**TMS marker processing script**

These script files are generated to estimate the TMS target area using 4 fiducial markers attached around the TMS coil. In preprocessing script file, fiducial markers’ x, y, z coordinates will be extracted and mean\_coordinates.m Matlab script file will perform k-means clustering to partition all of x, y, z coordinates into 4 clusters. Postprocessing script file will estimate the TMS target location in subject’s brain surface and report the intersection surface in standard (Talairach. TLRC) space.

**Content:**

1. TMS\_preprocessing.sh – AFNI/shell script file to extract fiducial markers’ x,y,z coordinates in subject space
2. TMS\_postprocessing.sh - AFNI/shell script file to estimate TMS target location (intersection) in both subject/ standard (TLRC) space
3. mean\_coordinates.m – Matlab code for clustering the fiducial markers’ coordinates
4. t1\_mprage+orig.BRIK/HEAD – t1 mprage example file for demo

**Requirements:** AFNI/ SUMA, Matlab (Any versions include kmeans function)

**Marker preprocessing**

1. 3dUnifize captures an outer boundary of the subject
2. (Option) @clip\_volume clips regions of a volume. (e.g. users can crop the area that includes TMS coil: TMS coil region of interest)
3. create a mask which only contains outer boundary of the subject and TMS coil ROI
4. Set threshold (markers’ intensity) to capture all the voxels within fiducial markers. Threshold values can be varied across sessions/ MRI modalities; therefore, it is required to check the raw mprage data before putting the threshold value
5. mean\_coordinates.m performs k-means clustering to partition all of markers’ x, y, z coordinates into 4 clusters. Then final output (paddle.tag) includes 3 x, y, z coordinates (one from center of the TMS coil and two from other fiducial marker coordinates)

**Marker postprocessing**

1. 3dresample generates a low resolution version of the standard template (TLRC)
2. @fast\_roi process involves running 3dSkullStrip with a set of options to speed it up. It also converts the original space of anatomical data (nosk.anat+orig) to tlrc space (nosk.anat+tlrc). Other outputs from @fast\_roi are nosk.anat.ply (ascii file format of nosk.anat+orig) and transformation matrix (nosk.anat.Xaff12.1D and nosk.anat.Xat.1D).
3. SurfToSurf is used to interpolate data from one surface (TMS coil surface) to another (subject’s brain surface). This is done by projecting each node of TMS coil surface and finding the closest node from subjest’s brain surface. Output from SurfToSurf (s2s.1D) includes node index and x, y, z cords of nearest node.
4. Vecwarp transforms the intersection coordinates in original space to standard space using transformation matrix.
5. A line between the TMS center and intersection on subject’s brain surface visualizes in SUMA.
6. whereami reports brain area located at x y z cord in TLRC space.