User manual

Rniftitools (0.0-1)

R package to trace head surfaces from MR images

Homepage

http://rniftilib.r-forge.r-project.org/
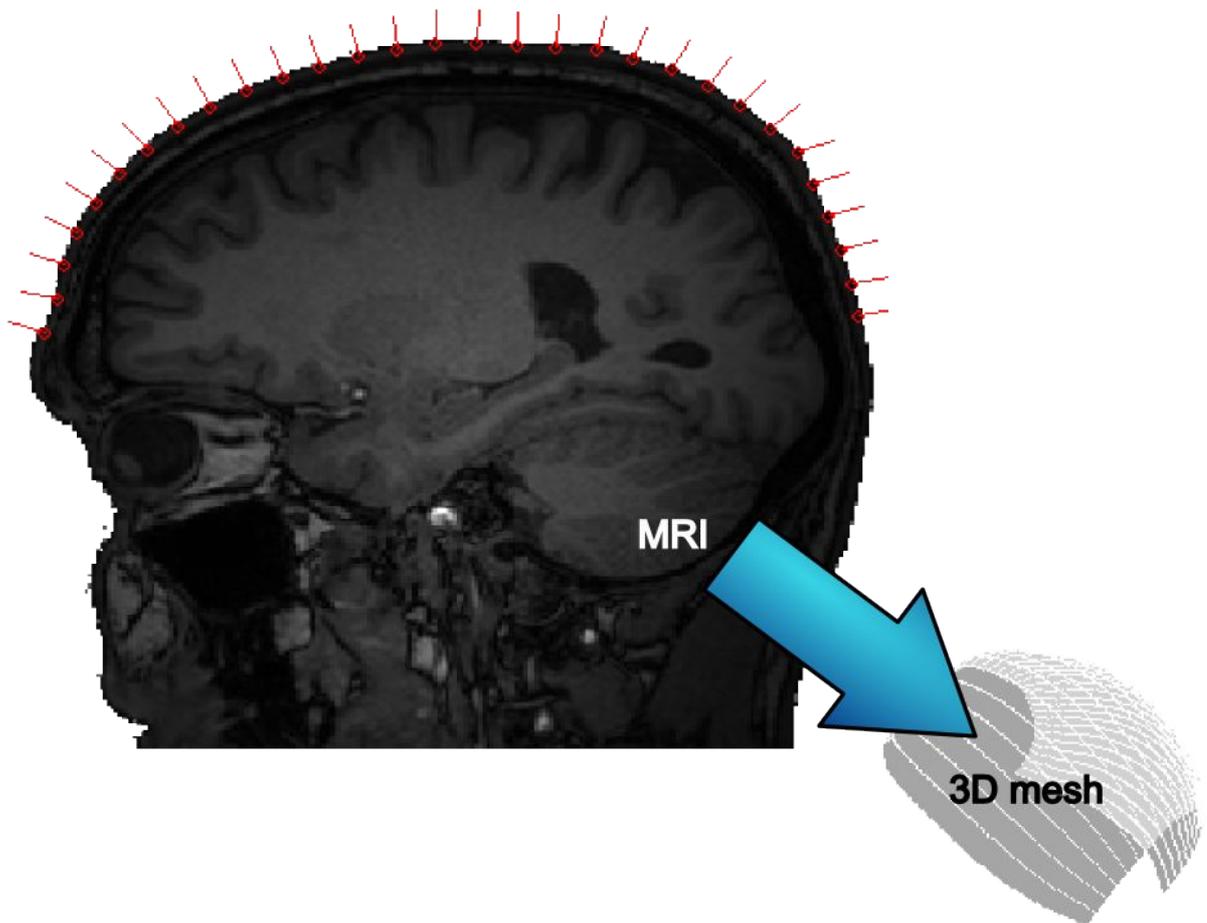
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Introduction to the Rniftitools package

This package is a collection of scripts and functions based on the [Rniftilib](#) package. The initial functions originate from [Transcranial Magnetic Stimulation (TMS)](#) experiments. In these experiments a model of the head surface was required to improve the localization of the TMS coil in [stereotactic](#) space. The `Rniftitools` package provides functions to generate such head surface models from MR images. The final surface model has the following properties:

- mesh form a two-dimensional manifold (all triangles are connected and can be flattened to a plane)
- there are allways two coplanar neighbouring triangles
- the surface is represented by a simple triangle mesh

Finally the head surface model can be used to determine the "optimal" location for the TMS stimulation by determining the nearest point on the surface from the target position. The target position must be available in the coordinate system of the MR (nifti) image.

The steps to create a triangle mesh representing the top of the head surface are given below:

Step 1: Load required packages and load the MR image(T1) in NIfTI format.

Make sure that recent versions of the packages tcltk, Rniftilib and Rniftitools are installed. Copy or enter the following code into the R console to start the head surface extraction:

```
library(Rniftilib);
library(Rniftitools);

image=nifti.image.read(file.choose());

surface = TraceSurfaceGUI(image);
```
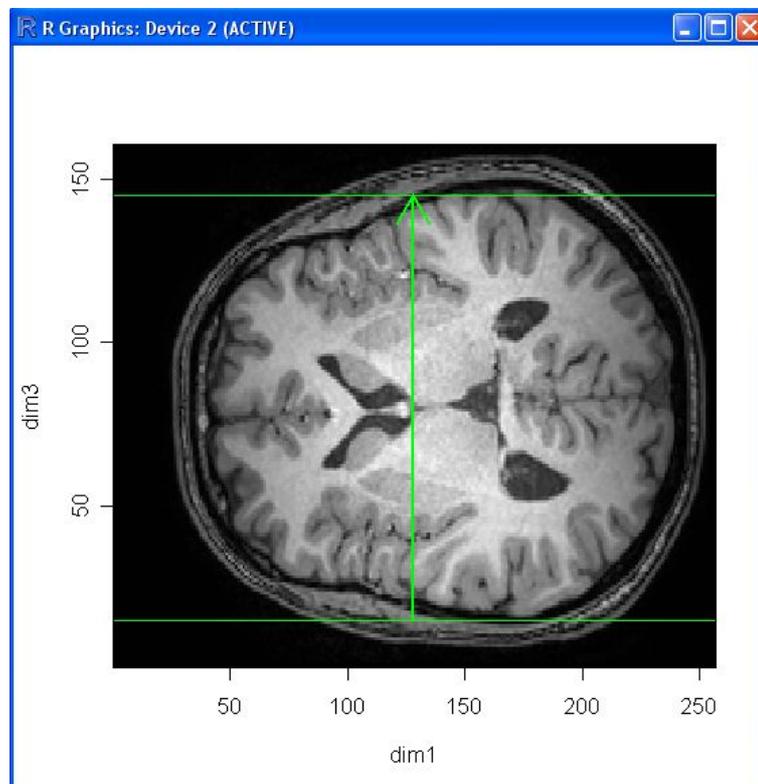
This will ask you to select a T1-NIfTI image (via a file chooser dialog) and start the graphical menu for the extraction algorithm.

Step 2: Select start and end slice for contour tracing
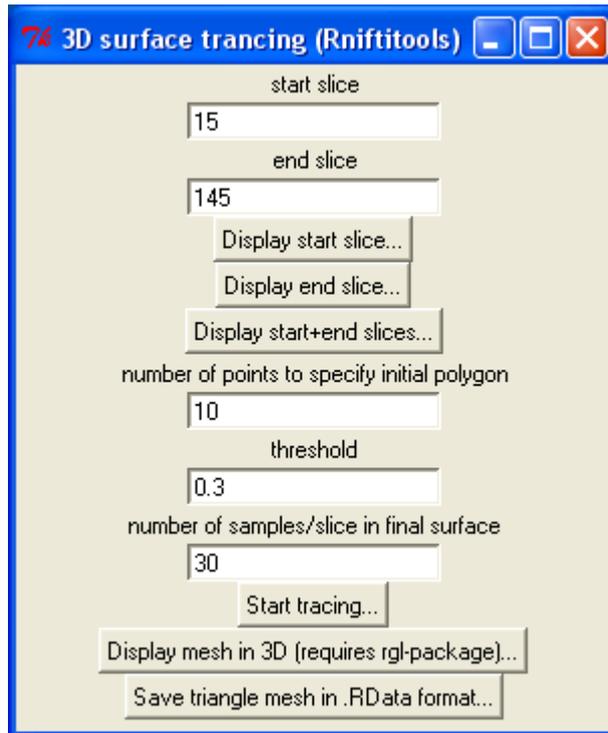
## *Step 3: Use the "Display start+end slices" button.*

This will display a "top view" image with the start and end slices marked by two green lines.

Step 4: Draw initial contour to sketch surface outline in the first slice.

Press the "Start tracing" button and draw an initial contour by using the mouse.

Note: Contour tracing takes place in voxel space! Therefore, the orientation of the head in the display depends on the voxel order used in the NifTI image.
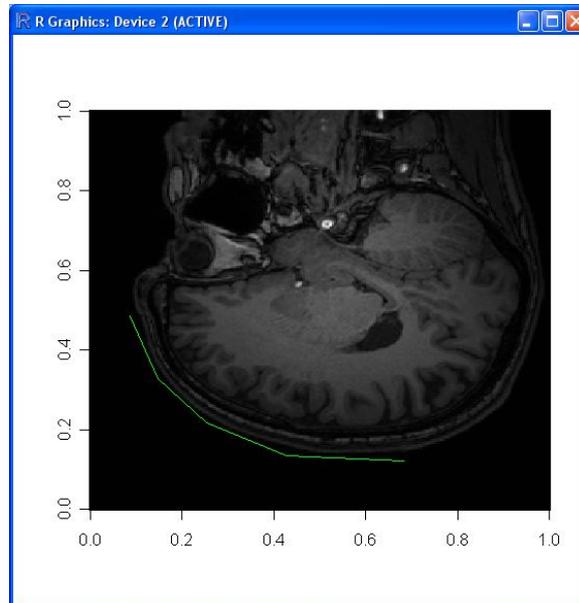
Step 5: Automatic tracing (wait until the last slice is processed...)

The trancing is automatically started after entering the last point of the initial contour.
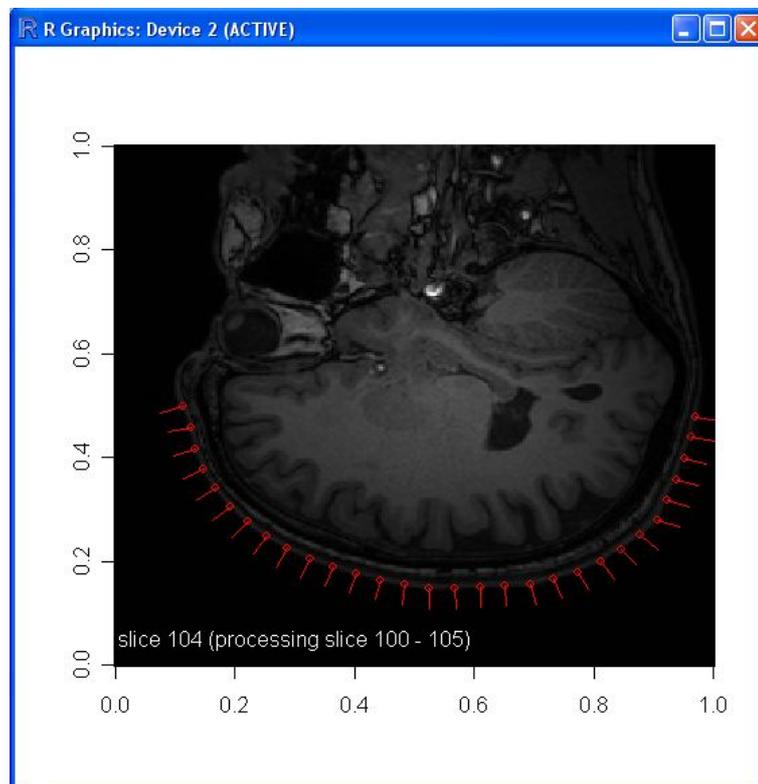
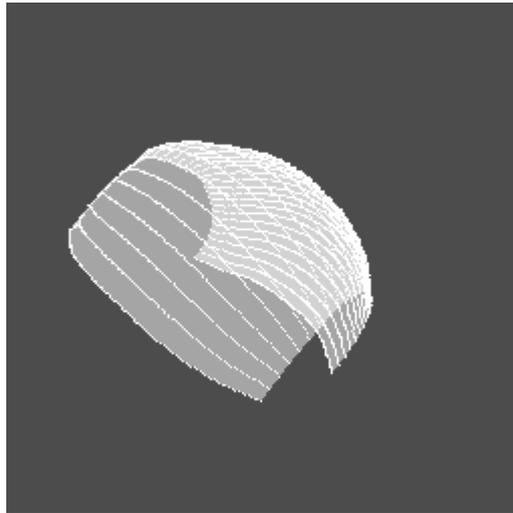### Step 6: The final surface model (visualized with the rgl package)

Use the "Display mesh in 3D" button to visualize and verify the final result.

A movie of the final model can be generated by

```
play3d(spin3d(axis=c(0,0,1), rpm=20), duration=3)
```

or stored as a gif animation

```
movie3d(spin3d(axis=c(0,0,1), rpm=20), duration=3)
```


Step 7: Improving the result

The figure below visualizes an intermediate step in the surface tracing procedure. The arrow corresponds to the normal of the surface, a vector pointing into a direction approximately perpendicular to the surface. This is the direction used to sample the grey values from the T1 image. The image on the right side shows the result. The curve is scanned from right to left and the first point exceeding a value of `MIN+(MAX-MIN*threshold)` is used for the new position of the surface control point. The threshold can be set individually by changing the corresponding value in the graphical menu.