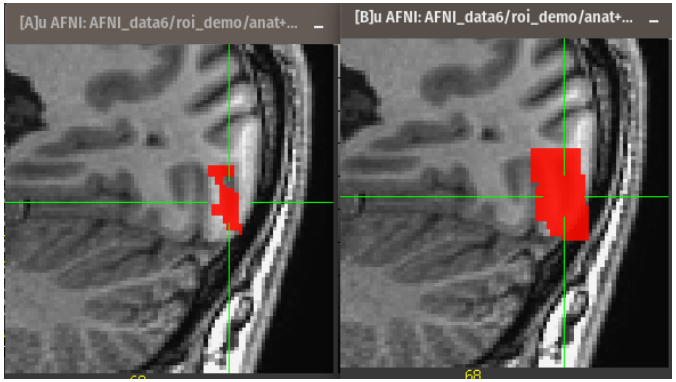
```
3dROIstats -mask 3rois+orig func_slim+orig'[0]'
```

Output shown in the shell (use > command to save into to a text file):

```
File                 Sub-brick       Mean_-1     Mean_1      Mean_2
func_slim+orig[0]    0[Full_Fsta]    10.805717   69.336539   71.333655
```

More tools for ROIs

```
3dmask_tool -prefix mask_dil3 -dilate_result 3 \
    -inputs anat_roi+orig
```




```
3dAutomask -prefix anat_am anat+orig
```

- **whereami** can provide the user with more detailed information regarding the output of **3dClusterize**
  - ★ For instance, say you want more information regarding the center of mass voxels from each cluster (from the 3dclust output). I.e., where do they fall approximately within the atlases?

```
3dClusterize -clust_nvox 200 -bisided -8.0 8.0 -ithr 2 -idat 1 -
  NN 1 -inset func_slim+orig. -quiet > visual_clusters.1D
whereami -coord_file clusts.1D'[1,2,3]' -tab | less
```

Center of mass output, columns 1,2,3, from 3dClusterize, Clusterize plugin or 3dclust reports.

```
++ Input coordinates orientation set by default rules to RAI
+++++++ nearby Atlas structures +++++++

Original input data coordinates in TLRC space

Focus point (LPI)                          Coord.Space
  -3 mm [L],  -83 mm [P],    2 mm [S]     {TLRC}

  -3 mm [L],  -86 mm [P],   -3 mm [I]     {MNI}

  -3 mm [L],  -90 mm [P],    2 mm [S]     {MNI_ANAT}

Atlas           Within  Label                                  Prob.   Code
TT_Daemon       0.0     Left  Lingual Gyrus                     MPM    232
TT_Daemon       0.0     Left  Brodmann area 18                  MPM    295
TT_Daemon       1.0     Left  Brodmann area 17                  MPM    294
TT_Daemon       4.0     Left  Cuneus                            MPM    240
TT_Daemon       4.0     Right Lingual Gyrus                     MPM    32
TT_Daemon       4.0     Right Brodmann area 18                  MPM    95
TT_Daemon       5.0     Right Brodmann area 17                  MPM    94
TT_Daemon       7.0     Right Cuneus                            MPM    40
CA_ML_18_MNIA   0.0     Left Calcarine Gyrus                    ---    43
CA_ML_18_MNIA   3.0     Left Lingual Gyrus                      ---    47
CA_ML_18_MNIA   7.0     Right Lingual Gyrus                     ---    48
CA_MPM_18_MNIA  0.0     Area 17                                 ---    181
CA_MPM_18_MNIA  1.0     Area 18                                 ---    240
```

Shown: Cluster #1's coordinates according to various atlases (TT, MNI, etc), as well as the name of the anatomical structure that is located at or near these coordinates (varying by atlas)

- **whereami** can report on the overlap of ROIs with atlas-defined regions

```
whereami -omask anat_roi+tlrc
```

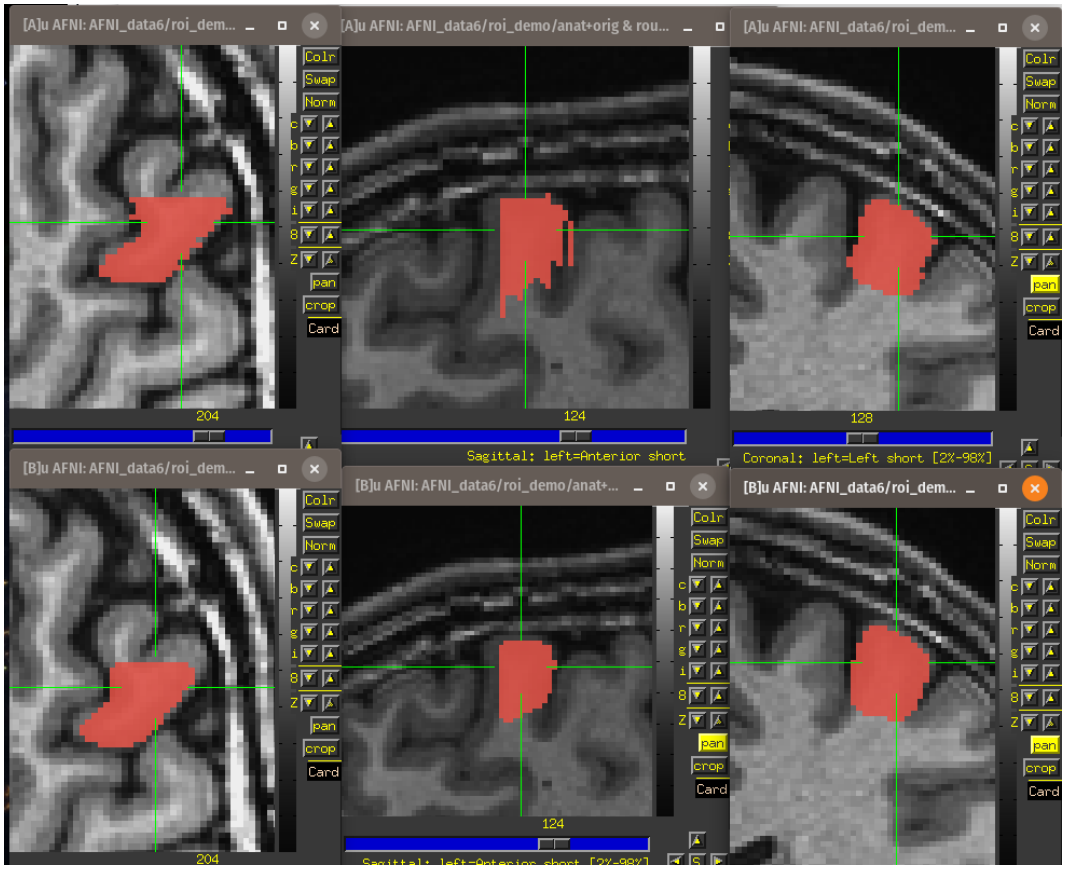
```
++ Input coordinates orientation set by default rules to RAI
++ Input coordinates space set by default rules to TLRC
++ In ordered mode ...
++ Have 2 unique values of:
   0   1
++ Skipping unique value of 0
++ Processing unique value of 1
++    195 voxels in ROI
++    195 voxels in atlas-resampled mask
Intersection of ROI (valued 1) with atlas TT_Daemon (sb0):
   89.2 % overlap with Middle Occipital Gyrus, code 33
   6.7  % overlap with Middle Temporal Gyrus, code 35
   -----
   95.9 % of cluster accounted for.

Intersection of ROI (valued 1) with atlas TT_Daemon (sb1):
   19.5 % overlap with Brodmann area 37, code 113
   1.5  % overlap with Brodmann area 19, code 96
   -----
   21.0 % of cluster accounted for.

++    195 voxels in atlas-resampled mask
Intersection of ROI (valued 1) with atlas CA_N27_MPM (sb0):
   1.5  % overlap with hOC5 (V5 / MT+), code 110
   -----
   1.5  % of cluster accounted for.

++    195 voxels in atlas-resampled mask
Intersection of ROI (valued 1) with atlas CA_N27_ML (sb0):
   61.0 % overlap with Right Middle Occipital Gyrus, code 52
   20.0 % overlap with Right Middle Temporal Gyrus, code 86
   -----
   81.0 % of cluster accounted for.
```

ROI irregularities - Modal smoothing

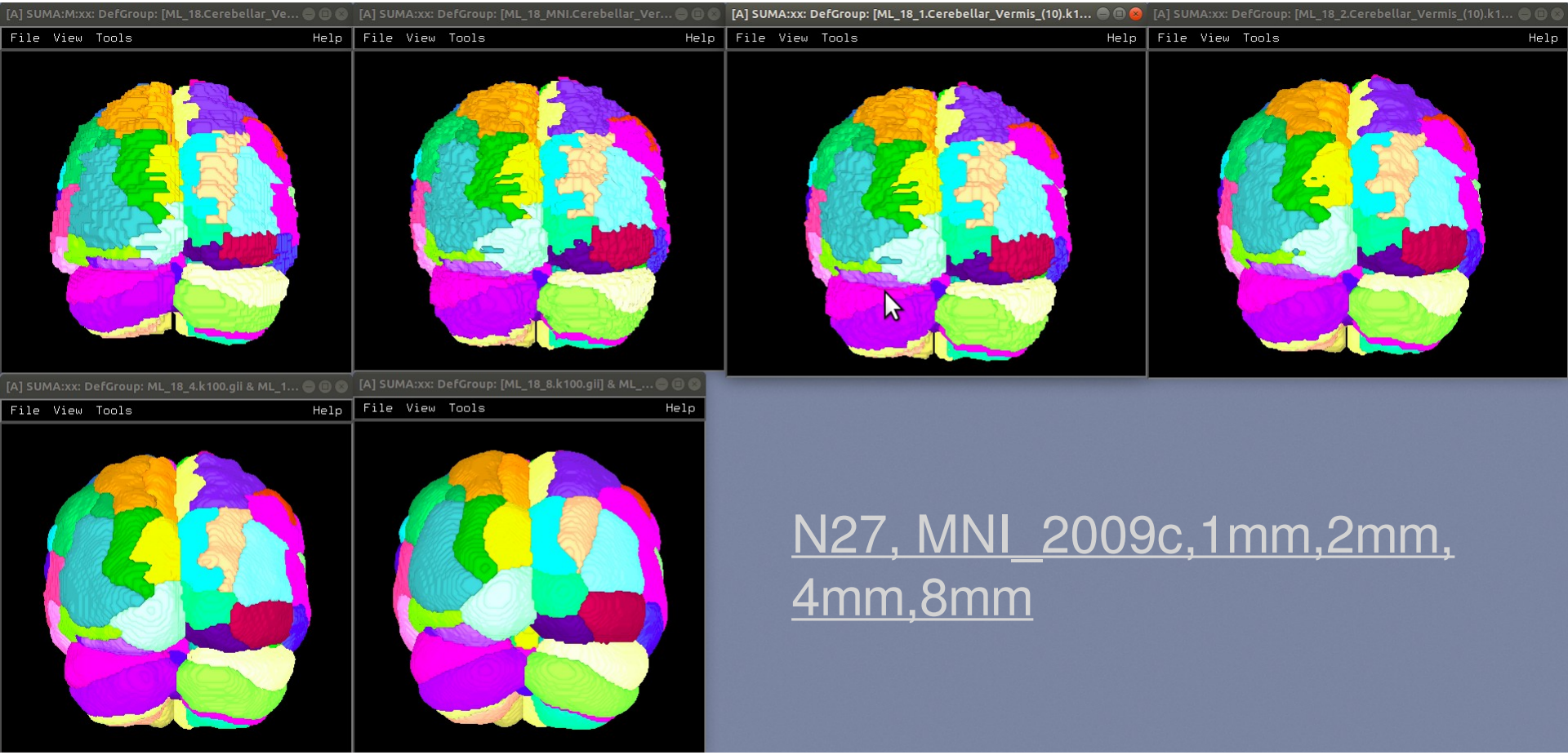


Original drawing

Smoothed

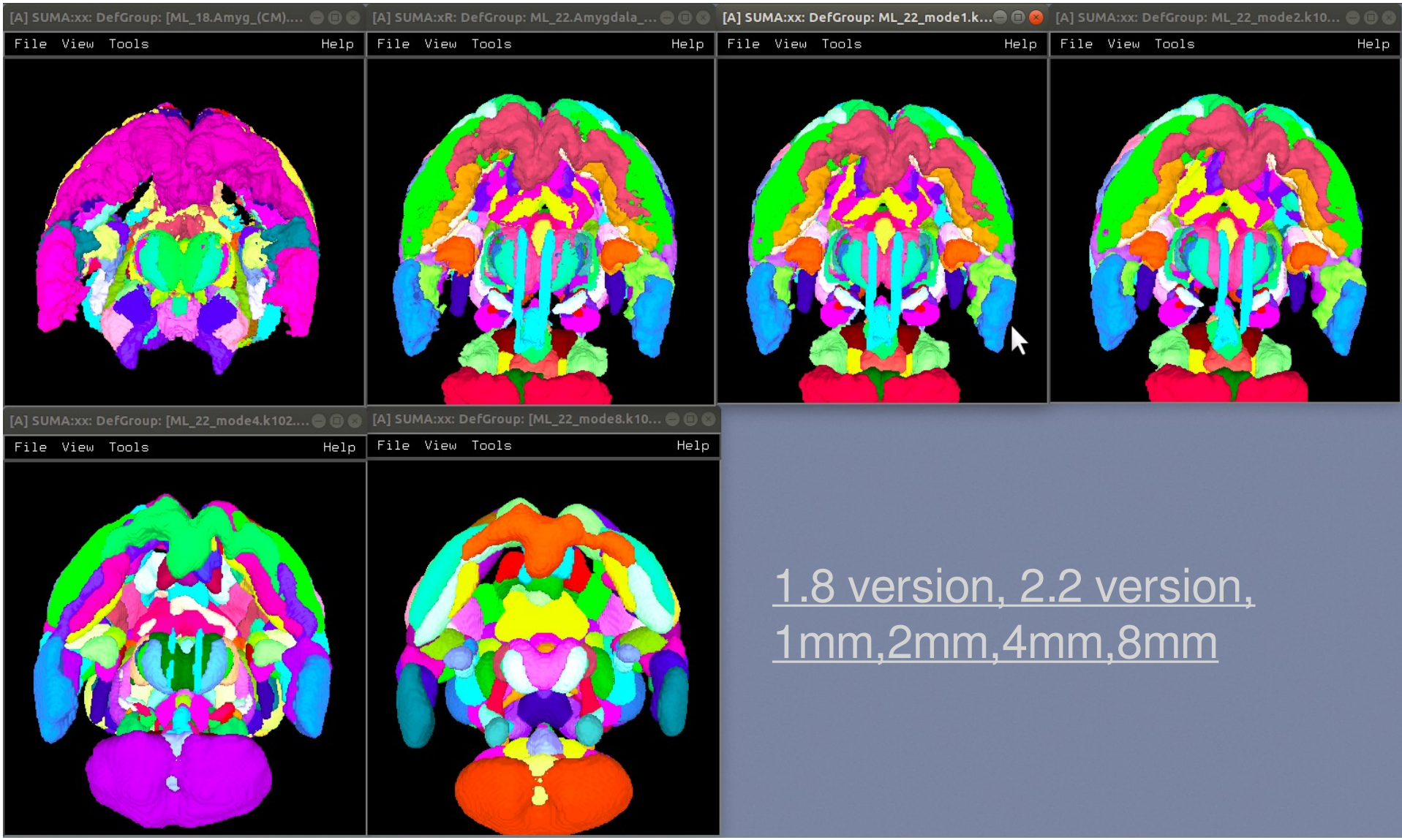
```
3dLocalstat -stat mode -prefix coronal_mode3 \
     -nbhd 'SPHERE(3)' roughcoronalROI+orig.
3drefit -cmap INT_CMAP coronal_mode3+orig.
```

MacroLabel atlas - modal smoothing example



N27, MNI_2009c,1mm,2mm, 4mm,8mm

Eickhoff-Zilles MPM 2.2 atlas - modal smoothing example



Circularity – "double dipping"

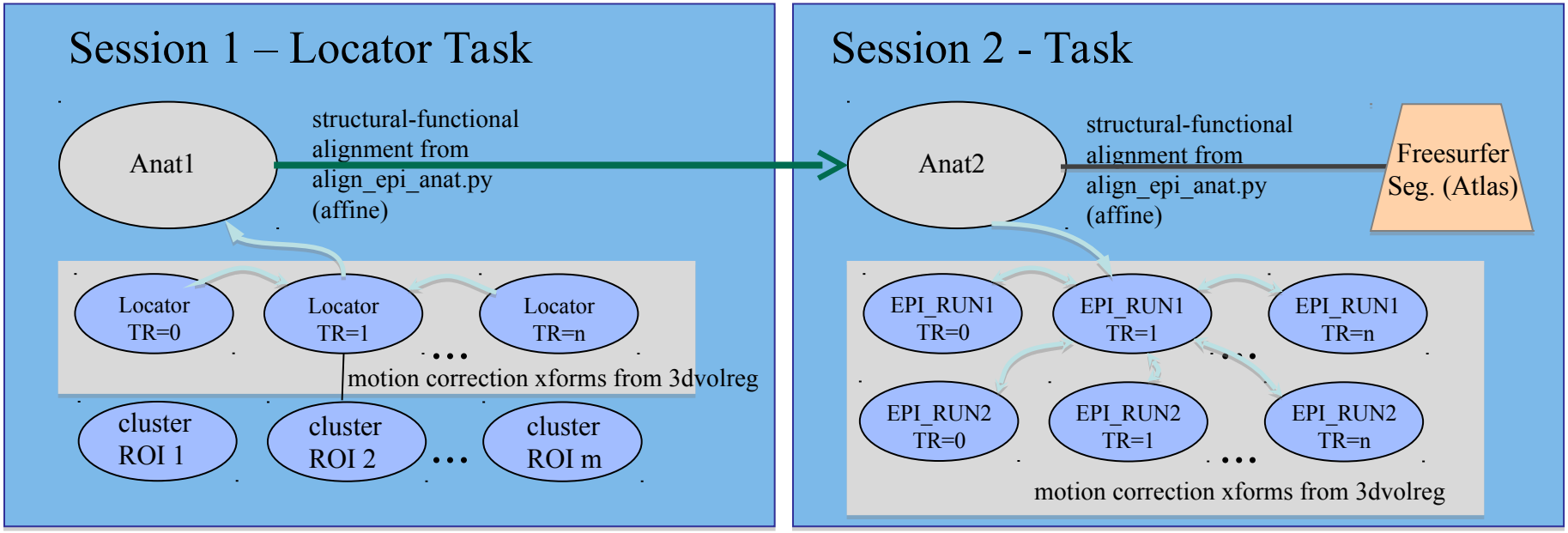
Using results from one set of data to limit the data in that same set.

FMRI example:

- Find largest differences with some threshold between groups A and B
- Create ROIs from those differences
- Show differences between ROIs for the same two groups showing that indeed A is very different from B with a p-value of 0.05. They're different because they're different.

- Solution : Use ROIs from independent data: Atlas regions, locator tasks, other subjects

ROIs from Locator session day 1 applied to session day 2 EPI



align_epi_anat a2 to e2 => a2e2.aff12.1D
align_epi_anat a1 to a2 => a1a2.aff12.1D
align_epi_anat L1 to a1 => L1a1.aff12.1D

cat_matvec a2e2.aff12.1D a1a2.aff12.1D L1a1.aff12.1D > L1e2.aff12.1D

e2 -> a2 ⇨ a2 -> a1 ⇨ a1 -> L1 e2 -> L1

3dAllineate -1Dmatrix_apply L1e2.aff12.1D –final NN –prefix ROI1_e2 \
-base epi_run1+orig'[1]' –input ROI1+orig

That's All for Now

That's All for Now