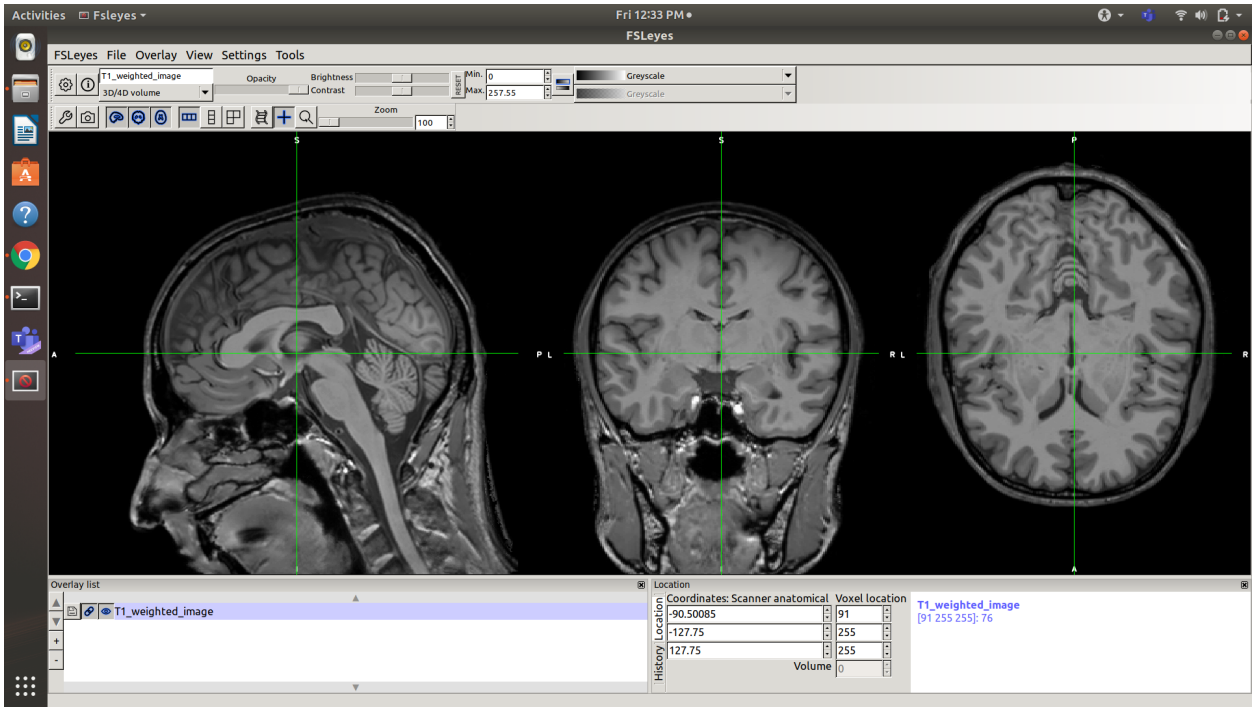
Assignment-1(COL786)

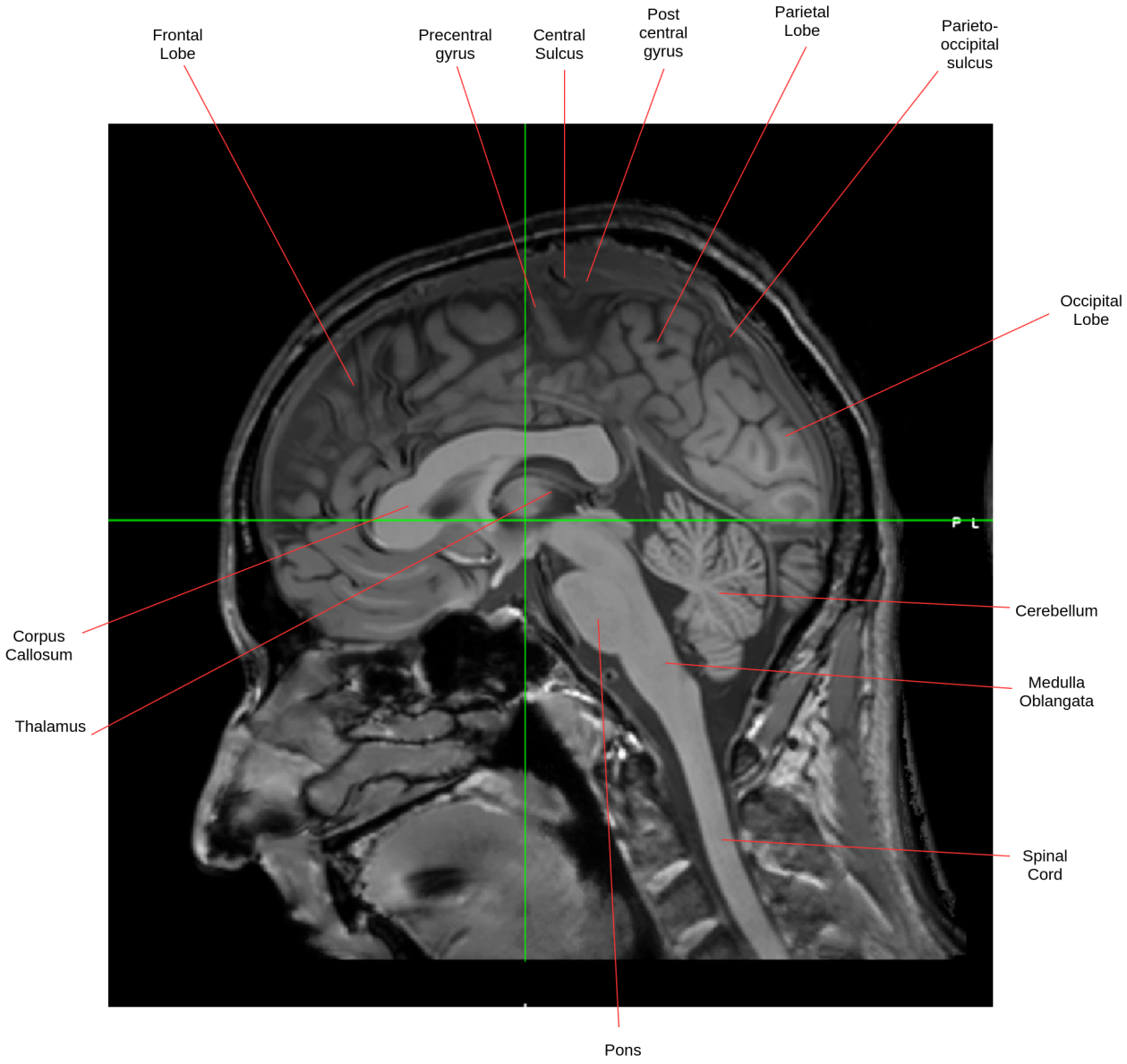
(Entry No:-2020CSY7576, Shivansh Chandra Tripathi)

1)Lobe Identification

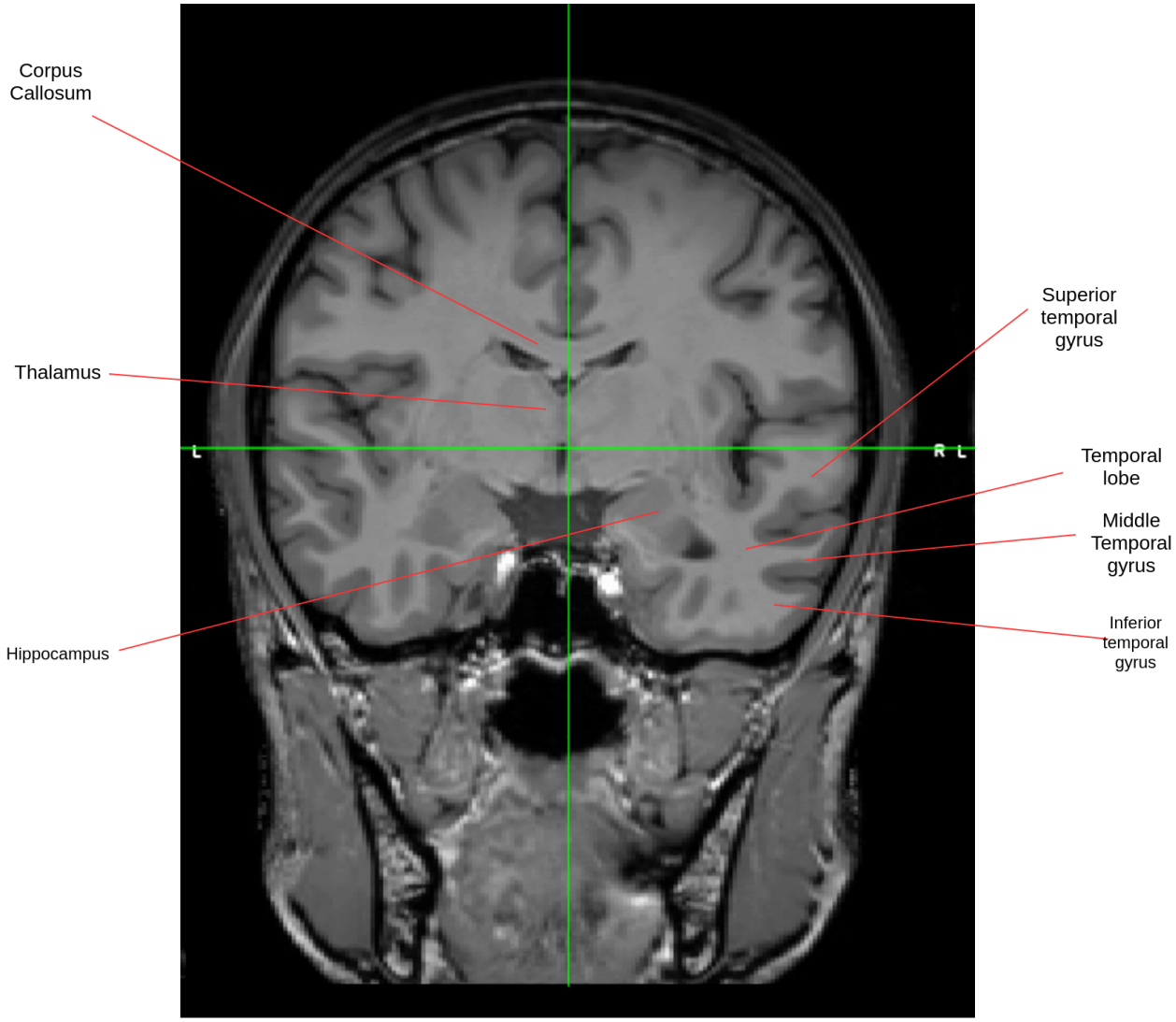
T1_weighted_MRI



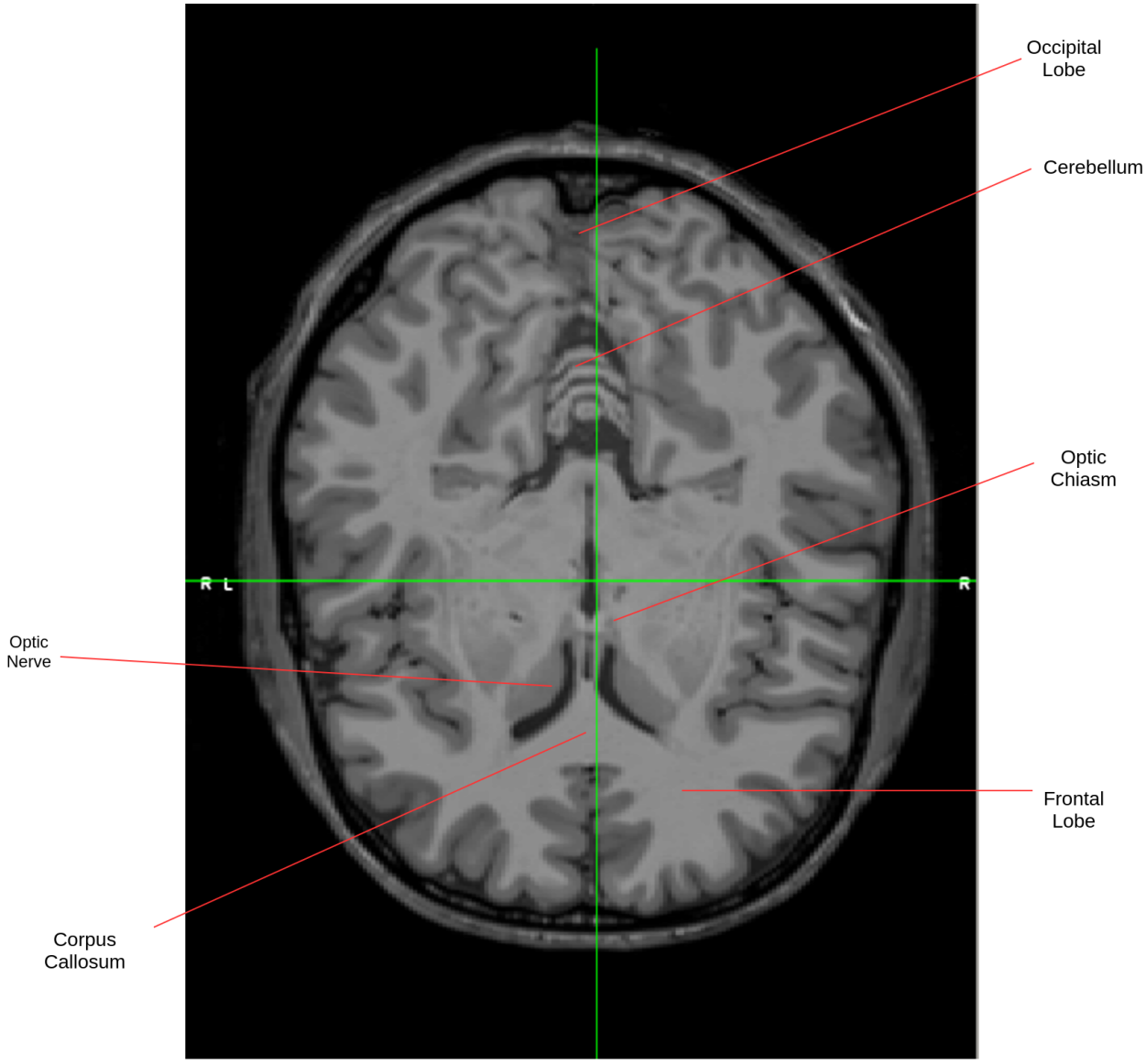
Sagittal Plane



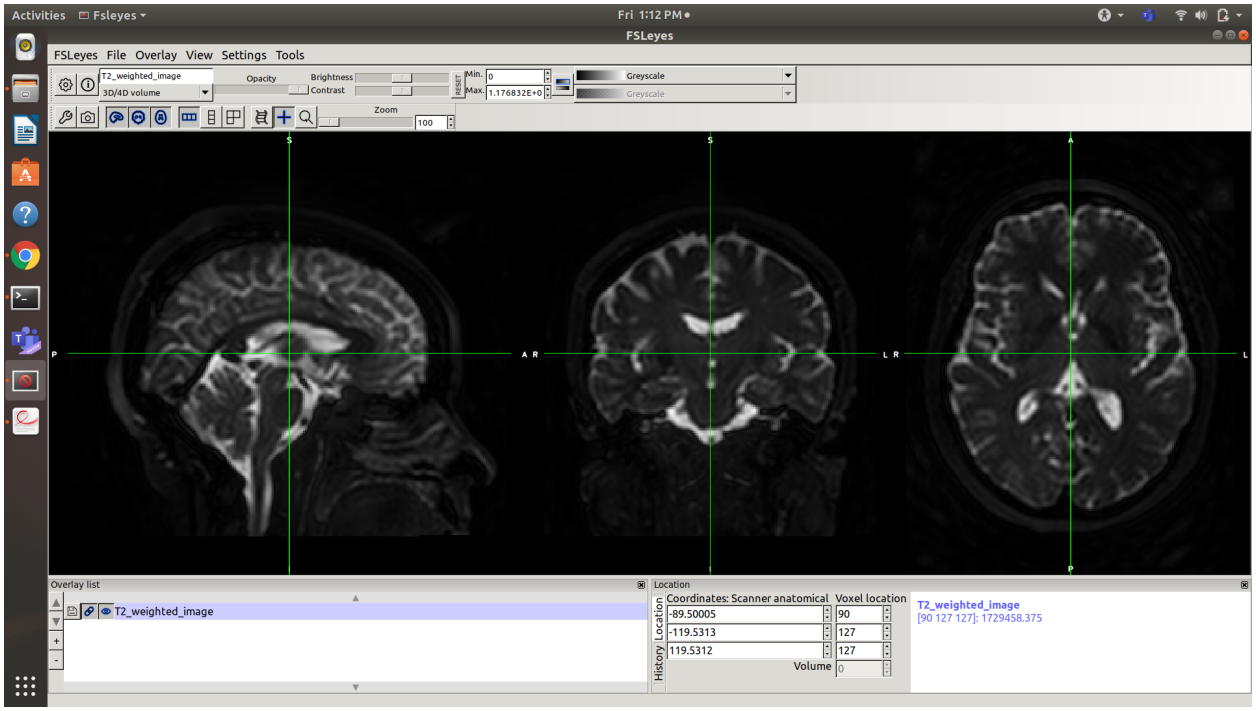
Coronal Plane



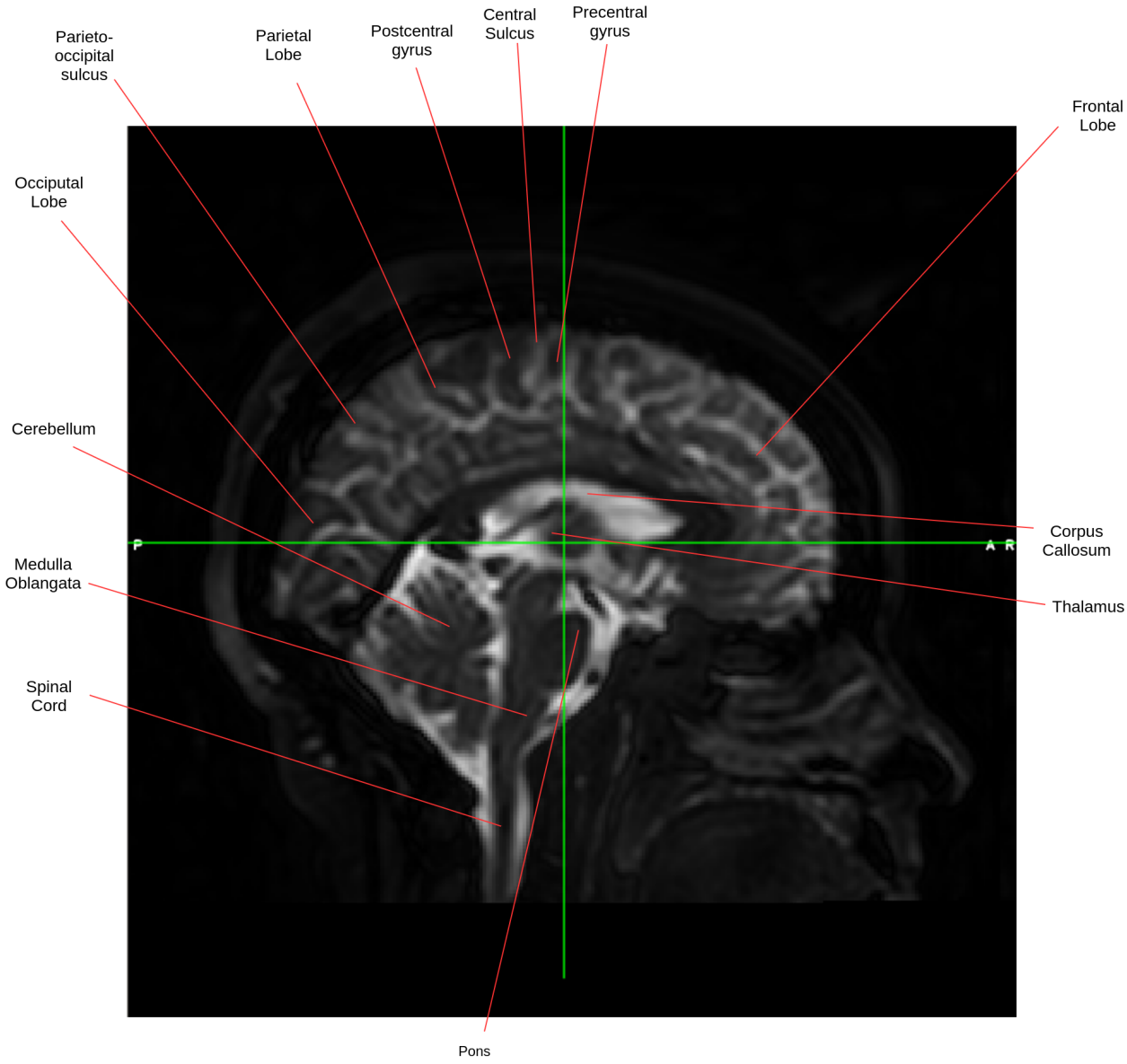
Transverse Plane


Occipital Lobe
Cerebellum
Optic Chiasm
Optic Nerve
Frontal Lobe
Corpus Callosum
R L
R

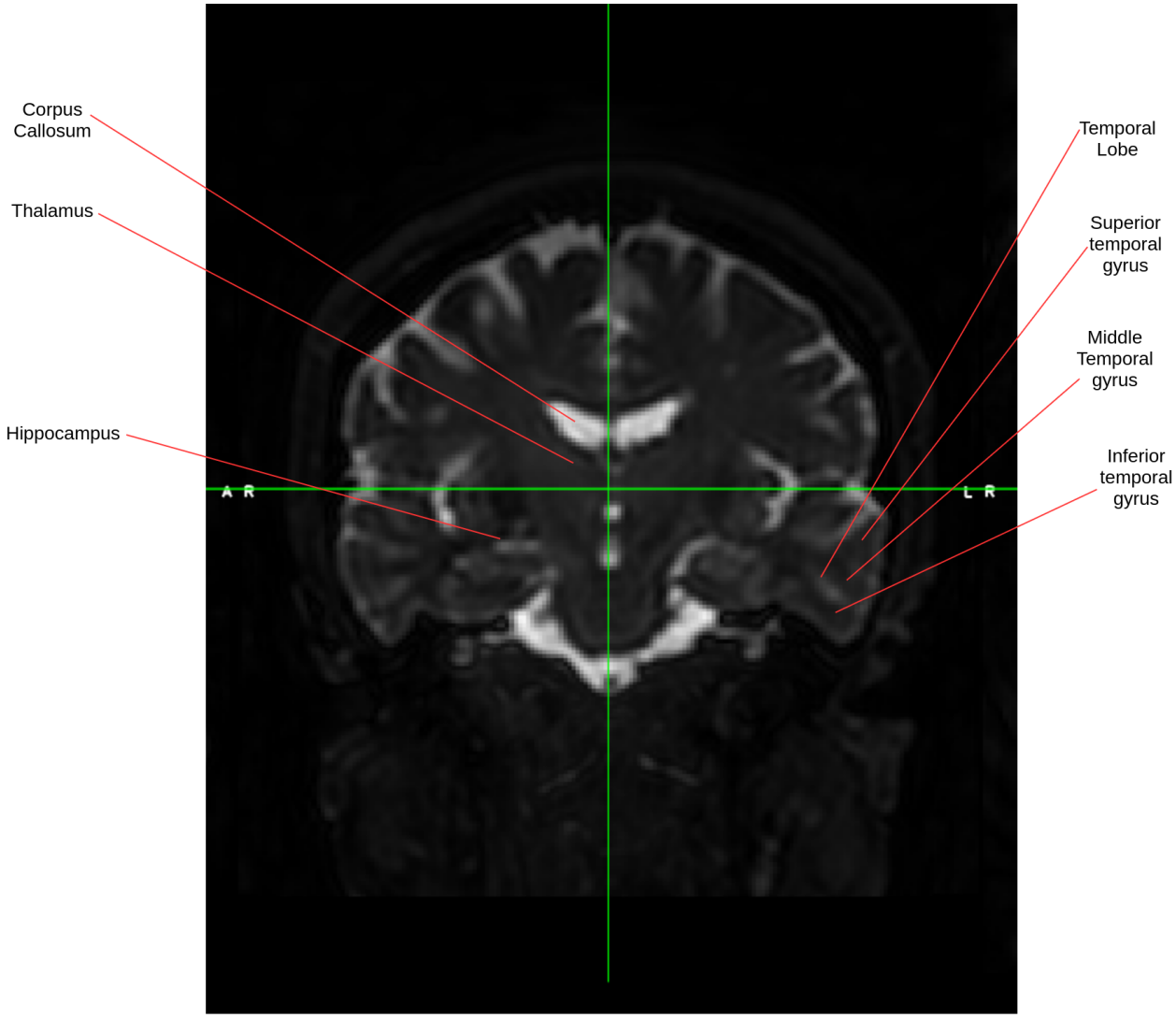
T2_Weighted_MRI



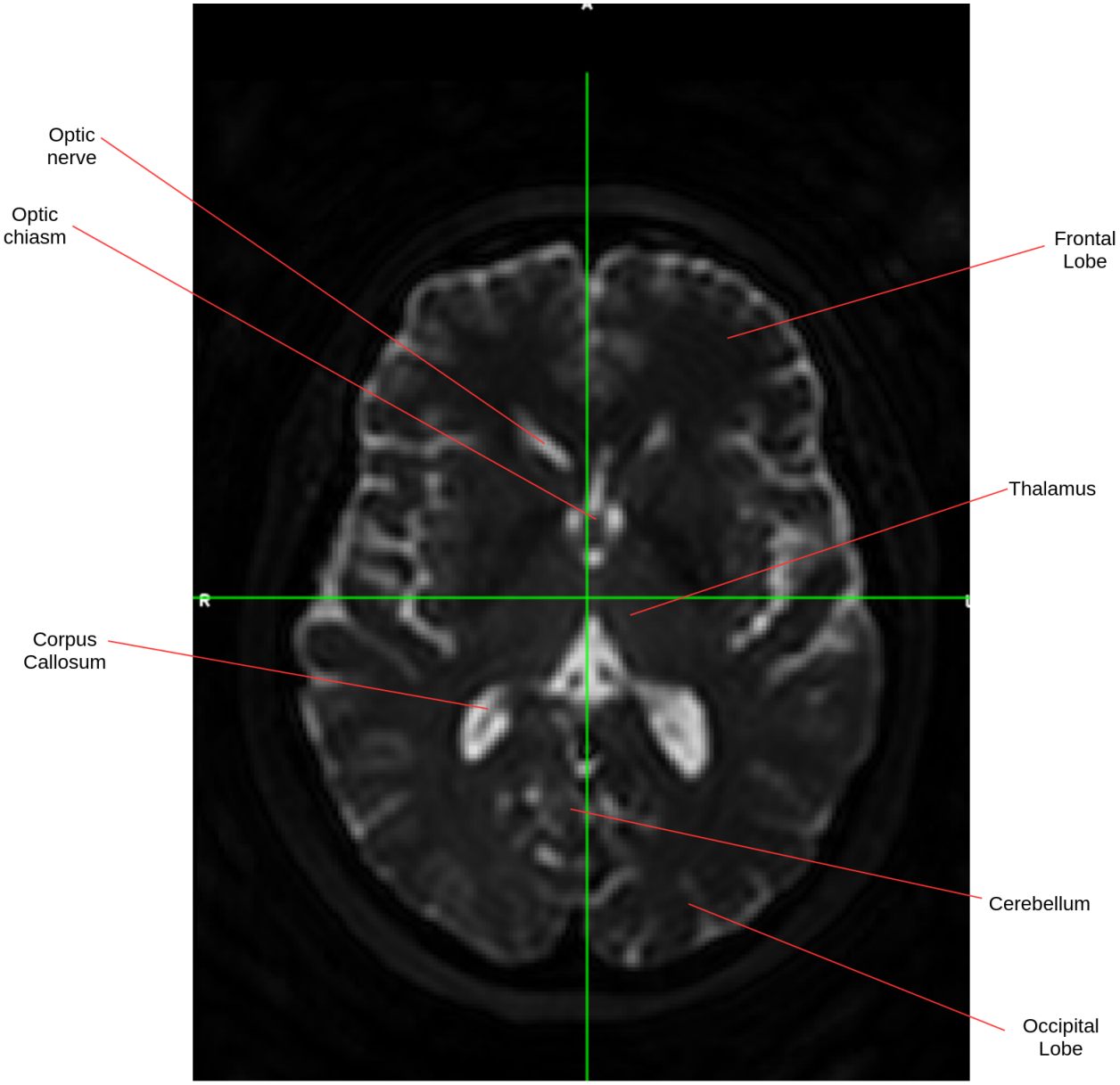
Sagittal Plane



Coronal Plane



Transverse Plane


Optic nerve
Optic chiasm
Frontal Lobe
Thalamus
Corpus Callosum
Cerebellum
Occipital Lobe

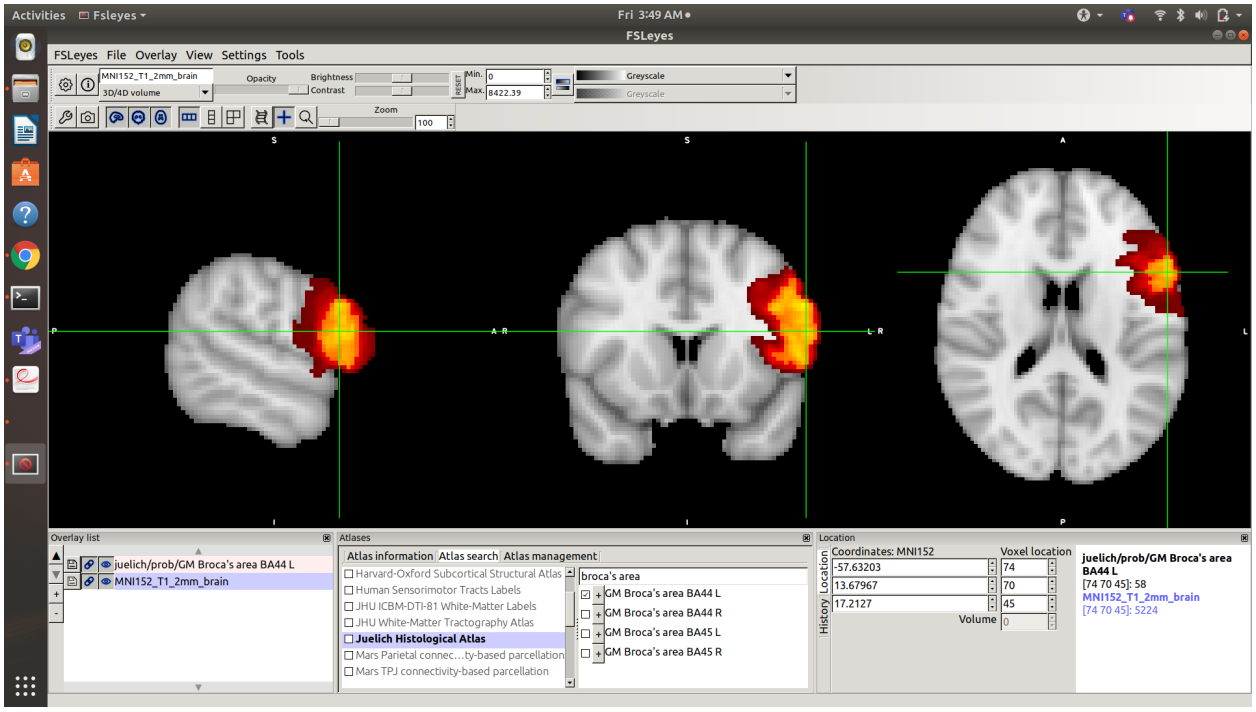
Sagittal View- For the sagittal view, the boundary between the frontal and parietal lobe can be located by finding the central sulcus, on the lateral surface. Central sulcus can be tracked by looking for precentral and post central gyrus. Now, to find the boundary between parietal and occipital lobe we find the parieto-occipital sulcus which separates the two. Cerebellum is clearly visible as a leaf like structure on the dorsal part of brain stem. Note that it is difficult to spot temporal lobe in this view since it's hidden behind the sagittal plane. Corpus Callosum, the white matter network of axons connecting the two hemispheres is also clearly visible. Along with the lobes and cerebellum, Pons, Medulla Oblangata, Spinal cord, Thalamus can also be spotted.

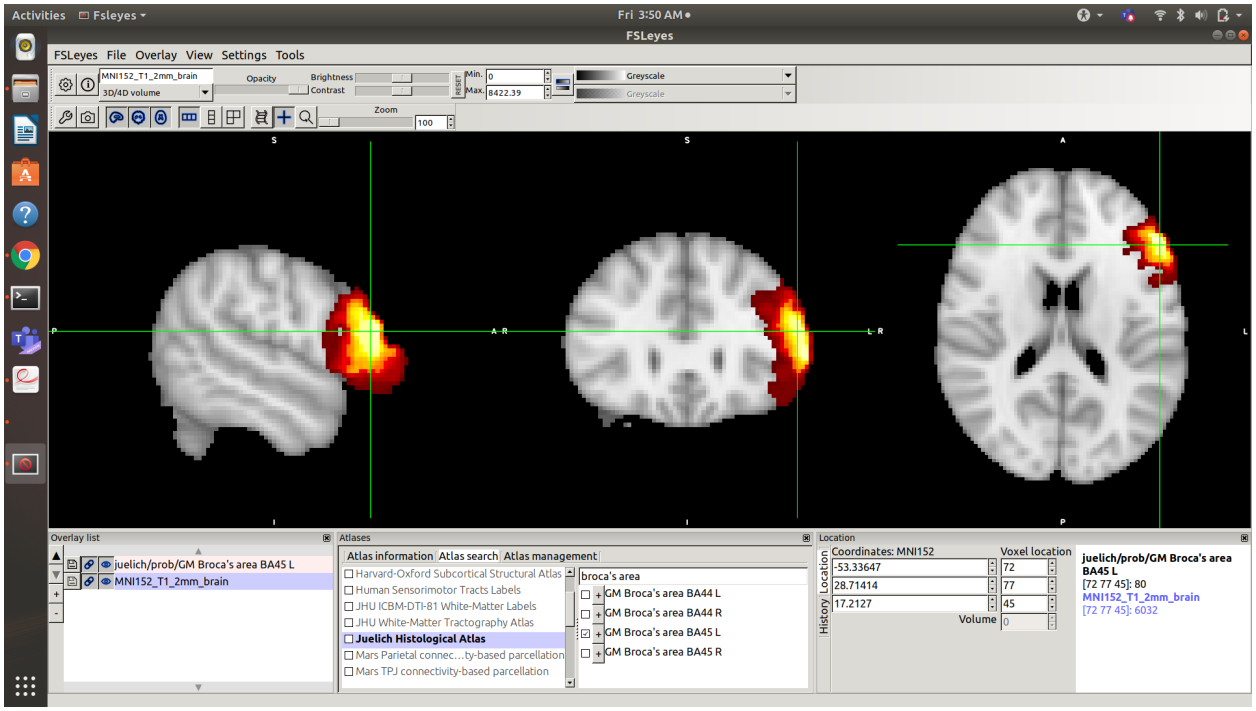
Coronal View- Since the point of intersection of three planes in our T1 and T2 images above is near the basal ganglia, we can clearly spot temporal lobe in this view. (because a plane parallel to our coronal plane that could've been more towards the caudal area, could hide the temporal lobe and show occipital lobe more distinguishably). Temporal lobe is clearly spotted using its three major gyri- superior, middle and inferior temporal gyrus. Along, with that corpus callosum is visible, thalamus and hippocampus can also be located.

Transverse View- Optic Nerve and Optic chiasm are clearly spotted, by the fact that towards the anterior part of optic chiasm is surely frontal lobe, we label it. Towards the rostral area of brain, we can see a white matter crossing the two hemispheres, which we know to be corpus callosum. Using other two views for reference, we can find cerebellum, and behind the cerebellum we know the lobe to be occipital lobe.

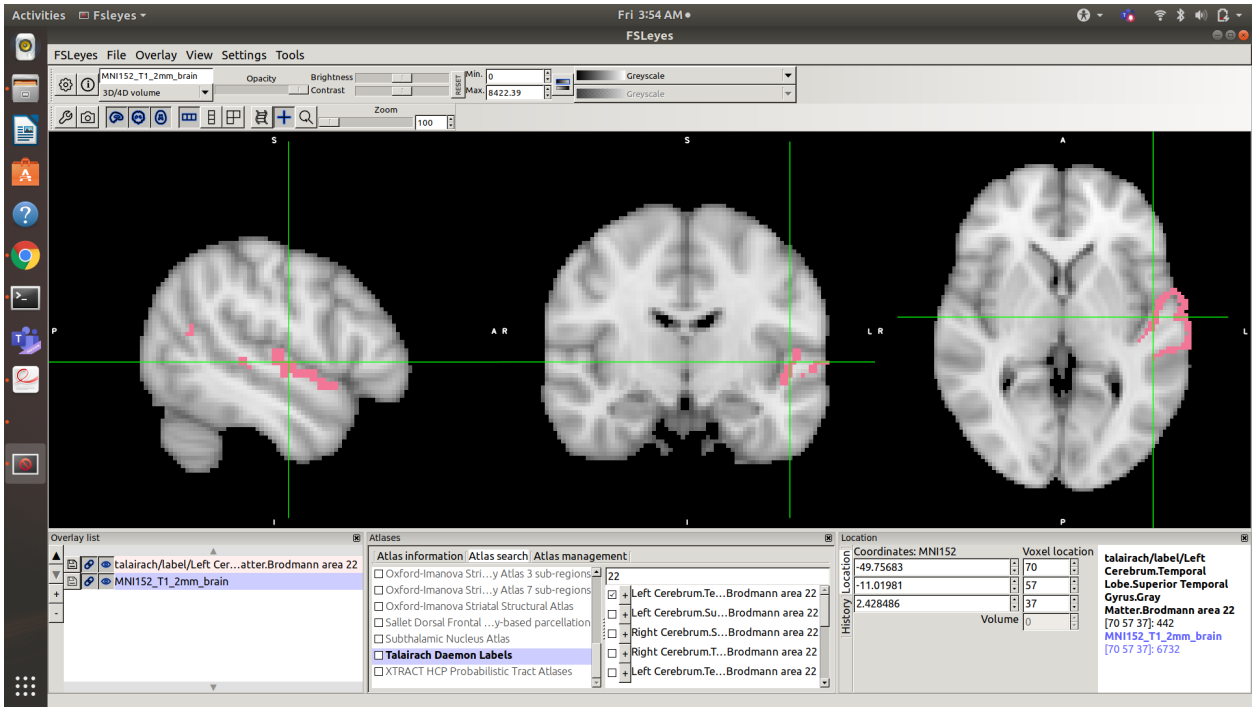
2)Using Atlas to identify brain regions (MNI152_T1_2mm_brain.nii.gz is used)

Broca’s area (left)-using Juelich Histological atlas

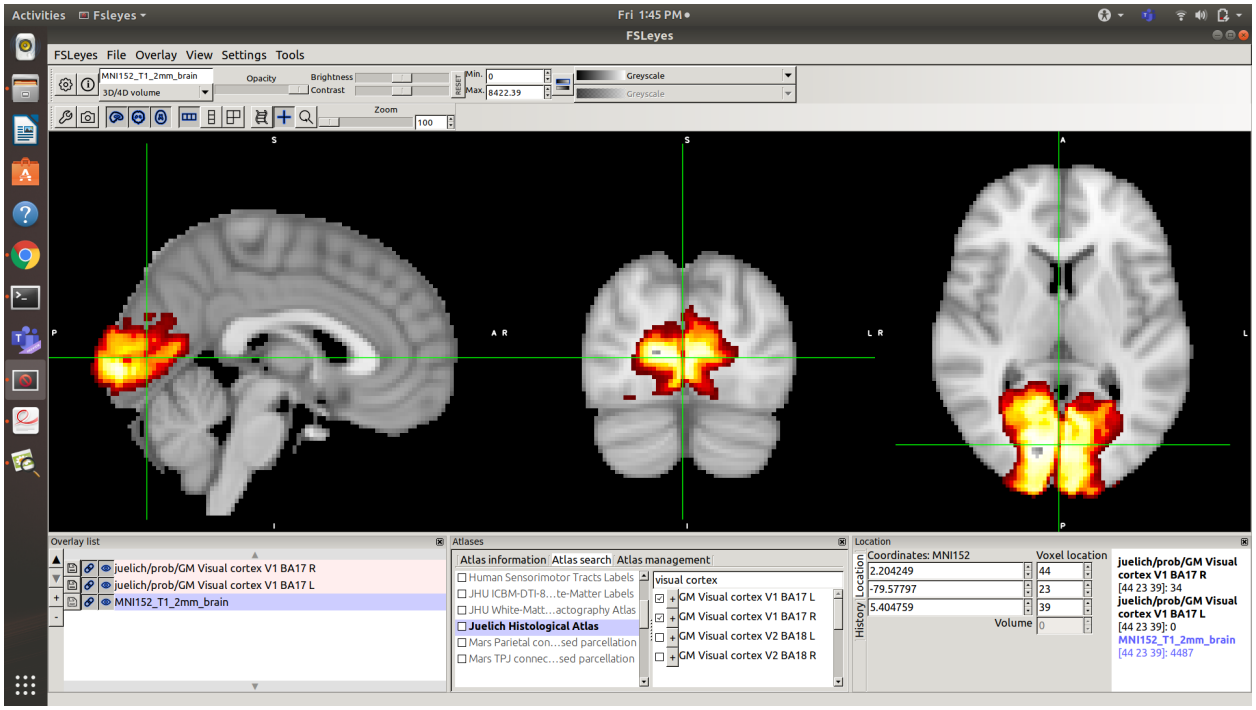




Wernicke’s area (left)-using Talairach Daemon Labels



Visual cortex (bilateral)-using Juelich Histological atlas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FSLeyes
FSLeyes File Overlay View Settings Tools
MNI152_T1_2mm_brain
3D/4D volume
Opacity
Brightness
Contrast
Min.
Max.
8422.39
Greyscale
Zoom
100
Overlay list
juelich/prob/GM Visual cortex V1 BA17 R
juelich/prob/GM Visual cortex V1 BA17 L
MNI152_T1_2mm_brain
Atlases
Atlas information
Atlas search
Atlas management
Human Sensorimotor Tracts Labels
JHU ICBM-DTI-8...te-Matter Labels
JHU White-Matt...actography Atlas
Juelich Histological Atlas
Mars Parietal con...sed parcellation
Mars TPJ connec...sed parcellation
visual cortex
GM Visual cortex V1 BA17 L
GM Visual cortex V1 BA17 R
GM Visual cortex V2 BA18 L
GM Visual cortex V2 BA18 R
Location
Coordinates: MNI152
Voxel location
2.204249
-79.57797
5.404759
44
23
39
Volume
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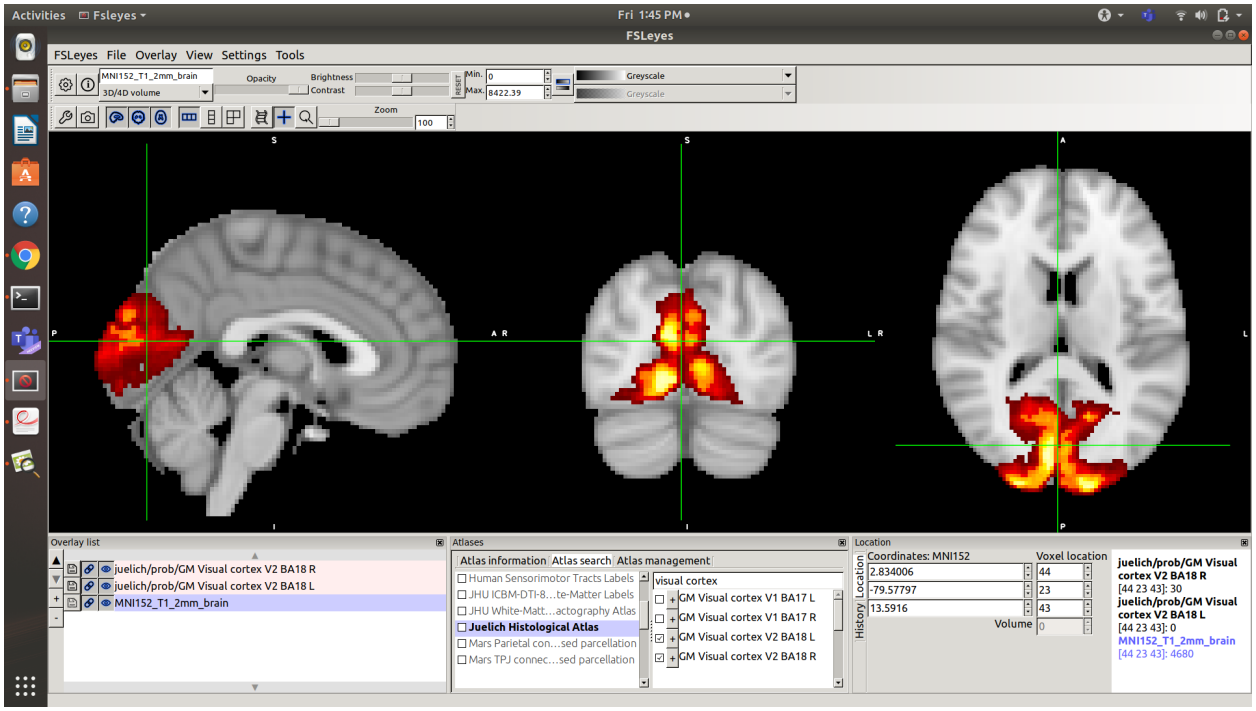
juelich/prob/GM Visual cortex V1 BA17 L
[44 23 39]: 0
MNI152_T1_2mm_brain
[44 23 39]: 4487


Activities
Fsleyes
Fri 1:45 PM
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FSLeyes File Overlay View Settings Tools
MNI152_T1_2mm_brain
3D/4D volume
Opacity
Brightness
Contrast
Min.
Max.
8422.39
Greyscale
Zoom
100
Overlay list
juelich/prob/GM Visual cortex V2 BA18 R
juelich/prob/GM Visual cortex V2 BA18 L
MNI152_T1_2mm_brain
Atlases
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JHU ICBM-DTI-8...te-Matter Labels
JHU White-Matt...actography Atlas
Juelich Histological Atlas
Mars Parietal con...sed parcellation
Mars TPJ connec...sed parcellation
visual cortex
GM Visual cortex V1 BA17 L
GM Visual cortex V1 BA17 R
GM Visual cortex V2 BA18 L
GM Visual cortex V2 BA18 R
Location
Coordinates: MNI152
Voxel location
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13.5916
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23
43
Volume
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[44 23 43]: 0
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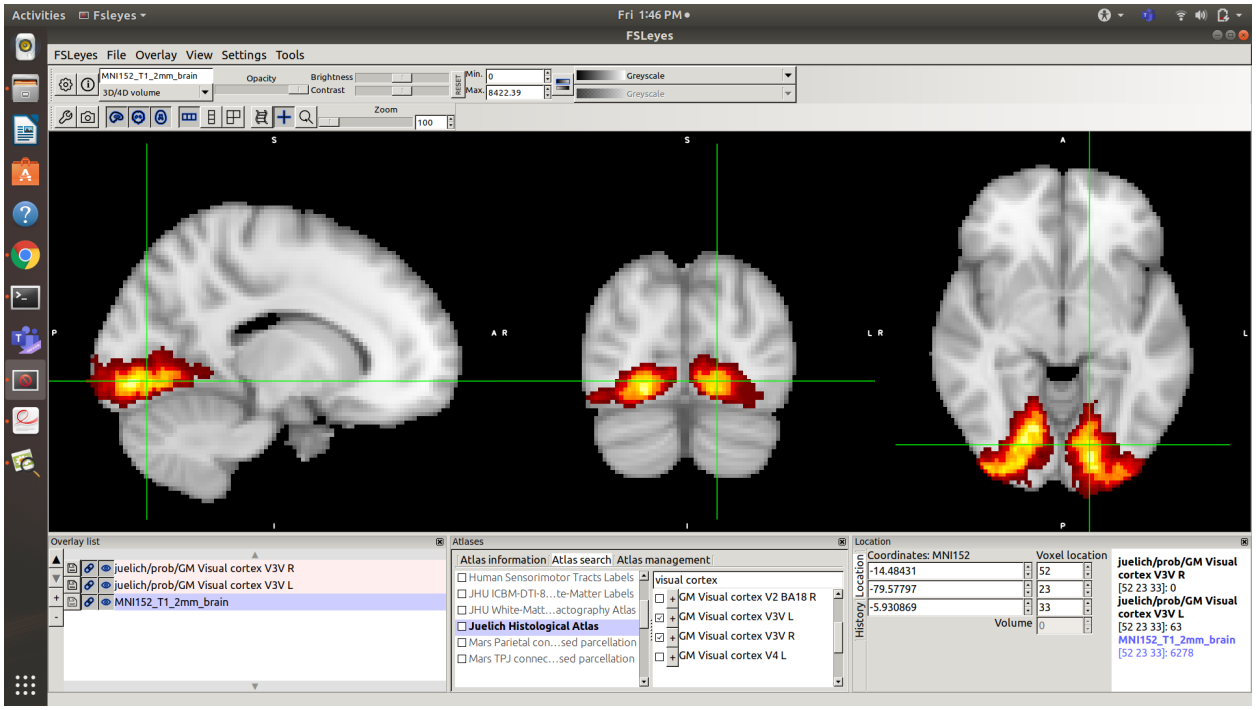
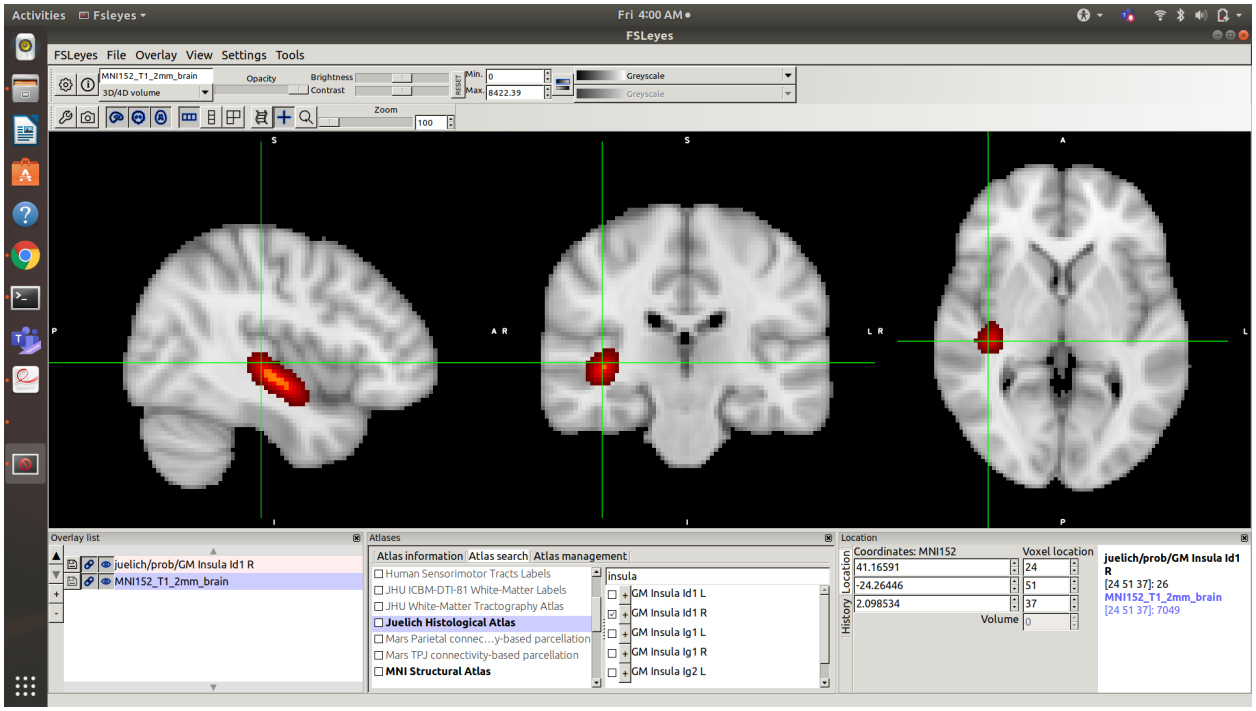
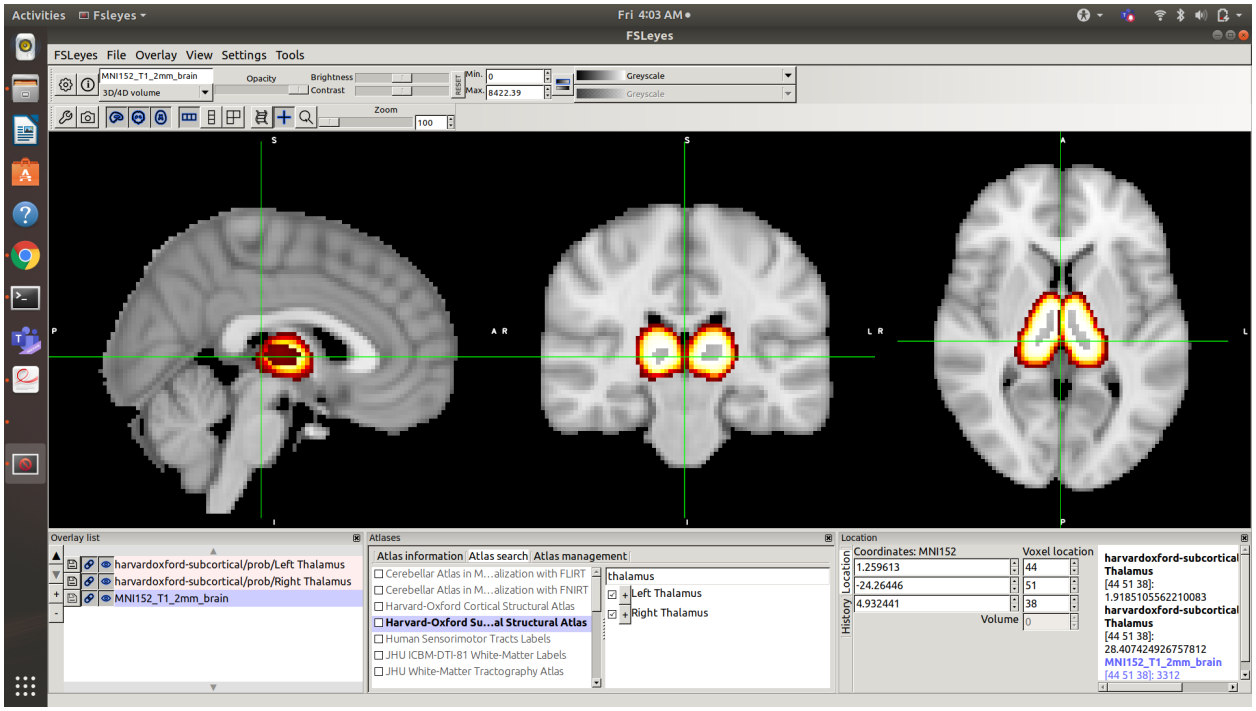


Insula (right)-using Juelich Histological atlas

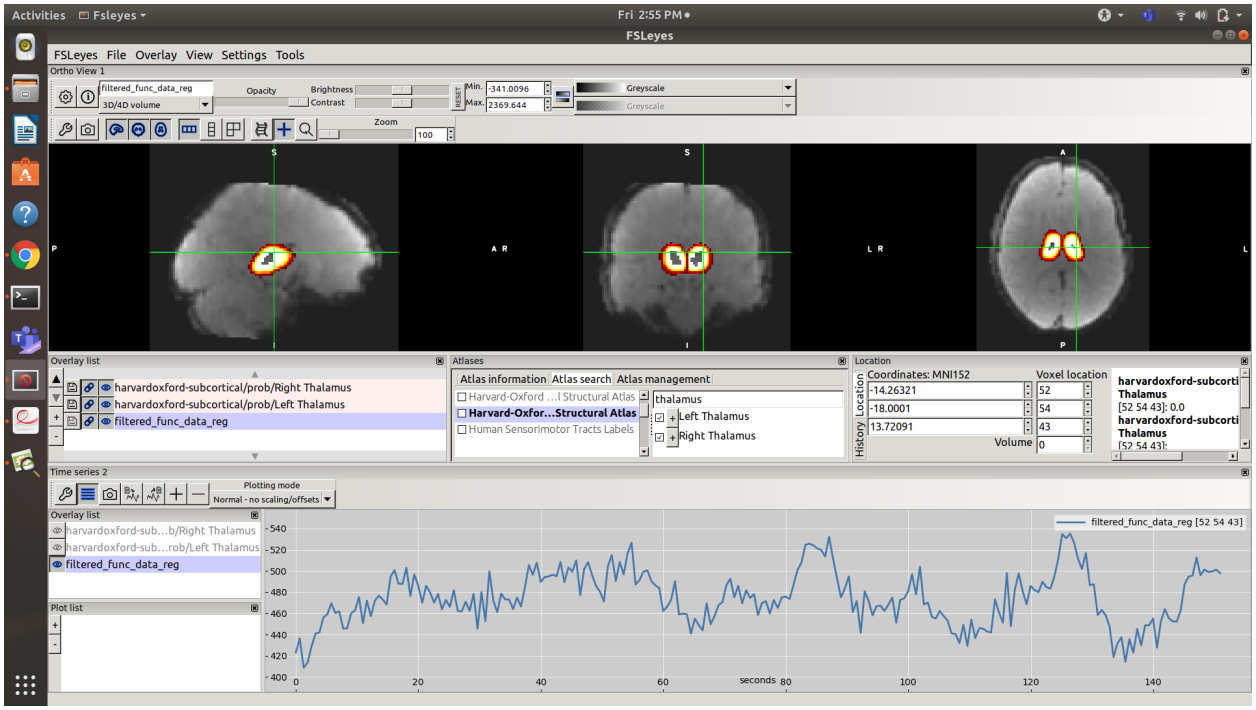


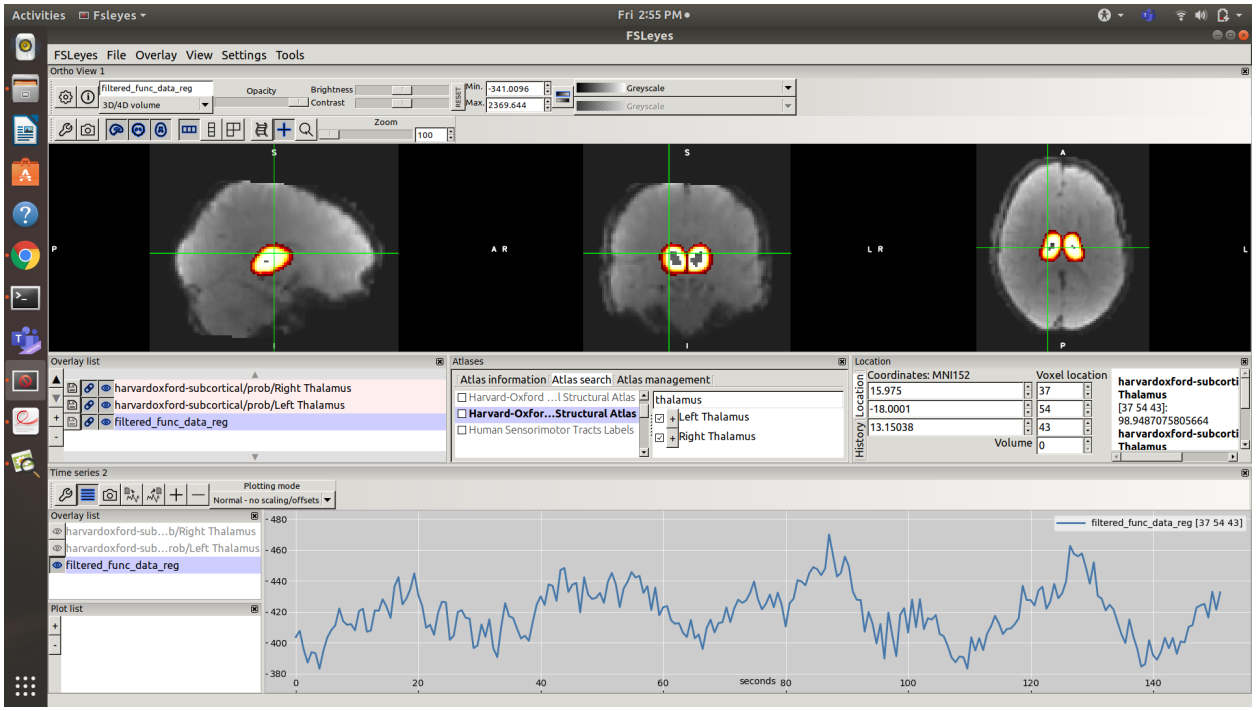
Thalamus (bilateral)-using Harvard-Oxford Subcortical Structural Atlas



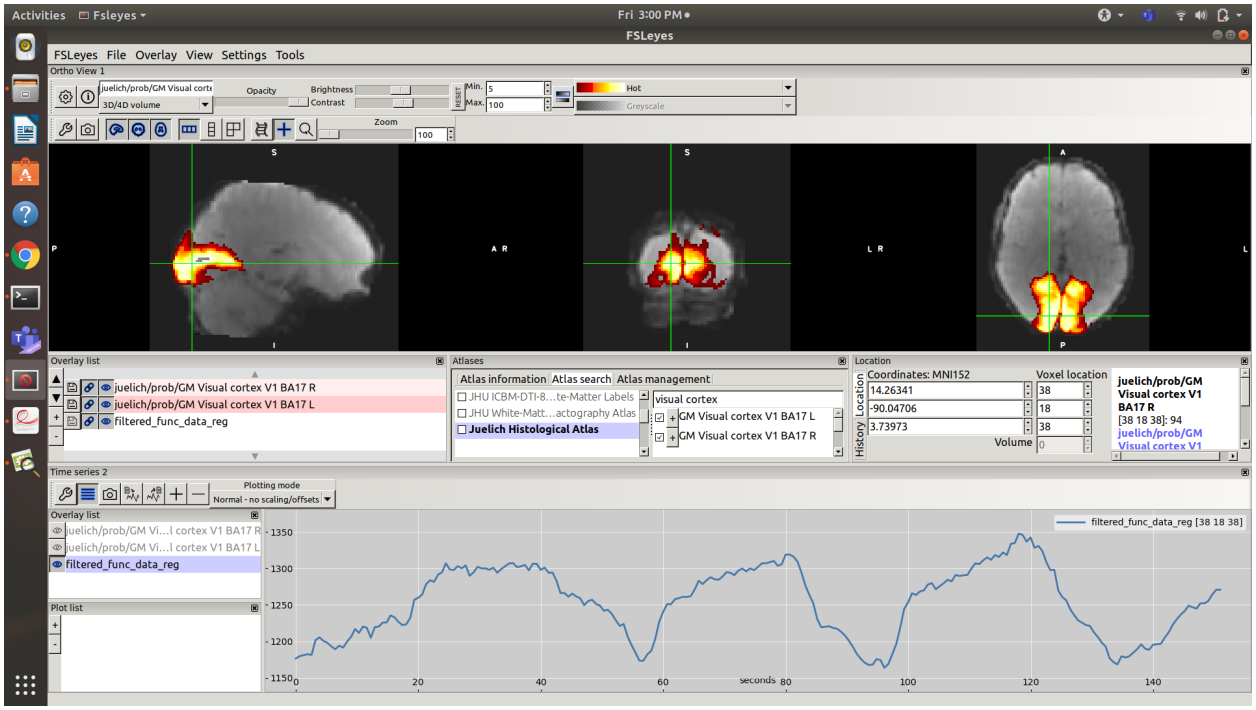
Plot Time Series

a)Thalamus-located using Harvard-Oxford Subcortical Structural Atlas



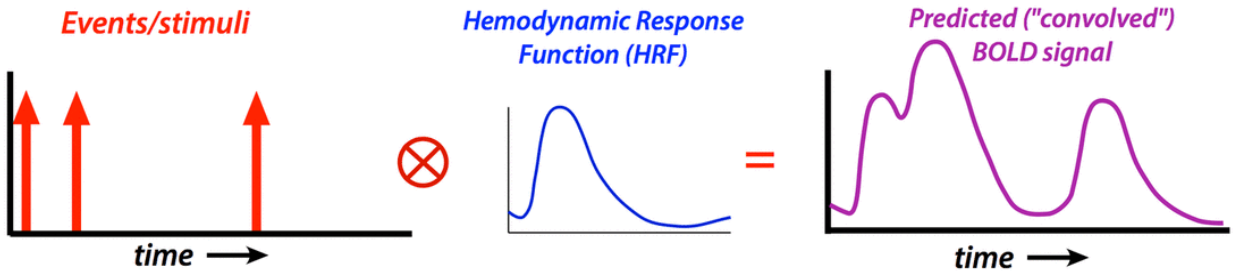


b)Visual Cortex



MNI Co-ordinates: (14.26341, -90.04706, 3.73973)
The checkerboard paradigm given is as follows:
Checker Block Paradigm:
block_types = [FIXATION, CHECKER, FIXATION, CHECKER, FIXATION, CHECKER]
block_durations = [20.0, 20.0, 20.0, 20.0, 20.0, 20.0] # seconds
It can be thought of as a square wave, with amplitude 1 during checker presentation.

Convolving with a typical heomodynamic response function would yield on an average higher amplitudes during the checker time. This will be an ideal Bold signal(convolution of HRF and experiment paradigm) as shown:



(Source: http://mriquestions.com/uploads/3/4/5/7/34572113/convolution-of-3-events_orig.gif)

From the above diagram we can see that the BOLD responses are highest where both HRF and Checker signal will be high. It will be average when only one of them is high and lowest when both are low. For the particular voxel selected in the above visual cortex region, we can clearly see, that the BOLD signal rises whenever the checker starts (at 20, 40, 60), and stays higher for the entire duration of 20s. As soon as checker is removed, BOLD signal starts falling gradually, note that there is not a steep fall, since the metabolism and Heomodynamics take time and hence the signals don't go down abruptly. We can clearly notice the signals following a pattern with response to stimulus, on the other hand, analyzing all voxels of the thalamus, yield close to the signal depicted above in time series of the thalamus, no signal is close to the ideal BOLD signal for this experiment, still there is some rise and fall at certain time instants when the checker starts, which explains that thalamus has extremely low activations with response to the experiment although not zero. But, visual cortex has high activations with respect to the experiment. Hence, we can conclude, probabilistically that visual cortex is highly probable for visual activations like checker board representation and thalamus is extremely lowly probable.