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DTITool 'An Insightful look into Diffusion Tensor Images'

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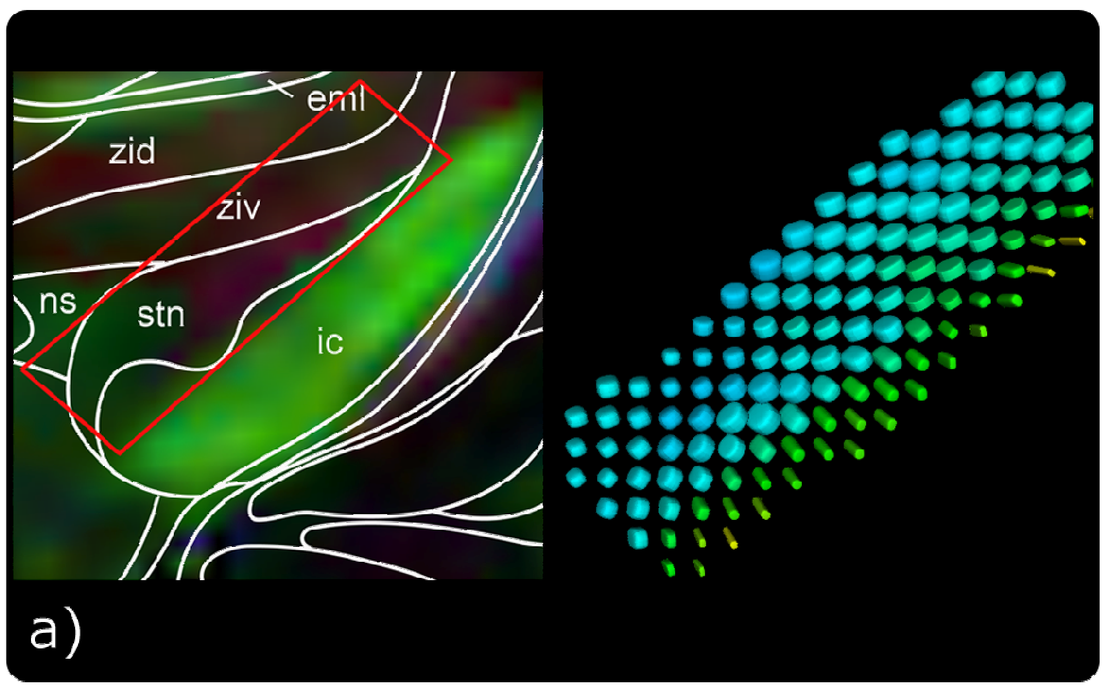

Figure 1: Use of superquadric glyphs to analyse the sub-thalamic nucleus (STN) in a mouse brain.

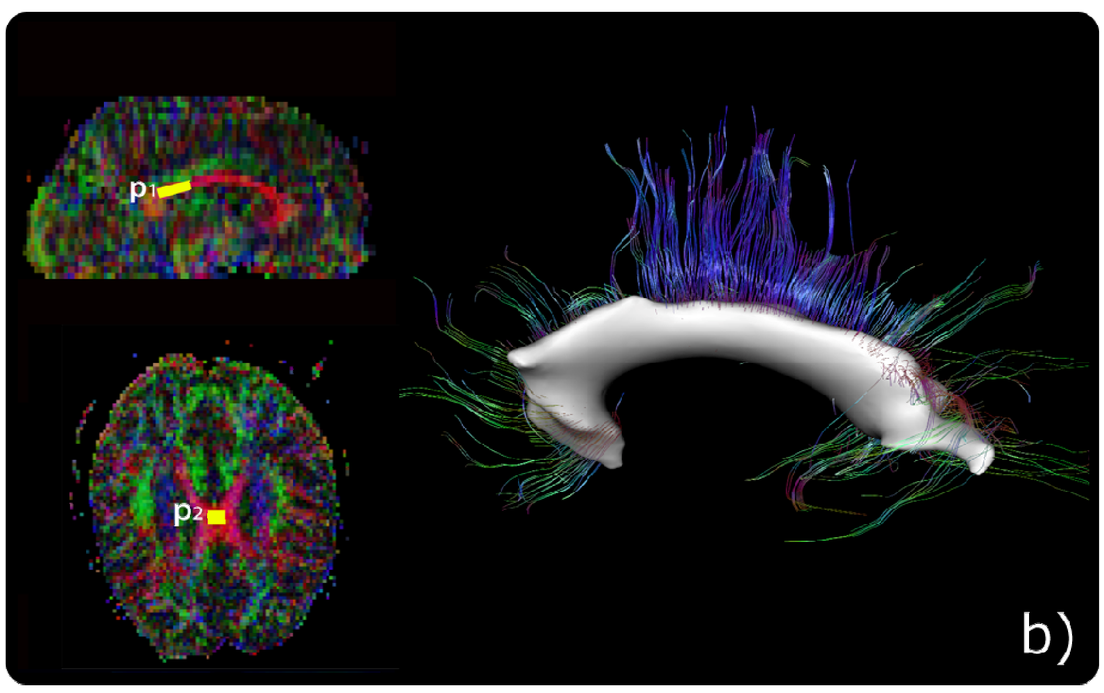

Figure 2: Fusion of a segmented corpus callosum and the commissural fibers, colored using RGB mapping of the main eigenvector and rendered in the GPU. The planes show the used ROIs.

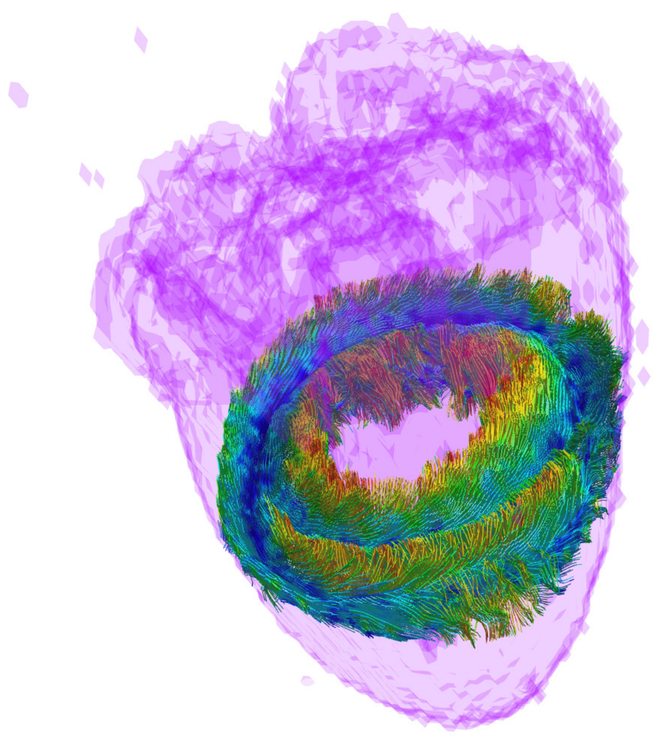

Figure 3: Fusion of short fibers tracked in a slice of a healthy mouse heart dataset, color coded with the helix angle and a isosurface depicting the hear.

Introduction

Diffusion Tensor Imaging (DTI) is being subject of intense research due to its ability to non-invasively probe the structure of biological tissues, simplicity, feasibility in clinical practice and established mathematical frameworks.

Given a DT field, the tissue's fibrous structures can be reconstructed employing fiber tracking techniques. This establishes an important application of DTI such as the study of brain connectivity. DTI has also been used to identify abnormalities in several diseases such as stroke, schizophrenia and multiple sclerosis.

Our Approach: DTITool

Our framework unifies a collection of state-of-the-art algorithms dedicated to medical image processing and visualization. In such a framework, the advantages are twofold: **reusability** of the algorithms permitting the definition of higher level ones; usability by **clinical partners** enabling a pragmatic voice in the research pipeline.

Features of Interest

- DT anisotropy indices, similarity and distance measures can be calculated and used in a DTI analysis;
- 2D/3D slice visualization: typical plane visualization where the measures are color coded with a customizable lookuptable;
- Local tensor information visualization using 3D glyphs such as cuboids, ellipsoids and superquadrics, using the CPU, or GPU accelerated sleek ellipsoids (see Figure 1);
- Fiber tracking from user defined seeding regions of interest (ROIs) or whole volume. ROIs can also be used as filters to prune the fiber tracking results. Fibers can be rendered using GPU allowing the use of lighting/shadow models to convey better structural perception;
- Novel semi-automatic segmentation algorithms (see Figure 2);
- Statistics along fiber tracts or segmentation results, using any of the available measures;
- Smooth isosurfaces for segmentation results, visualization with context (see Figure 3).