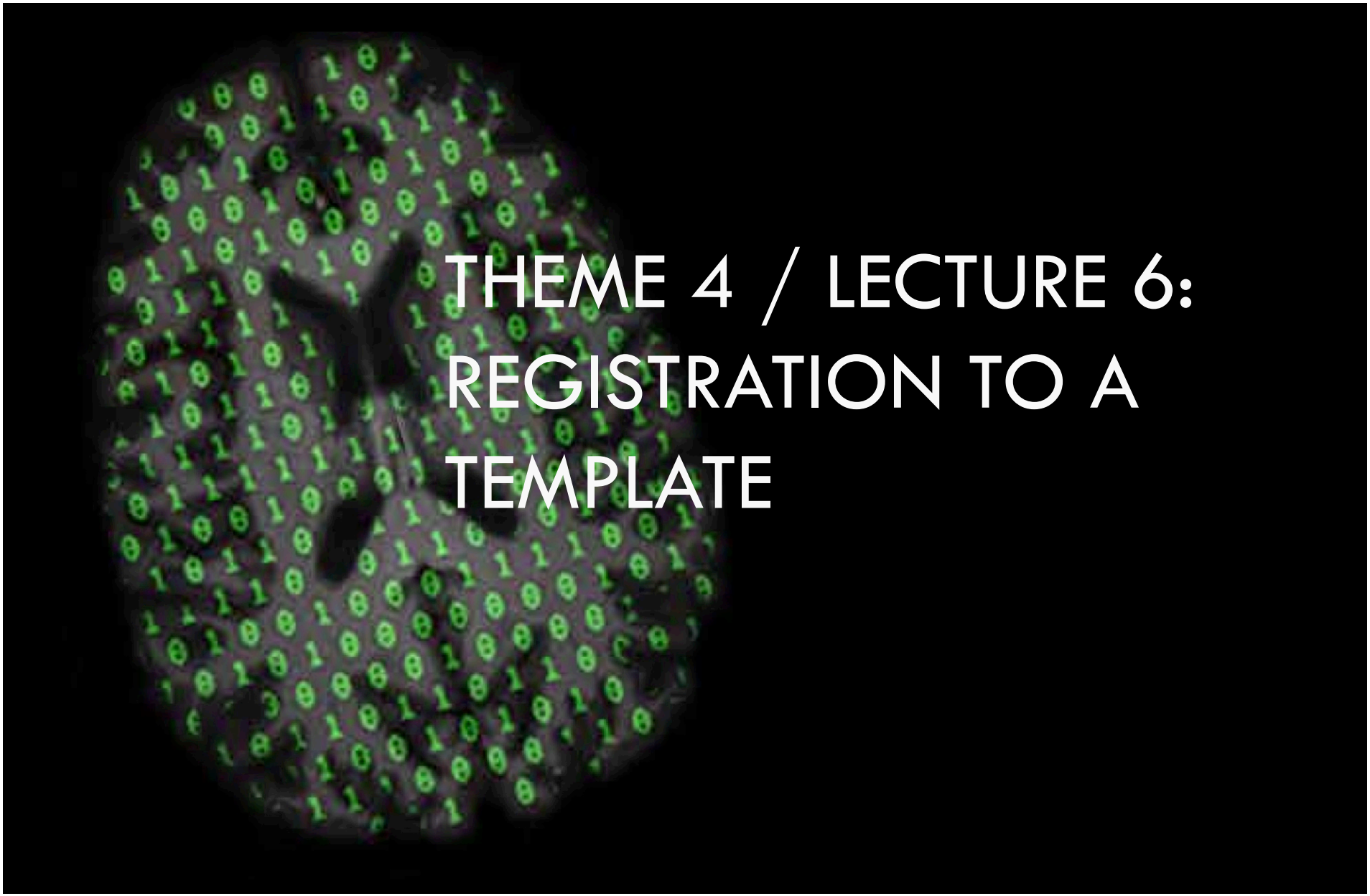
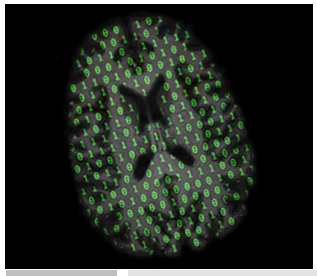
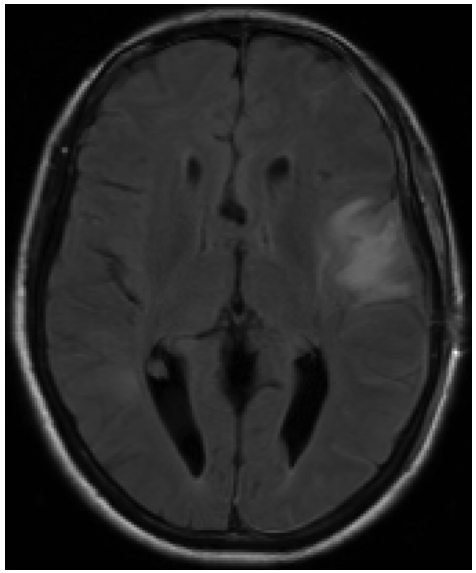


THEME 4 / LECTURE 6: REGISTRATION TO A TEMPLATE



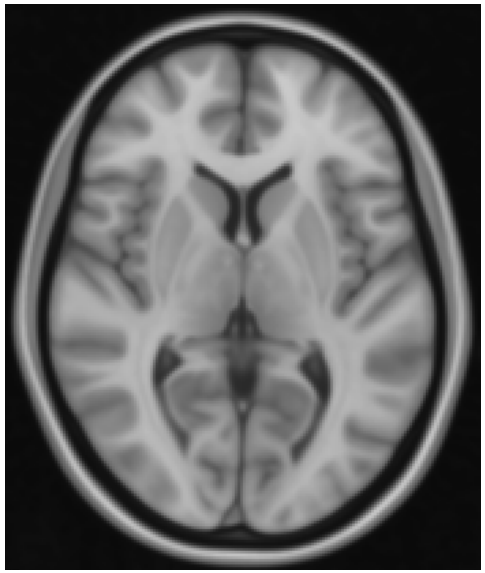
Registration to a Template

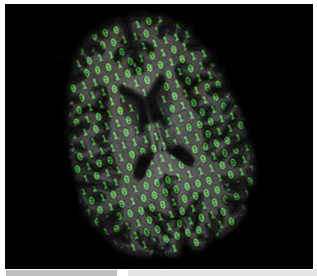
Warped FLAIR image



Warped ROI image

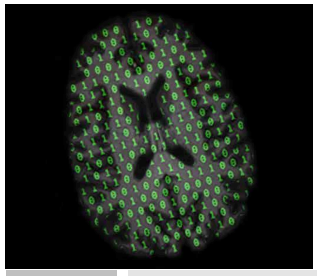
Eve/MNI T1 Template



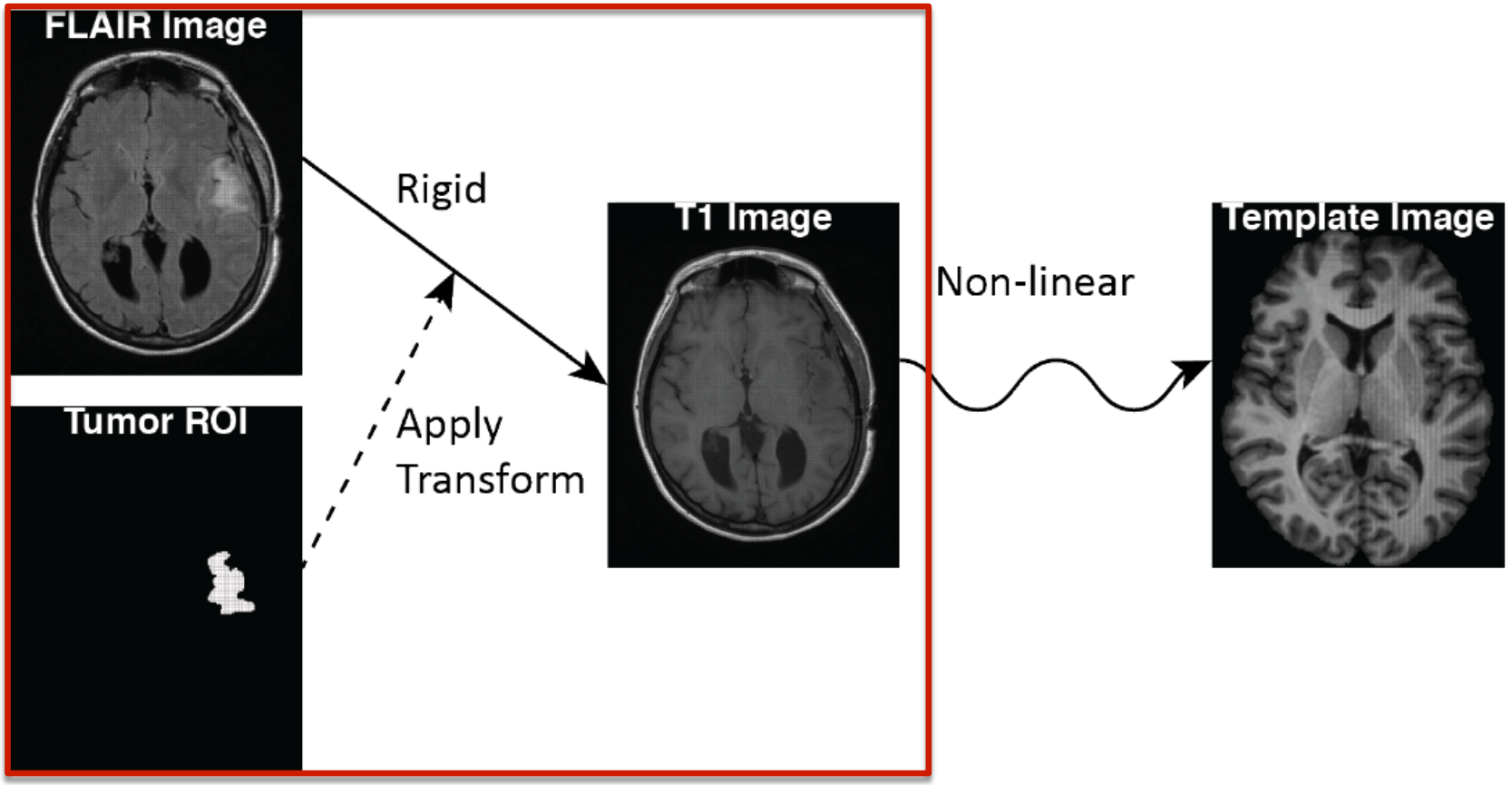


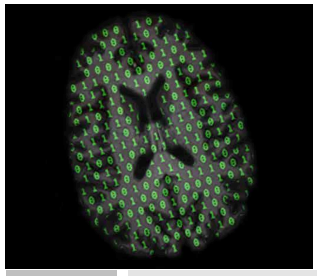
Types of Registration

- Complexity
  - rigid (6df)
  - affine (12df)
  - **nonlinear (>12df)**
- Co-registration (within the same person)
  - Cross-sectional between-modalities
  - Longitudinal within-modality
  - Longitudinal between-modalities
- **Registration to a template**
  - **A template image is necessary**
    - **MNI template stored in …/data/Template/MNI152_T1_1mm_brain.nii.gz**
    - **Eve template stored in …/data/Template/JHU_MNI_SS_T1.nii.gz**
  - **There are many different templates**
- One subject to another



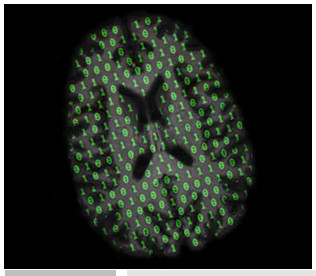
Overall Framework





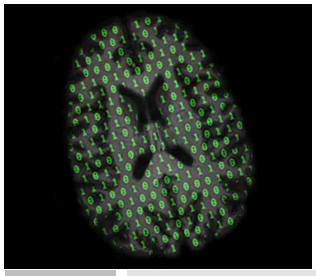
Registration to a Template

- Commonly requires an affine transformation
  - brain may be different sizes and in different spaces
  - translate/rotate as in rigid-body registration
  - scale up or down in size and shearing
- Affine transformation then non-linear transformation
- Usually achieves better local agreement
- Can change the volume of structures differentially



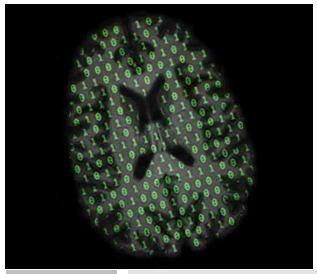
Reading in the T1 Scan from BRAINIX

```
library(oro.nifti)
library(extrantsr)
library(fslr)
library(scales)
neurodir <- "/home/fsluser/Desktop/MOOC-2015"
mridir = file.path(neurodir, "BRAINIX", "NIfTI")
t1 = file.path(mridir, "T1.nii.gz")
t1 = readNIfTI(t1, reorient = FALSE)
```

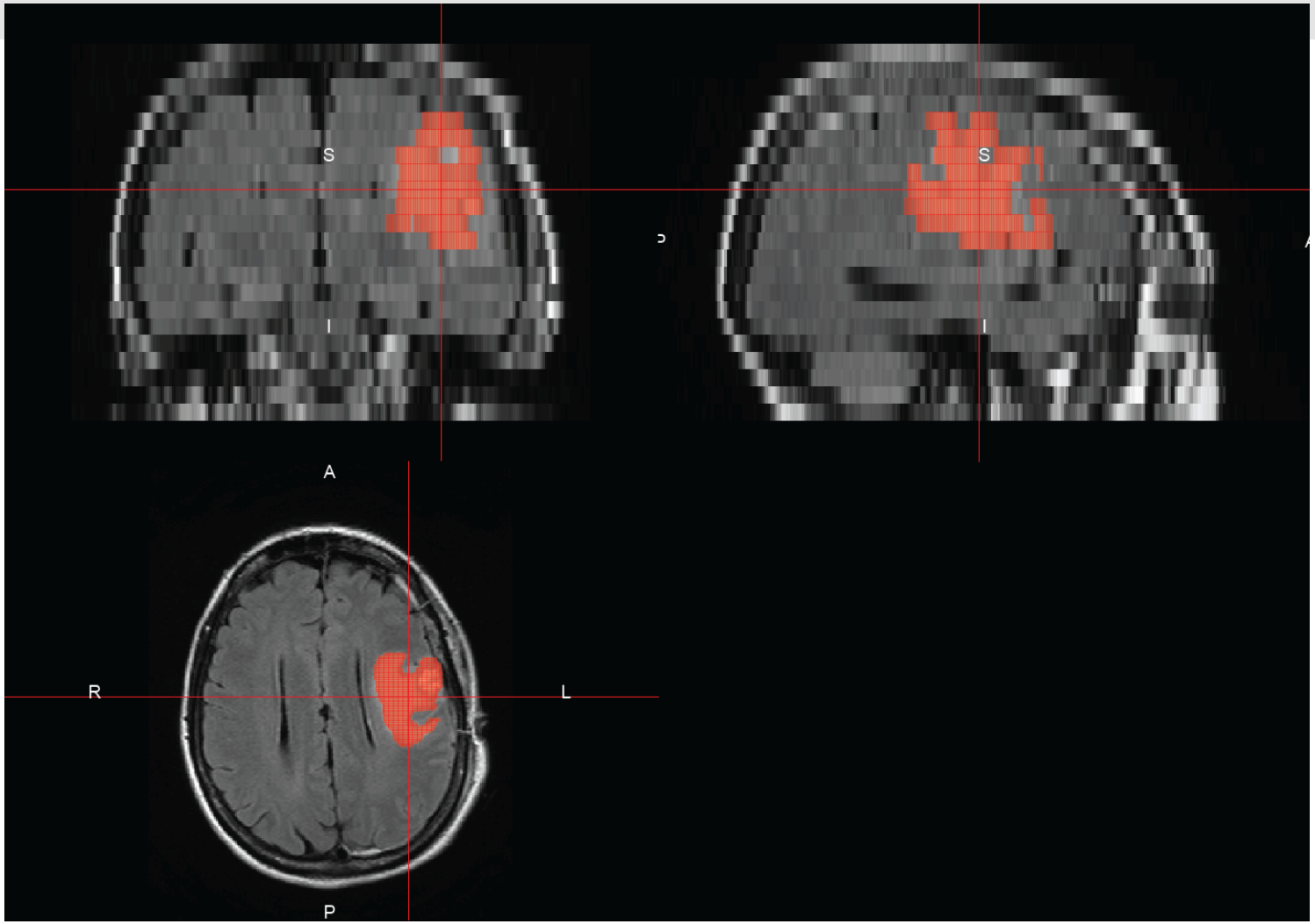


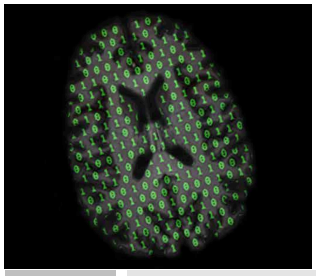
A Region of Interest from a Tumor on FLAIR

```
flair = file.path(mridir, "FLAIR.nii.gz")
roi = file.path(mridir, "ROI.nii.gz")

flair_file=readNIfTI(flair, reorient = FALSE)

roi_file=readNIfTI(roi, reorient = FALSE)
is_tumor<- (roi_file>0)
roi_file[!is_tumor]=NA

orthographic(flair_file,roi_file, xyz=c(200,155,12),
             col.y=alpha("red",0.2),
             text="Image overlaid with mask",
             text.cex = 1.5)
```



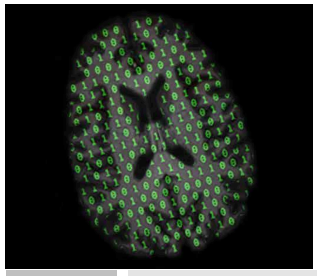
A Region of Interest from a Tumor on FLAIR





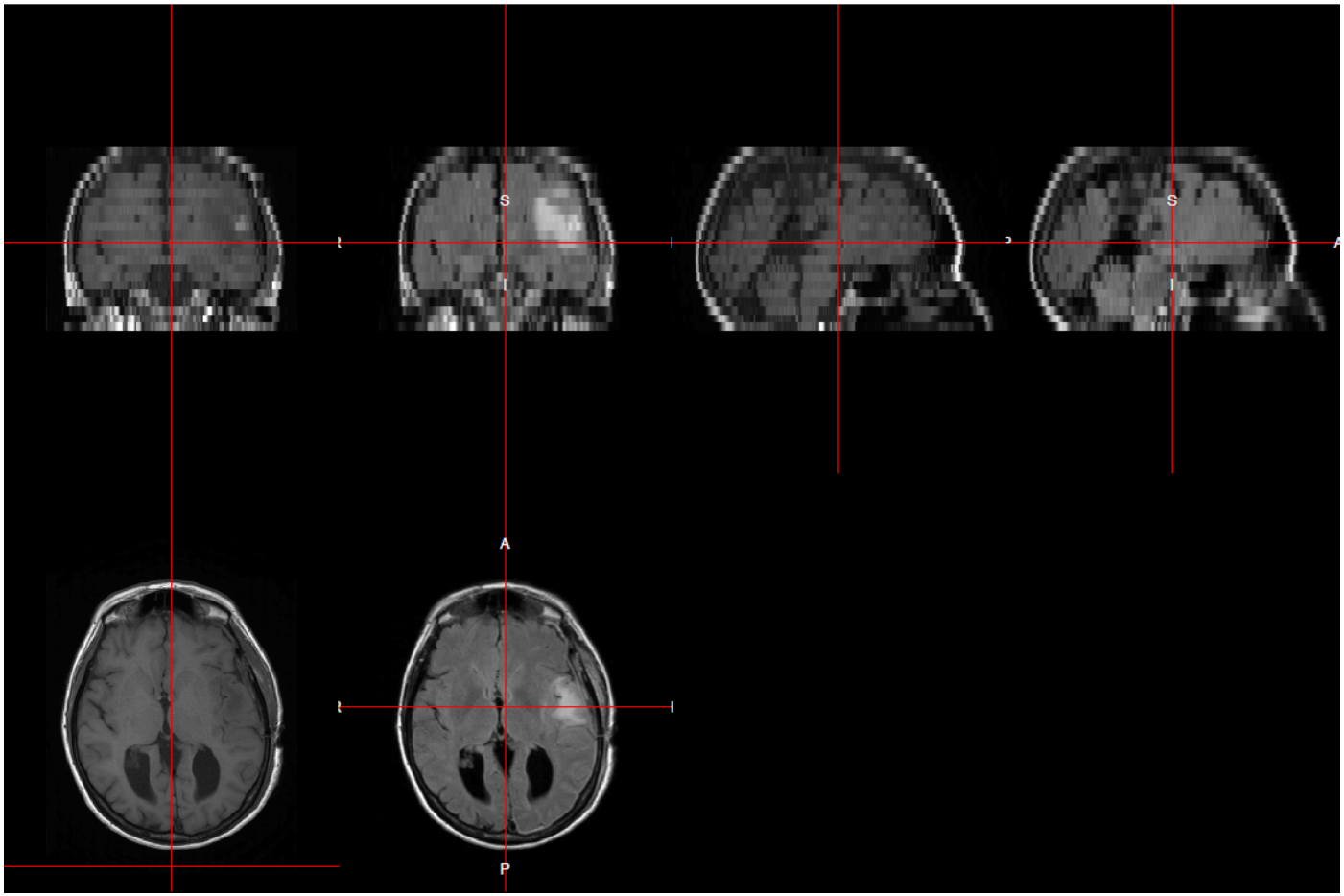
Rigid FLAIR to T1, Apply Transform to ROI

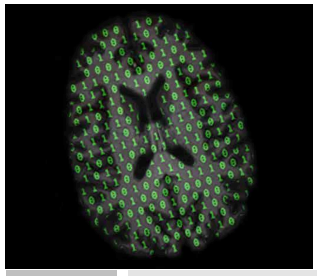
```
reg_flair = file.path(mridir,"FLAIR_regToT1.nii.gz")
reg_roi = file.path(mridir,"ROI_regToT1.nii.gz")

reg_flair_img = ants_regwrite(filename = flair,
                              template.file = t1,
                              outfile = reg_flair,
                              typeofTransform = "Rigid",
                              other.files = roi,
                              other.outfiles = reg_roi,
                              verbose = FALSE)

reg_roi_img = readNIfTI(reg_roi, reorient = FALSE)
```



FLAIR to T1 Registration Results

```
double_ortho(t1,reg_flair_img)
```





FLAIR to T1 Registration: ROI Overlay

```
ortho2(reg_flair_img,reg_roi_img,col.y=alpha("red",0.2))
```