Diffusion Imaging Quality Control with DTIPrep

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**DWI/DTI QC**

- This tutorial teaches you how to do quality control (QC) of diffusion images both for DTI as well as other diffusion models (such as HARDI)
- DWI/DTI QC is performed with the NA-MIC tool **DTIPrep**
  - Can be called within Slicer
  - Also stand-alone tool
Dataset

For this tutorial you will need some DWI/DTI data files that can be found on this link: http://hdl.handle.net/1926/1759
Diffusion Artifacts

Diffusion images are sensitive to a number of artifacts

- Motion
- Eddy-current distortions
- Noise/SNR issues
- Vibrational artifacts
- Venetian blind artifacts
- “unknown”…

Bad DWI’s are removed
Outline

- DTI QC pipeline
  1. Start DTIPrep
  2. Load DWI dataset
     - Check DWI & gradient info
  3. Protocol for Automatic QC
  4. Run Automatic QC on DWI
  5. Final Visual QC
  6. Check DTI glyphs in Slicer
DTIPrep

• Stand alone/Slicer module

  – Additional manual on NITRC page

• Protocol based QC
  – Protocol defines all the parameters

• Automatic report creation

• Embed/Cropping of DWI data
  – Same size images => simplifies processing

• Visualization of gradient scheme
Start Slicer 4

**Linux/Mac users:**
Launch the Slicer executable located in the Slicer4 directory

**Windows users:**
Select **Start**→**All Programs**→**Slicer4.0.1**→**Slicer**
Or launch the Slicer executable from Slicer4 directory
Start DTIPrep within Slicer

1. Select DTIPrep
   - Diffusion category
2. Create new Commandline module
3. Click “Apply”
4. DTIPrep starts up
DTIPrep Main Window

- Toolbar
- Info Window
- DWI Viewers
- 3D Viewer
Load DWI image

• Click NRRD icon
• File Dialog
  – Select your DWI
  – DTI/DTIPrep_JB.nhdr
• “Open”
• Done with loading
DWI info

Detailed DWI Info
Gradient info in 3D

Displays gradient scheme on unit sphere (F = File)

- Check for uniformity
Protocol in DTIPrep

- Protocol defines parameters
- Use default parameters or load prior parameter set
- Select “Protocol” tab
- Select “Default”
- Detailed parameters
  - See manual on NITRC
Run QC

- Select “RunByProtocol”
  - Runs for a few minutes (5-15)
- Checks:
  1. Image dimensions
  2. Gradients directions
  3. Intensity changes across slices
  4. Excessive motion across slices
  5. Motion and eddy current correction
  6. Residual motion detection
  7. Optional noise removal
QC Result

- Loads QC’ed DWI when finished
- Detailed reporting
- Directions after motion correction
- Reasons for exclusion
Visual QC & Save

- Double click on “VC_Status”
- Option to include or exclude
- Often unnecessary
Conclusion

• DTI QC is a must
• DTIPrep & Slicer provide comprehensive QC
• This tutorial guided you through the “default” use of DTIPrep
• Future: Better Slicer integration, directional artifacts detection & correction (Farzinfar et al, ISBI 2012)
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