DTI Subproject
Processing & Analysis

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Objectives

• Determine if DTI can:
  – provide a robust marker of PD progression
  – serve as an adjunct to clinical assessment and PET
Scope Of Work

• DTI computations:
  – Rigorous quality control
  – Accurate alignment to structural MRI
  – Calculation of:
    • standard DTI measures (FA, MD)
    • advanced DTI measures (geodesic FA, generalized FA)
    • eigenvectors (tractography)

• Exploratory Group Analyses
  – Region-of-interest based
  – Regionally unbiased
  – Joint analyses of DTI with PET
MRI Acquisitions

**Structural MRI**
- T1w
- “Proton density”
- T2w

**DTI**
- Bo
- Diffusion weighted
Automated Quality Control
Frame-to-Frame Similarity

Good Quality

Motion

Instability

Brain Signal

mean

mean

Noise

skl divergence

skl divergence

PARKINSON'S PROGRESSION MARKERS INITIATIVE
Play a Part in Parkinson's Research
DTI Quality Control: First 8 Scans

Subject ID

PARKINSON’S PROGRESSION MARKERS INITIATIVE
Play a Part in Parkinson's Research
DTI-MRI Co-registration

Rigid alignment

Raw DWI

Nonlinear alignment
(in collaboration with Dr. Tom Fletcher, U Utah)
DTI Interpretation

High Sensitivity – Low Specificity

Summary:
1. Mean displacement distance of tissue water that is captured on DTI using a clinical MRI scanner \( \sim 10-20 \text{um} \)

2. Structural features of axons other than myelin are sufficient to give rise to DTI contrast

(A) Non-myelinated olfactory nerve of the garfish
(B) Myelinated optic nerve of the garfish

C. Beaulieu, NMR in Biomedicine 2002; 15; 435-55
DTI Computations

sMRI | Fractional Anisotropy | Kullbeck-Leibler Anisotropy
Summary

• Accomplishments
  – MRI sites were qualified
  – DTI of first 8 subjects QC’ed
  – MRI quality is generally very good
  – Standard and advanced DTI measures implemented

• What needs to be done
  – Format for uploading derived data to LONI
  – Processing of DTI as data arrive
  – Interim group analyses (n=20 per group?)