# Perfusion Study Group: Freeware corner

Software	Contact name	Locati
ASLtbx	Ze Wang	Pennsylvani
PMI	Steven Sourbron	Leeds,
DUSTER	Dafna Ben Bashat	Tel Aviv, Is
PMA	Kohsuke Kudo	Sapporo, J
FSL	Michael Chappell	Oxford,
EnABIE	Zahra Shirzadi	Toronto, Ca





# ASLtbx: ASL signal processing toolbox https://cfn.upenn.edu/~zewang/ASLtbx.php. >3400 downloads since 2009



Ze Wang, PhD redhatw@gmail.com

## Main features:

- 1. Matlab and SPM(5, 8, 12) based scripts.
- 2. ASL specific motion correction.
- 3. Nuisance regression before CBF calculation.
- 4. Adaptive outlier cleaning.
- 5. Compatible with PASL, CASL, and pCASL.
- 6. Other denoising methods to be included (ongoing).
- 7. Sample data with customized scripts.
- 8. A discussion board:

https://groups.google.com/forum/#!forum/asltbx-discussion-board

Hangzhou Normal University, University of Pennsylvania



## Platform for Research in Medical Imaging (PMI) Steven Sourbron (s.sourbron@leeds.ac.uk) <u>https://sites.google.com/site/plaresmedima/</u>





Documents 🕨 GitHub	PMI-0.4  Packages
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_FusionExportColorMix.p	ro 28/11/2013
_SeriesExportChecker.pro	28/11/2013
_SlicesAxialToCoronal.pro	o 23/04/2015
_SlicesCollapse.pro	28/11/2013
_SlicesCoronalToSagittal.	pro 28/11/2013
_SlicesGradient.pro	28/11/2013
_SlicesMask.pro	28/11/2013
SlicesMedianFilter.pro	28/11/2013
_SlicesMirror.pro	28/11/2013
_SlicesResolution.pro	28/11/2013
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_SlicesRotate.pro	28/11/2013
_SlicesSagittalToAxial.pro	28/11/2013
_SlicesShift.pro	28/11/2013
SlicesSmooth.pro	28/11/2013



### **DUSTER: DCE Up-Sampled Temporal Resolution analysis method**

Gilad Liberman, Yoram Louzoun, Moran Artzi, Guy Nadav, James R. Ewing and Dafna Ben Bashat

- Runs on Linux/Windows on data obtained from GE, Philips and Siemens
- Fully automatic Analysis of DCE data using the Extended Tofts Model with BAT, producing parametric maps  $K^{\text{trans}}$ ,  $K_{\text{ep}}$ ,  $v_{\text{p}}$ ,  $v_{\text{e}}$ , BAT using model selection
- Includes calculation of baseline T<sub>1</sub> maps using DESPOT1, with FAs correction; motion correction; brain extraction; removing and compensation of noisy timepoints; raw-signal-to-T<sub>1</sub>-to-CTC conversion; B<sub>1</sub> inhomogeneity correction; artery localization; AIF extraction at temporal super- resolution and model fitting with model selection
- The user may choose to intervene in a fully manual or semi-automatic way in voxel selection and in choice of AIF
- The program is designed as an open-source software, and provides a user-friendly interface for exploration of the results at all levels of the analysis

WIP: Incorporating the ACoPeD (AIF-corrected-perfusion-DCE-MRI) feature



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ISMRM 2015 Toronto, Canada



#### Main GUI



Estimated pharmacokinetics parameters





Tel Aviv Center for Brain Functions

#### **Explore Results**



#### Manual Inspect AIF



#### A detailed report





















DSC and CT Perfusion (automated analysis) Diffusion-Perfusion mismatch (automated ROI)











**SWI** 



### Kohsuke Kudo, MD, PhD (kkudo@huhp.hokudai.ac.jp)

### Fully automated analysis ✓ Segmentation $\checkmark$ Bolus detection $\checkmark$ AIF selection

### QSM based OEF

# Perfusion in FSL

- **FSL**: The FMRIB Software Library (v5.0)
  - ➡ OS X, Linux and Windows\* compatible.
- **BASIL**: a toolset for resting ASL quantification:
  - ➡ All varieties of ASL

Single and multi-delay, pASL and pcASL, time-encoded ...

- ➡ Absolute perfusion quantification. Calibration / M0 estimation.
- Corrections for acro-vascular contamination and dispersion
- ➡ Partial volume correction.
- **VERBENA**: Vascular model quantification of DSC perfusion
  - Correction for macro-vascular contamination.

## Michael Chappell michael.chappell@eng.ox.ac.uk

## www.fmrib.ox.ac.uk/fsl









# ASL post-processing pipeline: Enhanced Automated Blood-flow Estimate (EnABIE)



Shirzadi Z et al. JMRI 2015

Contact info: Zahra Shirzadi, zshirzadi@sri.utoronto.ca Primary investigator: Dr. Bradley MacIntosh, bmac@sri.utoronto.ca



Perfusion images improvement

(percentage of detected voxels) optimization

(when desired)

