



Master 2 internship
Strasbourg University – ICube Laboratory
Duration: 6 month
Period: from april 2014 to October 2014

MR image processing of mouse brain

Host teams:

- Modèles, Images, Vision (MIV): <http://icube-miv.unistra.fr/>, ICube laboratory (site of Illkirch)
- Imagerie Multimodal Intégrative en Santé (IMIS): <http://icube-imis.unistra.fr/>, ICube laboratory (site in the civil hospital of Strasbourg)

Supervisors:

- Vincent Noblet (MIV, ICube), François Rousseau (MIV, ICube)
- Paulo Loureiro de Sousa (IMIS, ICube)

Objectives:

In the context of the recent acquisition of a small animal 7T MR scanner and in collaboration with the IGBMC (Institut de Génétique et de Biologie Moléculaire) and the ICS (Institut Clinique de la Souris), the objective of this internship is to develop automatic image analysis pipelines to perform brain morphometric studies on mice.

The first part of this project consists in the implementation of a set of criteria to objectify the quality of MR images. These criteria will then be used in the optimization phase of acquisition sequences.

The second part of this project is to develop a pipeline of image analysis to conduct morphometric studies on cohorts of mice. This part will benefit from methodological developments that have already been made in the MIV team in the context of human brain imaging. These methodological developments will be adapted to the case of mouse brain imaging. This translational work from human imaging towards mouse imaging will more specifically concern denoising algorithms (to improve image quality) [1], segmentation [2] (to quantify the volume of anatomical structures), registration [3] (for the use of atlas and for conducting group studies) and change detection (for the longitudinal follow-up) [4]. All the methods will be implemented in Python and C++ and integrated into the software platform Medipy (<http://piiv.u-strasbg.fr/traitement-images/medipy/>) to create a library specifically dedicated to small animal imaging .

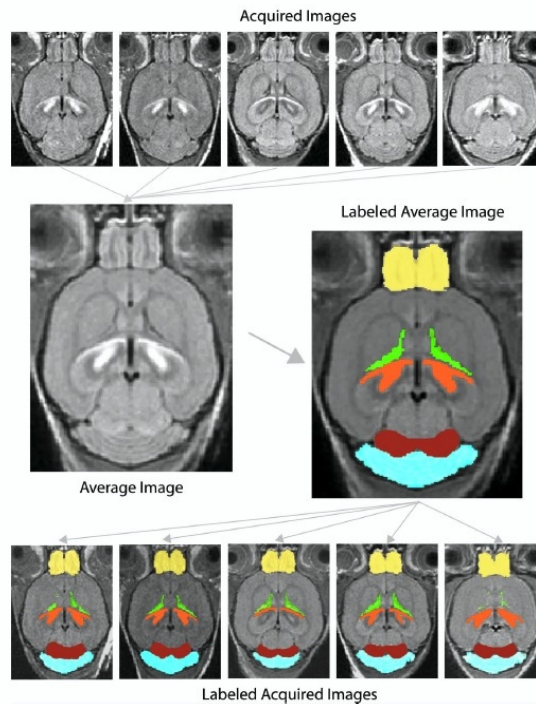


Figure 1 Segmentation of mouse MR images (from Bock *et al.*, J. Neurosci. 26(17), 2006)

[1] F. Rousseau, *A non-local approach for image super-resolution using intermodality priors*. Medical Image Analysis, pp. 594-605, Vol. 14, Num. 4, 2010

[2] F. Rousseau, P. Habas, C. Studholme. *A supervised patch-based approach for human brain labeling*. IEEE Transactions on Medical Imaging, pp. 1852-1862, Vol. 30, Num. 10, 2011.

[3] V. Noblet, Ch. Heinrich, F. Heitz, J.-P. Armpach, *An efficient incremental strategy for constrained groupwise registration based on symmetric pairwise registration*. Pattern Recognition Letters, pp. 283-290, Vol. 33, Num. 3, 2012.

[4] M. Bosc, F. Heitz, J.-P. Armpach, I.-J. Namer, D. Gounot, L. Rumbach, *Automatic Change Detection in Multi-Modal Serial MRI: Application to Multiple Sclerosis Lesion Follow-up*. NeuroImage, pp. 643-656, Vol. 20, Num. 2, 2003.

Required skills:

- Python and C++ programming
- Knowledge in image processing

Remuneration:

In accordance with the current French regulations, the trainee will be paid a gratuity of 436 euros per month.

Sending application (CV + cover letter) at Vincent Noblet (vincent.noble@unistra.fr).