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

- Goals

    - Identify modules which can be implemented as Slicer command line tools

    - Brainstorm about workflow integration

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

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)
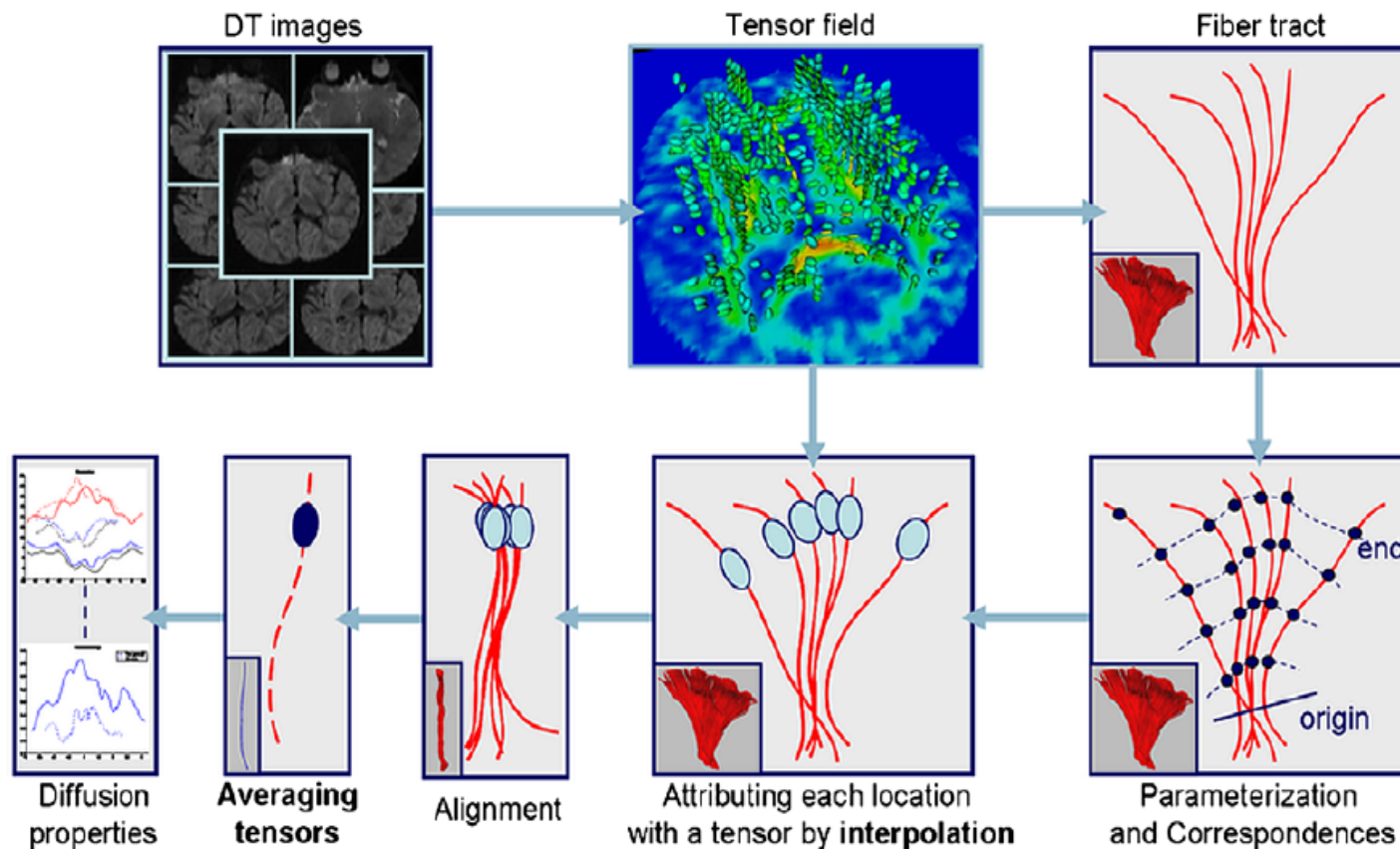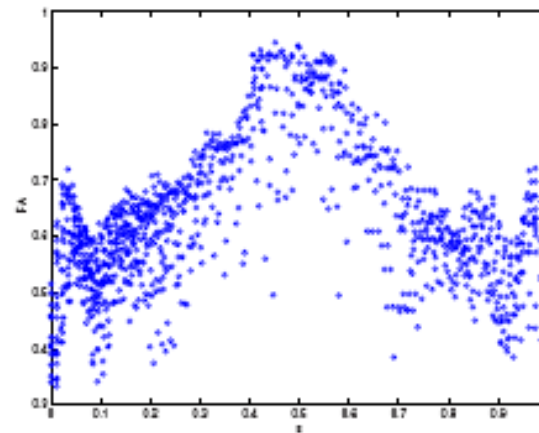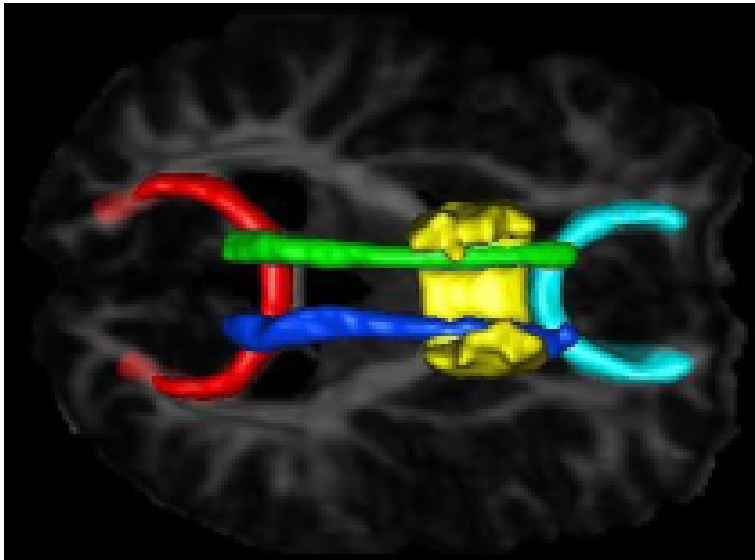
Manual Tractography Overview
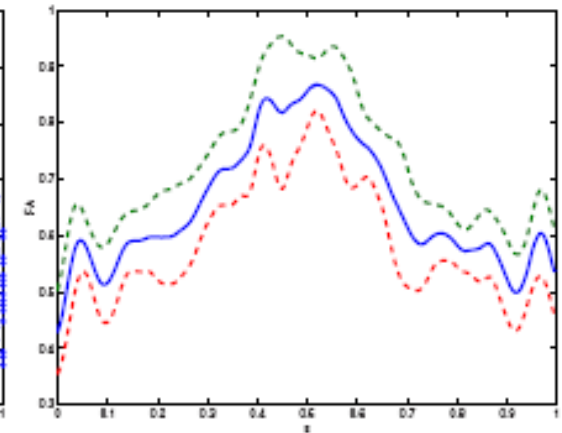

Fig. 3. Overview of the DTI analysis framework.

Manual tractography

- Image Preprocessing

- ROI drawing (InsightSNAP)

- Fiber tractography (fibertrack, FiberTracking, Slicer3)

- Fiber post-processing (FiberViewer)
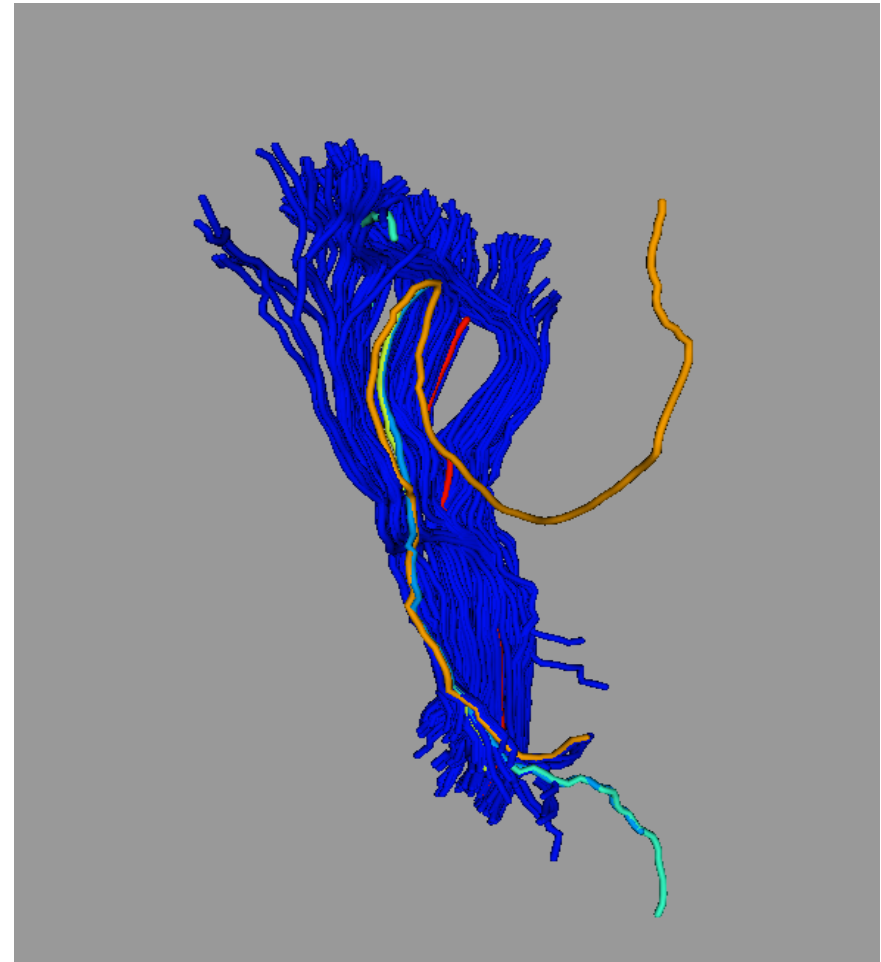
  - clustering

  - cutting

Volumetric Tractography
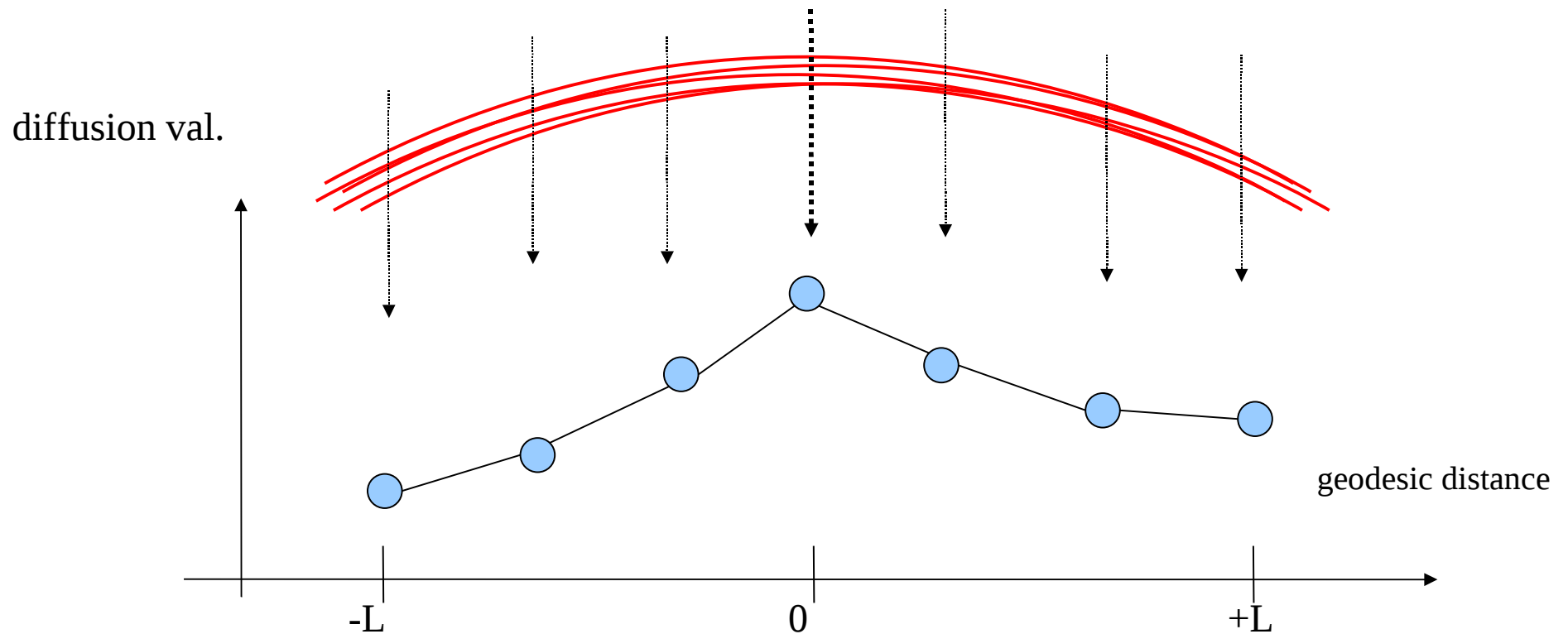
Clustering

- FiberViewer

- Interactive

- Fiber post-processing

- Fiber region of interest

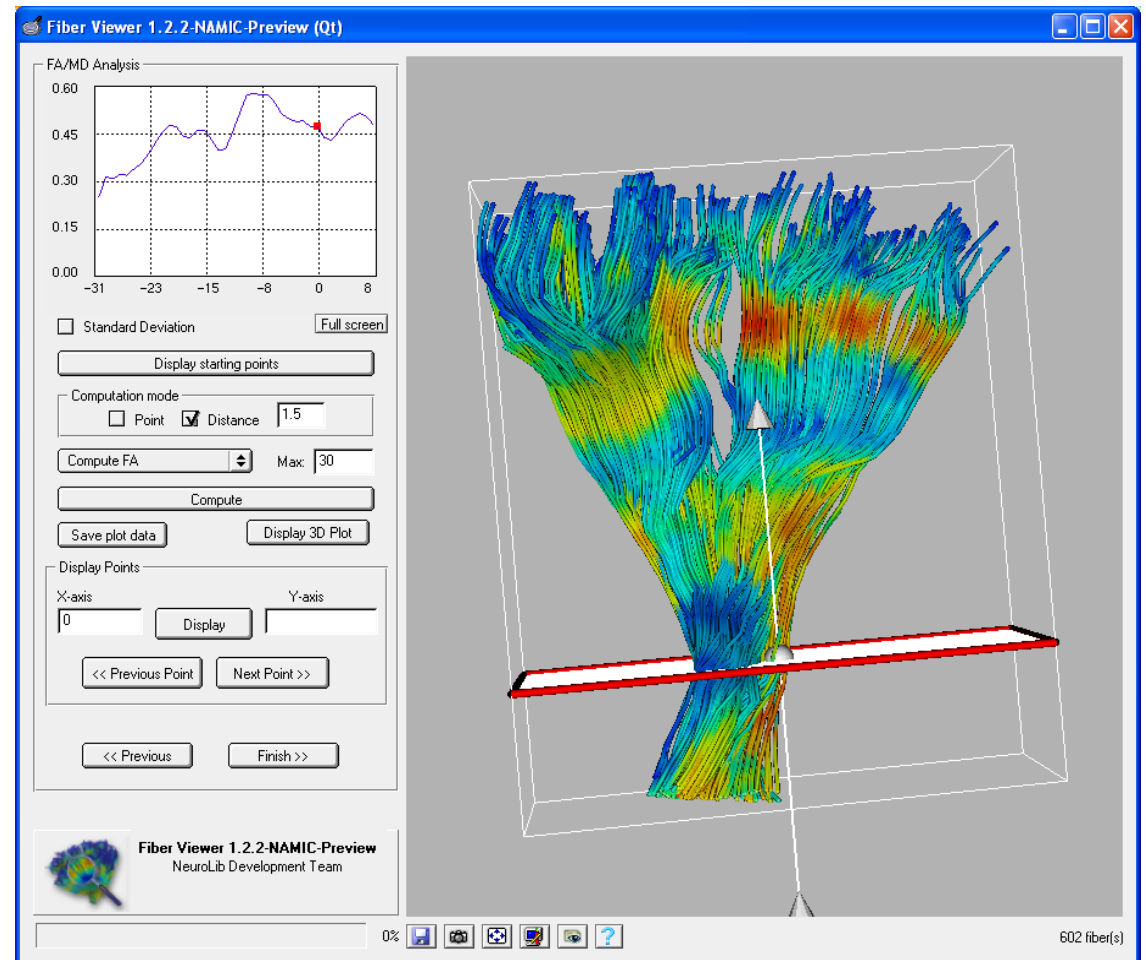# *Arc-Length stats*

diffusion val.
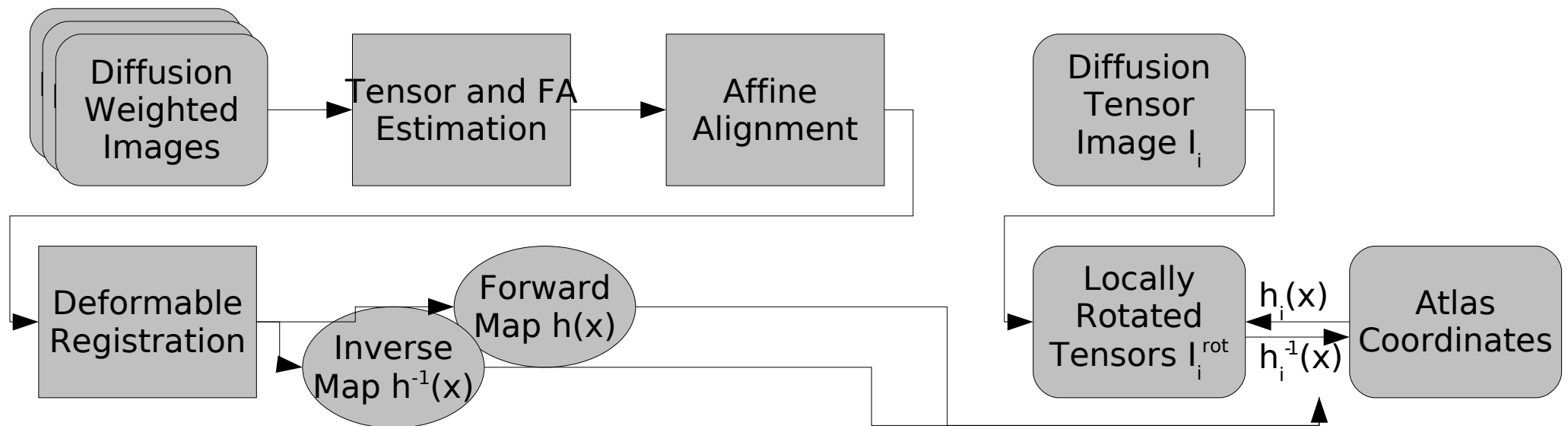
geodesic distance

-L   0   +L

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