ER-flow Application Description Template

Application Name: FSL BedpostX

Application domain: Medical Imaging

Brief description of application
The FMRIB Software Library (FSL) is a toolbox of programs to analyze brain images. Bedpostx is one of such programs to process DiffusionTensor Imaging (DTI) data acquired with Magnetic Resonance Imaging (MRI). It reconstructs the fibers in each voxel (called tractograpy) using an advanced method that supports crossing fibers.
BedpostX stands for Bayesian Estimation of Diffusion Parameters Obtained using Sampling Techniques, where the X stands for modelling crossing fibres. BedpostX runs a Markov Chain Monte Carlo sampling to build up distributions on diffusion parameters at each voxel, creating all the files necessary for running probabilistic tractography. BedpostX allows for modelling crossing fibres within each voxel on the brain and to automatically determine the number of crossing fibres per voxel.

Data:
    input data format: tgzipped directory (image and possible parameters)
    output data format: tgzipped directory that contains all the files you need for probabilistic tractography.
    sample data: lfn://lfc.grid.sara.nl:5010/grid/vlemed/AMC-e-BioScience/medical-imaging/fsl-bedpostx/sample-data/bedpost-input.tgz
    application and documentation: http://fsl.fmrib.ox.ac.uk/fsl/fsl4.0/fdt/fdt_bedpostx.html
    publications:

- [Behrens 2003a] T.E.J. Behrens, M.W. Woolrich, M. Jenkinson, H. Johansen-Berg, R.G. Nunes, S. Clare, P.M. Matthews, J.M. Brady, and S.M. Smith. Characterization and propagation of uncertainty in diffusion-weighted MR imaging. Magn Reson Med, 50(5):1077-1088, 2003.
- [Behrens 2003b] T.E.J. Behrens, H. Johansen-Berg, M.W. Woolrich, S.M. Smith, C.A.M. Wheeler-Kingshott, P.A. Boulby, G.J. Barker, E.L. Sillery, K. Sheehan, O. Ciccarelli, A.J. Thompson, J.M. Brady, and P.M. Matthews. Non-invasive mapping of connections between human thalamus and cortex using diffusion imaging. Nature Neuroscience, 6(7):750-757, 2003.
- [Johansen-Berg 2004] H. Johansen-Berg, T.E.J. Behrens, M.D. Robson, I. Drobnjak, M.F.S. Rushworth, J.M. Brady, S.M. Smith, D.J. Higham, and P.M. Matthews. Changes in connectivity profiles define functionally distinct regions in human medial frontal cortex. Proc Natl Acad Sci U S A, 101(36):13335-13340, 2004.
- [Behrens 2007] T.E.J. Behrens, H. Johansen-Berg, S. Jbabdi, M.F.S. Rushworth, and M.W. Woolrich. Probabilistic diffusion tractography with multiple fibre orientations. What can we gain? NeuroImage, 23:144-155, 2007.
- [Sotiropoulos 2011] S.N. Sotiropoulos, I. Aganj, S. Jbabdi, G. Sapiro, C. Lenglet, T.E.J. Behrens. Inference on Constant Solid Angle Orientation Distribution Functions from Diffusion-Weighted MRI, p. 609, OHBM, Canada, 2011.
- [Jbabdi 2012] S. Jbabdi, S.N. Sotiropoulos, A. Savio, M. Grana, T.E.J. Behrens. Model-based analysis of multishell diffusion MR data for tractography: How to get over fitting problems. Magn Reson Med, doi: 10.1002/mrm.24204, 2012.

Execution environment
DCI: (EGI, SRM/LFC, vlemed VO)
middleware: gLite, CVMFS   workflow system: MOTEUR, WS-PGRADE

Execution characteristics		
data size (per unit, typical number of units):		
input: 200 MB	temporary:	output: 500 MB
processing time (per unit): 2 hours		
memory usage: n.a.	disk usage: output size	

Target users

Neuroscientists, radiologists, psychiatrists of the AMC Brain Imaging Center
http://www.lebic-amc.nl

number of users: 10+
user type: end-user

Usage scenario for workflow in the ER-FLOW

Various workflows have been implemented to port this application to EGI for the vlemed
VO and the SHIWA VO. These workflows are published on the SHIWA repository with
appropriate documentation and metadata
Users start FSL-BedpostX from the AMC science gateway.
Additionally, the workflows can be can be accessed and executed via the SHIWA Portal by
external users.

Contact information (workflow developers)
  name: Vladimir Korkhov   e-mail: vkorkhov@gmail.com
  name: Mahdi Jaghoori   e-mail: m.jaghouri@amc.uva.nl