

3D Visualization of fMRI and DTI tractography of the brain

OsiriX Foundation

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1 General Conditions

Please refer to <http://www.osirixfoundation.com/awards.html> for General Conditions.

2 Category

This document describes a **Category 2** Plugin Award Project.

3 Description

Functional MRI (fMRI) is capable of pre-surgical localization of critical cortical areas of the cerebral cortex, such as those serving motor, somatosensory, language, and visual functions and can thereby reduce the risk of their inadvertent injury. The axons form dense fiber tracts within the white matter; the functional architecture of these fiber tracts is not discernible by conventional structural MRI or fMRI. However, another recent MRI technique, diffusion tensor imaging (DTI) and tractography, has proven capable of modeling fiber architecture within the white matter.

Several techniques for extraction and visualization of fMRI and fiber tracking results have been developed and numerous programs and software libraries are currently available. The goal of this project is to incorporate some of these tools as plugins to OsiriX. Existing software programs include: numerous work by the Mass General Hospital group (<http://www.jch.com/volumes/dtifmri.htm>), some of the best software programs are provided by Chris Roden's group at the university of South Carolina who developed the MRICron software (<http://www.sph.sc.edu/comd/rorden/workshop/fsl/dti/>), and a very extensive set of software library is available from the INRIA group in Sophia Antipolis in France (<http://www-sop.inria.fr/asclepios/software/MedINRIA/>)

4 Requirements

The goal of this plugin is to provide an automatic and simple to use extension of OsiriX applicable to specific MRI image sequences of the brain. The plugin should perform the DTI quantification and address some of the critical issues such as mixing of voxel-based and geometry data, volume rendering techniques, graphics visualization techniques, and user interface design. It should allow the following:

- Fast extraction of parametric data for generation of fMRI maps and fiber tracking maps
- Image-tensor visualization of individual sets of bundles
- Bundle extraction and statistics calculation of output statistics based on the extracted bundles such as histograms of scalar values like FA/ADC, but also statistics of fiber length
- 3D display color-coded fibers

5 Deliverable

1. A fully functional plugin that can be called upon
2. A simple step-by-step workflow guidance that walk the user through different steps needed to perform image analysis
 - DTI-Module provides fast tensor estimation, tensor smoothing and DTI analysis
 - visualization of the FA map with an RGB color map
 - edit results ROI if needed
3. Generation of a summary dashboard display of the results (parametric images, statistics and histograms...), that can also be export in PDF or DICOM format
4. Export of the data in standard OsiriX ROIs that can be displayed in 3D volume rendering tools of OsiriX

6 Contact

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