

DTI Processing Workflows



Outline

- ◆ Motivation
- ◆ Image preprocessing
- ◆ Manual quantitative tractography
- ◆ Atlas-based processing

Introduction

- ◆ Group comparison of DTI
- ◆ collection of DICOM -> clinical result
- ◆ less focused on single image processing

Tools currently used (general)

- ◆ Teem – image cropping, arithmetic
- ◆ Rview – linear and b-spline registration
- ◆ NeuroLib
 - ◆ MriWatcher - multi-image viewing
- ◆ InsightSNAP – ROI drawing, Image viewing

Tools currently used (DTI)

- ◆ NeuroLib
 - ◆ FiberTracking – estimation, tractography (deprecated)
 - ◆ FiberViewer – visualization, clustering, along tract stats
 - ◆ DWIProcess – tensor estimation, transformation, tractography
- ◆ MedINRIA – whole brain tractography, tensor viz

Scripting frameworks

- ◆ python writing Makefile
- ◆ BASH scripting

Image Preprocessing

- ◆ DICOM -> 3D format (NRRD)
- ◆ Motion correction (Rview, In development - Ran)
- ◆ Eddy current correction (In development – Ran)
- ◆ EPI correction (In development – Tom)
- ◆ Outlier Detection (Marc Niethammer)
- ◆ Image Smoothing (DWI, DTI – Slicer3)
- ◆ Tensor estimation (dtiestim, FiberTracking, Slicer3)
- ◆ Scalar measure images (dtiprocess, FiberTracking, Slicer3)

Manual Tractography Overview

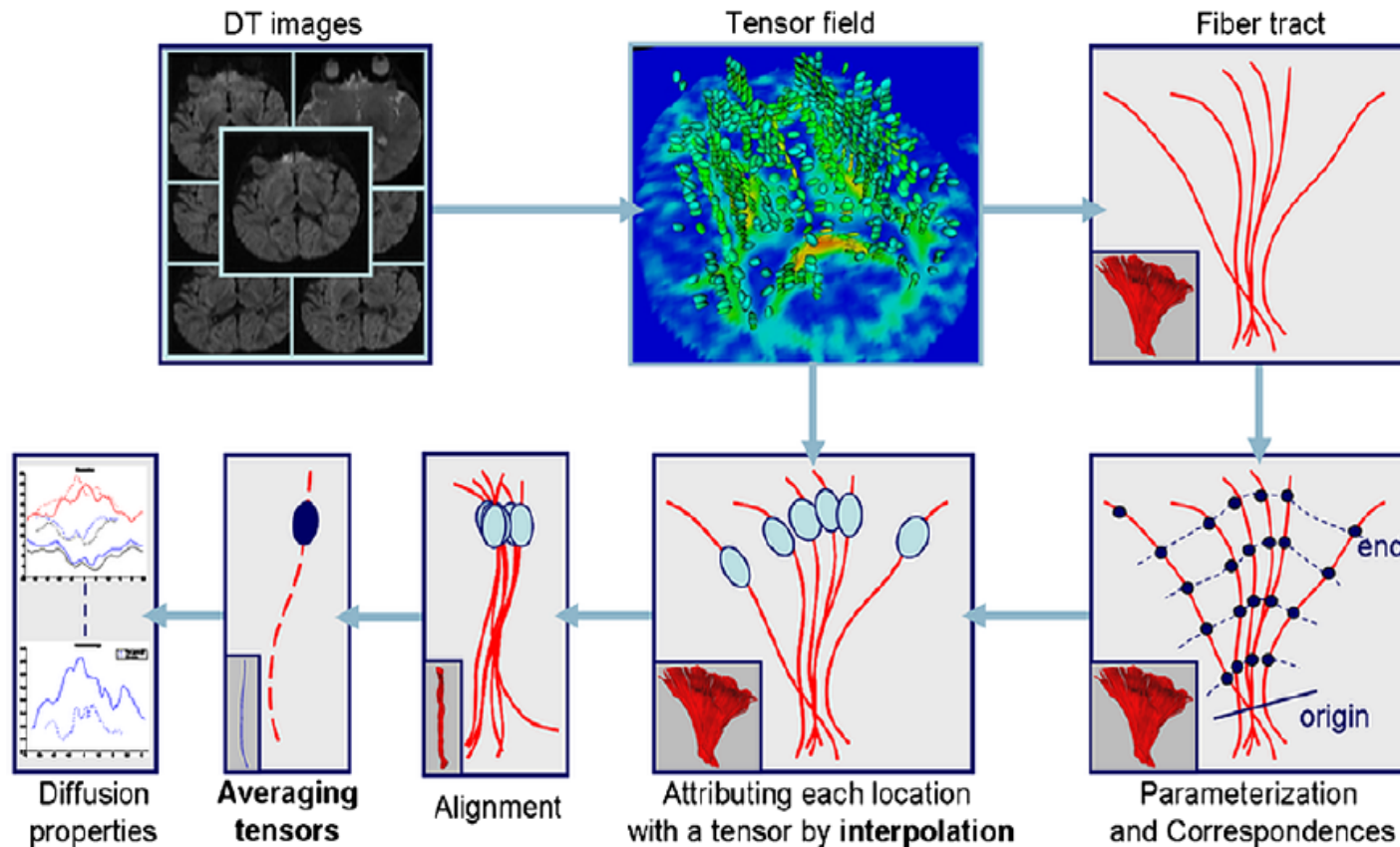
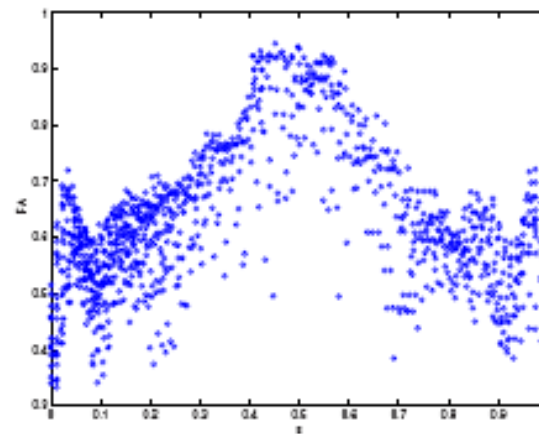
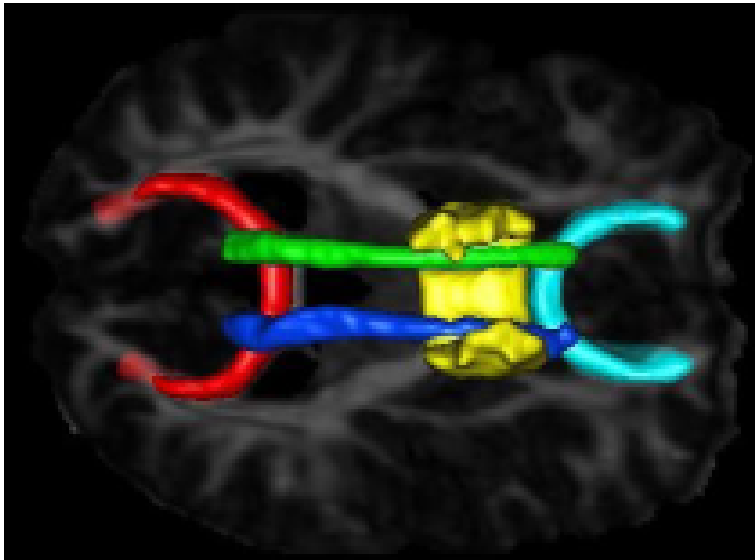


Fig. 3. Overview of the DTI analysis framework.

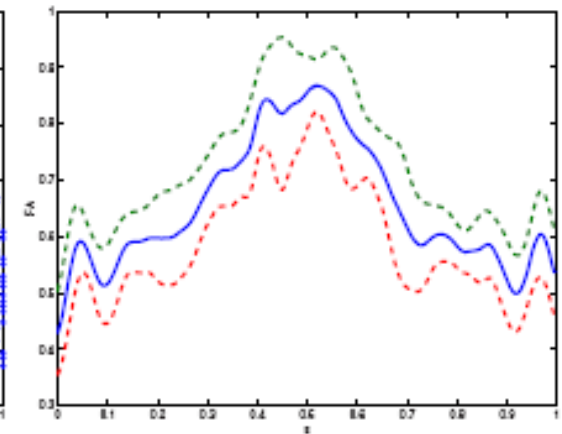
Manual tractography

- ◆ Image Preprocessing
- ◆ ROI drawing (InsightSNAP)
- ◆ Fiber tractography (fibertrack, FiberTracking, Slicer3)
- ◆ Fiber post-processing (FiberViewer)
 - ◆ clustering
 - ◆ cutting

Volumetric Tractography



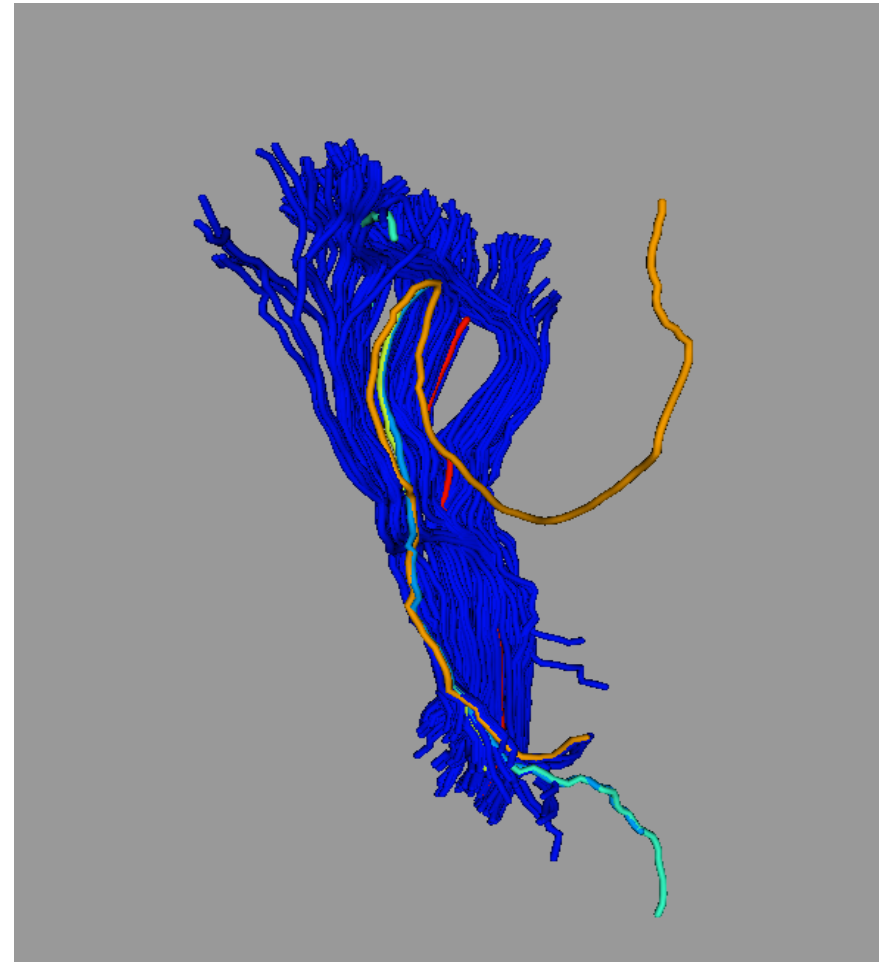
(a)



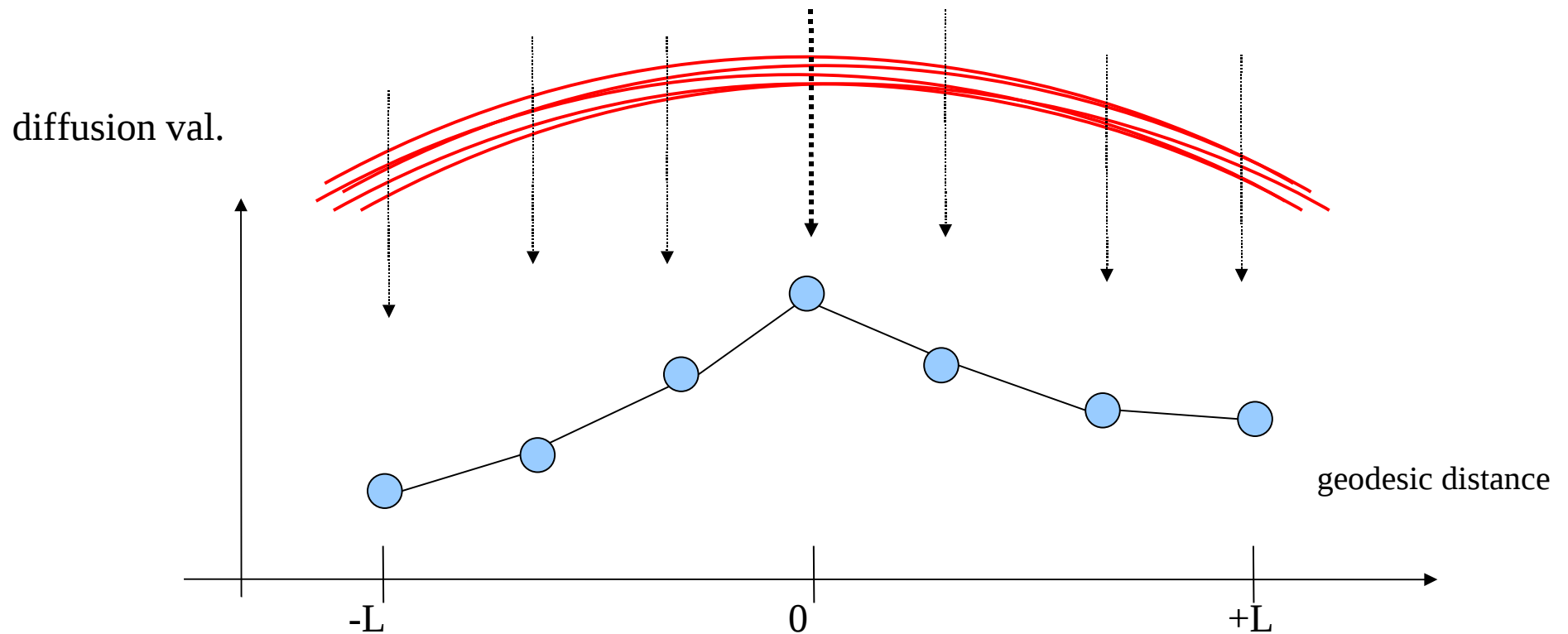
(b)

Clustering

- ◆ FiberViewer
- ◆ Interactive
- ◆ Fiber post-processing
- ◆ Fiber region of interest

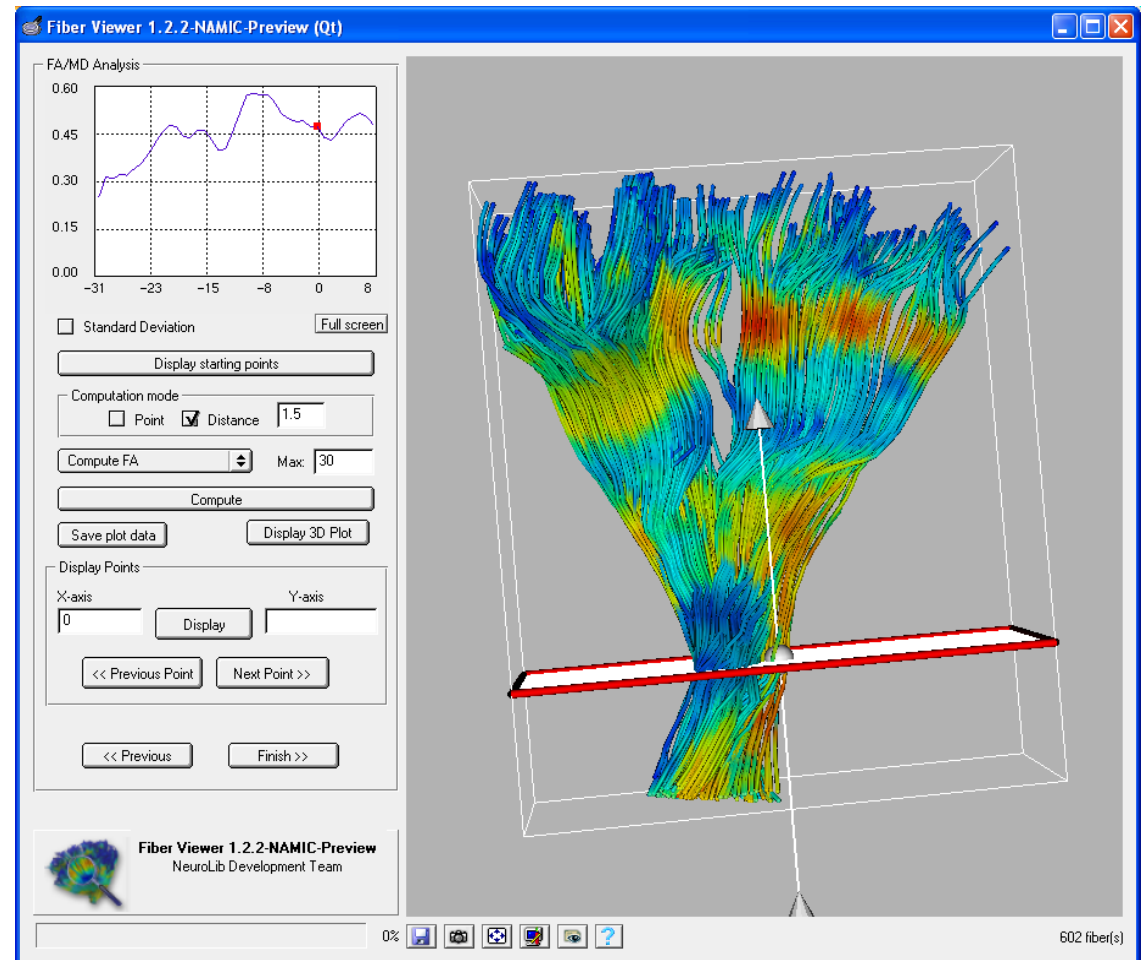


Arc-Length stats

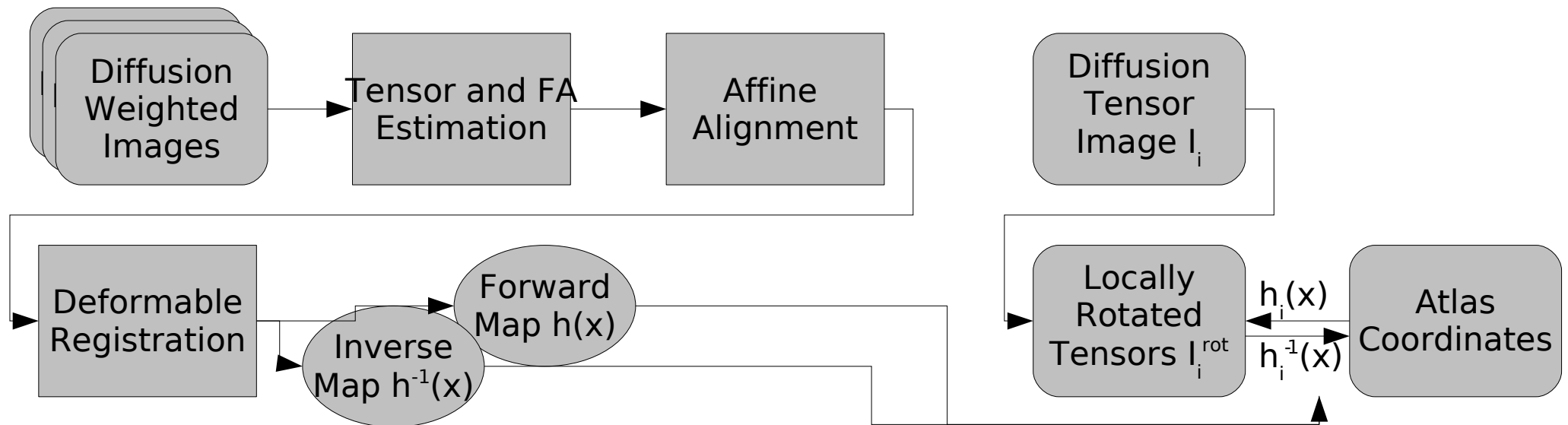


Tract-oriented statistics

- ◆ Arc-length statistics
- ◆ FiberViewer
- ◆ How to handle statistical output?



Atlas-based processing



Registration

- ◆ Affine alignment of b0 images (Rview)
- ◆ Fluid Registration of feature image (AtlasWerks)
 - ◆ Currently working with Serdar's B-spline tool
- ◆ Application of transformation to DTI (DWIProcess)
- ◆ Averaging of DTI images to atlas image

Atlas tract analysis

- ◆ Extraction of tract in analysis as done manually
- ◆ Mapping of atlas tract to individual (DWIProcess)
- ◆ Extraction of stats along fiber (FiberViewer)
- ◆ Collection and processing of results (python, MATLAB)

Structural Atlas

