

Goals

A. Gain exposure doing simple region of interest mapping.

B. Qualitatively compare tractography reliability across reconstruction method.

Picking up from last class

- 1. Reconstructed single subject data
- 2. Used three different approaches:
 - a. Diffusion Tensor Imaging
 - b. QBI
 - c. GQI
- 3. Generated simple region of interest.

Centrum Semiovale





1. Open DSI Studio (on the Desktop)

| C | 000 | DSI Studio Aug 28 2014 build | | |
|-----|--|--|-------------------------|---------|
| Dif | ffusion MRI Tractography | Recent src files: double click to open | | |
| 6 | STEP1: Open Source Images | File Name | Directory | |
| Ĭ | Open diffusion MR images to create .src file (DICOM, NIFTI, Bruker 2dseq, Varian fdf) | 1 257d_0006.src.gz | /Users/timothyv/Desktop | Thu Sep |
| 0 | STEP2: Reconstruction Open come to do reconstructiong COTI, QBI, DSI, GQI, or QSDR) | | | |
| 0 | STEP3: Fiber tracking Open .fib file to perform fiber tracking and analysis (track-specific analysis, connectivity matrix) | Depart file flere devide eliek te ener | | |
| | | Recent hb mes. double click to open | 1 | |
| | | File Name | Directory | _ |

2. Select Step 3: Fiber Tracking

3. Open the DTI reconstruction from last class

| | 0 | NT090_test.iib.mean.iib | /Osers/timotnyv/Dropbox/bigData/F0550/results | Tue C | |
|-----------------------------|----|--|---|--------|--|
| | 7 | CMU_60_20130923build.fib.mean.odf.fib.gz.fib | /Users/timothyv/Data/Atlases | Wed I | |
| | 8 | hcp80.sfODF.fib.gz.mean.fib.gz | /Users/timothyv/Data/DWITemplates | Fri Ju | |
| | 9 | hcp80.dODF.fib.gz.mean.fib.gz | /Users/timothyv/Data/DWITemplates | Fri Ju | |
| Diffusion MRI Connectometry | 10 | DSI257d-80_1mm_20140320build.fib.mean.fib.gz | /Users/timothyv/Data/DWITemplates | Mon N | |
| | | | | | |

DSI Studio Interface Region List 3D Viewer () /Users/timothyv/Desktop/257d_0006.src.gz.dti.fib.gz Edit Regions Tracts Slices View Options 80 ⊕ 🖸 🗇 ion List Diffusion 🛊 🗁 🔀 +isosurface 🛛 Full + Contrast 1.00 Offset 0.00 Options 🗋 🗁 😃 🗙 🕕 🚹 Atlas... Region Wi... Type Color Name Tracking P... Backgroun... Slice Tract Regio... Surfa... ODF **Region Viewer 3D Viewer Options** Fiber Tracts 80 eaion Window & Tracking Parameters ▲ 🗸 □ G / G 🔘 🗖 📜 🕁 fa0 💠 Noov ≑ Stop - Contrast 1.00 🗘 Offset 0.00 🗘 Tracts Deleted Seed Track Data List **V** 🕑 48 VD 48 1) 25 Zoom 1.00 Θ 0 ⊕



VQ 48

VD 25

Zoom 1.00

(91.2,48,39.8) MNI(-107.8,8.5,49.7) aal: fa0=0 adc=0 axial_dif=0 radial_dif=0

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0

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V \bigcirc **48**

But what if I forgot my ROI?

To draw an ROI again



To draw an ROI again



To draw an ROI again



(75.4,48,26.9) MNI(-71.9,1.2,20.5) aal: fa0=0.0371052 adc=0.77824 axial_dif=0.809279 radial_dif=0.762721

Or open the one you've saved



(75.4,48,26.9) MNI(-71.9,1.2,20.5) aal: fa0=0.0371052 adc=0.77824 axial_dif=0.809279 radial_dif=0.762721

How do the different reconstruction algorithms recover the three pathways that cross in the centrum semiovale:

- 1. the corpus callosum
- 2. corticospinal
- 3. arcuate/SLF



| Θ | 00 | Options | |
|---|----------|------------------|----------------|
| ► | Region W | /indow | |
| ▼ | Tracking | Parameters | |
| | Termi | nation Index | fa ‡ |
| | Thres | hold | 0.05000 |
| | Angul | ar Threshold | 75 |
| | Step S | Size(mm) | 1.00 |
| | Smoo | thing | 0.70 |
| | Min Le | ength(mm) | 10.0 |
| | Max L | ength(mm) | 200.0 |
| | Seed | Orientation | Random \$ |
| | Seed | Position | Subvoxel ‡ |
| | Rando | omize Seeding | Off ÷ |
| | Direct | ion Interpoation | Trilinear ÷ |
| | Tracki | ng Algorithm | Stremline(E: + |
| | Termi | nate if | 20000 |
| | | | Tracts ‡ |
| | Threa | d Count | 1 |
| ► | Backgrou | nd Rendering | |
| ► | Slice | Rendering | |
| ► | 🗹 Trac | t Rendering | |
| ► | 🗹 Regi | ion Rendering | |
| ► | Surf: | ace Rendering | |
| | | Rendering | |

The menu screen should look like this.

| Parameter | Value |
|----------------------|-------------|
| Termination Criteria | FA |
| Threshold | 0.05 |
| Max Angle | 75 Degrees |
| Step Size | 1 mm |
| Smoothing | 0.70 |
| Length | 10-200 mm |
| Initial Direction | Random |
| Seed Position | Subvoxel |
| Interpolation | Trilinear |
| Tracking Algorithm | Streamline |
| Termination | 20000 Seeds |

Set the Tracking Parameters to these values.



(48 12 25) MNI(-0 6 80 -8 8) aal; fa0=0 adc=0 avial, dif=0 radial, dif=0





(92.5,48,28.7) MNI(-110.9,-0.2,22.7) aal: fa0=0 adc=0 axial_dif=0 radial_dif=0

File naming note

 The .trk file format is a binary file that is readable by the TrackVis visualization tool. It is substantially smaller and faster to read than the alternative .txt file format.

Repeat all steps for GQI and QBI

| Parameter | Value | Parameter | Value |
|----------------------|-------------|----------------------|-------------|
| Termination Criteria | QA | Termination Criteria | QA |
| Threshold | 0.05 | Threshold | 0.05 |
| Max Angle | 75 Degrees | Max Angle | 75 Degrees |
| Step Size | 1 mm | Step Size | 1 mm |
| Smoothing | 0.70 | Smoothing | 0.70 |
| Length | 10-200 mm | Length | 10-200 mm |
| Initial Direction | Random | Initial Direction | Random |
| Seed Position | Subvoxel | Seed Position | Subvoxel |
| Interpolation | Trilinear | Interpolation | Trilinear |
| Tracking Algorithm | Streamline | Tracking Algorithm | Streamline |
| Termination | 20000 Seeds | Termination | 20000 Seeds |

Output file: "DSI_QQI.trk"

Output file: "DSI_QQI.trk"

Visualizing what you've done

Basic Visualization



Basic Visualization



(14.4,48,36.6) MNI(86.2,7.6,42.2) aal: qa0=0 qa1=0 qa2=0 qa3=0 qa4=0 gfa=0 iso=0 sum=0 nqa0=0 nqa1=0 nqa2=0 nqa3=0 nqa4=0

Basic Visualization



(14.4,48,36.6) MNI(86.2,7.6,42.2) aal: qa0=0 qa1=0 qa2=0 qa3=0 qa4=0 gfa=0 iso=0 sum=0 nqa0=0 nqa1=0 nqa2=0 nqa3=0 nqa4=0

Homework

In a word document, show how each reconstruction method recovers the underlying pathways. Describe qualitatively what each tracking result looks like. Use separate pages for each pathway.

Due at the beginning of class on Thursday (9/11)





Homework (example)

```
Acquisition: DSI ¶
Reconstruction: GQI¶
¶
```

Summary: Few noisy streamlines. Good coverage of all three major pathways in the <u>semiovale</u>. Few artifacts appear to be present.¶

