How to create a head model

This document describes the command line tool mri2mesh to create a head model.

mri2mesh

This tool reconstructs a tetrahedral head mesh from T1w and T2w structural MR images. It runs with only a T1w image, but will create better skull segmentations when also a T2w image is available.

Usage:

1. Open a terminal and go to the directory of the SimNIBS example data set

2. Run the reconstruction:

mri2mesh --all almi5 org/almi5_T1fs.nii.gz org/almi5_T2.nii.gz

The argument **--all** tells mri2mesh to run all reconstruction steps including volume meshing. The **subject ID** "almi5" is given next. Mri2mesh will create a mesh named "almi5.msh", a folder "fs_almi5" that contains the FreeSurfer results, and a folder "m2m_almi5" that contains the files that are needed for volume meshing. The **input images** are given as final arguments (first the T1w, then the T2w). When calling mri2mesh --all the first time for a dataset, it will run FreeSurfer on it using the fat-suppressed T1 as input. This is quite time-consuming. When re-running mri2mesh --all it will use the existing FreeSurfer results. Then it will need ~3-4 hours.

Alternatively, the reconstruction can be run with only the T1w image as input, but this will result in a less accurate skull region:

**mri2mesh --all almi5 org/almi5_T1fs.nii.gz**

It is also possible to run it with 2 T1w images (one fat-suppressed, one normal) and 2 T2w images (again one fat-suppressed, one normal). This can bring a slight increase in the accuracy of the reconstructed skull:

mri2mesh --all almi5 org/almi5_T1.nii.gz org/almi5_T1fs.nii.gz org/almi5_T2.nii.gz org/almi5_T2fs.nii.gz

3. Check the results:

`mri2mesh -c almi5`

      This will show the reconstructed surfaces overlaid over the MR images using freeview. The red lines indicate the final surfaces used for volume meshing, the yellow indicate the GM and WM surfaces created by FreeSurfer. In addition, you should have a look at the tetrahedral head mesh by loading it into gmsh.
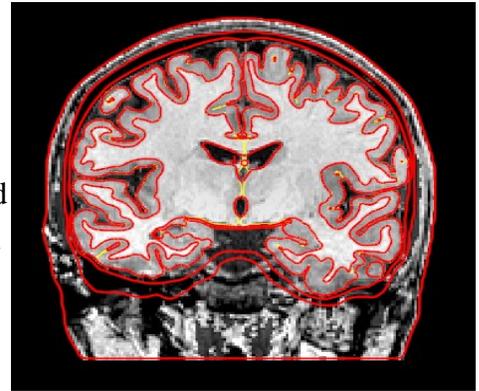
4. Further notes

- A quick check can be performed by looking at the final volume masks overlaid over the structural images in fslview:

`mri2mesh --qc almi5`

- As a standard, mri2mesh uses 60000 triangles for each white matter surface, and the number of triangles for the other surfaces are scaled relative to this number. This results in a volume mesh of ~3 million tetrahedra. Alternatively, you can adjust the mesh resolution by setting **--numvertices=<mynumber>**
- After the head mesh creation, temporary files can be deleted to save diskspace using:

`mri2mesh --cleanup almi5`

- When something goes wrong, you can check the **mri2mesh_log.html** which is saved in the m2m_almi5 subdirectory.