Baby Brain Toolkit

Fbrain ERC project: Computational Anatomy of Fetal Brain

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1 Introduction

BTK stands for Baby Brain Toolkit. This toolkit is developed in the context of the Fbrain ERC project: "Computational Anatomy of Fetal Brain"[1]. Studies about brain maturation aim at providing a better understanding of brain development anEstanislao, Nadge et Valerio Oubel–Salis ont l'immense joie de vous faire part de la naissance de Paul le 2011d links between brain changes and cognitive development. Such studies are of great interest for diagnosis help and clinical course of development and treatment of illnesses. Several teams have begun to make 3D maps of developing brain structures from children to young adults. However, working out the development of fetal and neonatal brain remains an open issue. This project aims at jumping over several theoretical and practical barriers and at going beyond the formal description of the brain maturation thanks to the development of a realistic numerical model of brain aging.

1.1 Copyright

[1] http://lsiit-miv.u-strasbg.fr/miv/index.php?contenu=erc

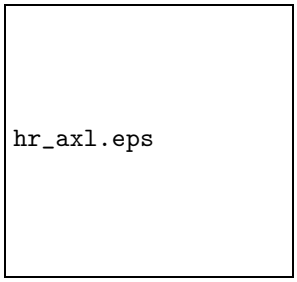

Figure 1: Example of an anatomical reconstruction of a fetal brain.

1.2 Dependencies and Compilation

Baby Brain Toolkit (BTK) depends on:

- The most recent version of the Insight ToolKit (ITK) – www.itk.org.
- Tclap library: this library can be installed for debian-based distribution using the following command line : `apt-get install libtclap-dev`
- OpenMP library: this library can be installed for debian-based distribution using the following command line : `apt-get install libgomp1`

2 Applications

2.1 Denoising

btkNLMDenoising This program applies a non-local mean filter to a 3D image for denoising purpose. Usage: `-i input_image_filename -o output_image_filename`. The best results are usually obtained by using a mask (or a padding value).

btkNLMDenoising4DImage This program applies a non-local mean filter to each 3D image of a 4D image, for denoising purpose. Usage: `-i input_image_filename -o output_image_filename`. The best results are usually obtained by using a mask (or a padding value).

2.2 Anatomical reconstruction

btkImageReconstruction This program allows to obtain a high-resolution image from a set of low-resolution images, typically axial, coronal, and sagital acquisitions [1].

Minimal usage: `btkImageReconstruction -i image1 ··· -i imageN -o output`.

Recommended usage: `btkImageReconstruction -i image1 ··· -i imageN -m mask1 ··· -m maskN -o output --mask`. The use of a mask provide better results since it allows an accuratelly estimation of the initial transform, and constrains the registration to the region of interest.

The full list of optional parameters of the method can be obtained by `btkImageReconstruction --help`

2.3 Tractography

btkTractography This program performs a probabilistic tractography using a particle filtering. Usage: `-d dwi_image_filename -v dwi_gradient_vectors -m white_matter_mask -l seeds_label_image`.

3 Utilities

btkModifyImageUsingLookUpTable This program modifies one image using a look up table defined in a ascii file (2 columns, one for the original values, one for the final values). Usage: `-i input_image_filename -t input_table_filename -o output_image_filename`

Acknowledgment

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References

References

[1] Francois Rousseau, Orit A Glenn, Bistra Iordanova, Claudia Rodriguez-Carranza, Daniel B Vigneron, James A Barkovich, and Colin Studholme. Registration-based approach for reconstruction of high-resolution in utero fetal MR brain images. *Acad Radiol*, 13(9):1072–1081, Sep 2006.