TOWARDS BIGDATA IN NEUROSCIENCE: DEEP LEARNING FOR SEGMENTATION OF ANATOMICAL STRUCTURE

Training period: 4-6 months in 2019 (March-July).

Laboratory: LaBRI, UMR 5800, Université Bordeaux I - Talence – France

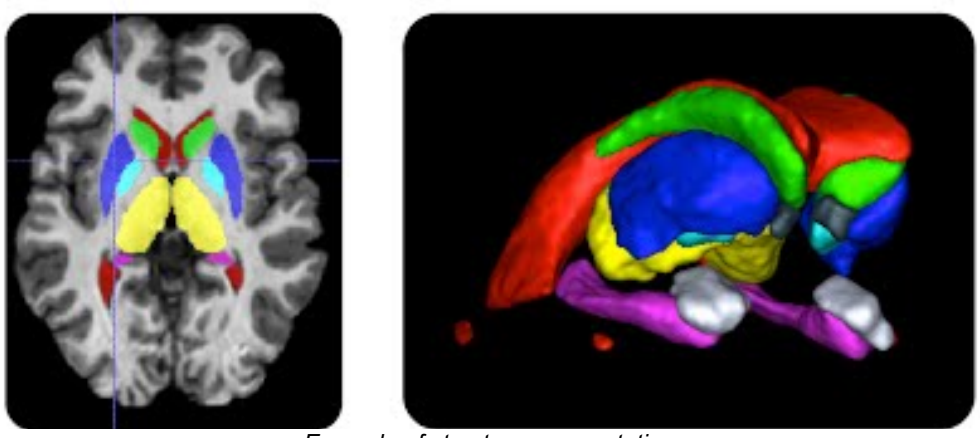
Supervisors:

- Pierrick Coupé / LaBRI UMR 5800 / PICTURA (pierrick.coupe@labri.fr)
- Vincent Lepetit / LaBRI UMR 5800 (vincent.lepetit@u-bordeaux.fr)
- Vinh-Thong Ta / LaBRI UMR 5800 / PICTURA (vinh-thong.ta@labri.fr)

Partners:

- Spain, University of Valence (J. V. Manjon)

Magnetic resonance (MR) imaging plays a crucial role in the detection of pathologies, the study of brain organization and clinical research. Every day, a vast amount of MR data is produced in clinical settings and this number is increasing rapidly, which prevents the use of manual analysis approaches. As a result, the development of reliable segmentation techniques for the automatic extraction of anatomical structures is becoming an important field of quantitative MR analysis. In the past few years, to address this challenge, we proposed multi-atlas patch-based segmentation methods (Coupe et al. 2011) and a web platform called “volBrain” integrating these methods (http://volbrain.upv.es) (Manjon and Coupe 2016). In less than 2 years, thanks to its robustness and efficiency, our volBrain platform processed around 100.000 MRI for 2000 users all around the world. This great success demonstrates the growing need for quantitative analysis and the effectiveness of the diffusion strategy.



Example of structure segmentation
obtained with our method (Coupe et al. 2011).

Recently, we developed new pipelines based on Deep Learning (DL). Our preliminary results demonstrate the potential of such framework to perform fast and accurate MRI segmentation. In this project, we propose to pursue this effort. First, the candidate will propose new pipeline for MRI segmentation based on DL. Then, the candidate will integrate quality control modules based on DL. Finally, the candidate will validate the proposed methods over large MRI dataset.

université de BORDEAUX LaBRI Pictura

OBJECTIVES OF THE PROJECT:

In this project, our final goal is to develop a new generation of quantitative MRI analysis methods to cope with the rise of BigData in neuroimaging. Moreover, the proposed methods will be implemented in full open access to the entire community through a web platform. To achieve this ambitious goal, we will follow several objectives:

- To develop novel fast methods by addressing the current limitations of Deep Learning (DL) in neuroimaging.
- To perform an intensive validation over largescale datasets and to include automatic quality control to ensure the robustness of the proposed tools.

PROFILE OF THE CANDIDATE:

The candidate (diploma of engineering school or Master 2) should be a specialist in deep learning and machine learning. She/He will have skills in image processing and programming. Interest in medical imaging is a plus. A good experience of Python, Keras and tensorflow is recommended. A good English reading/writing is also a key element.

To apply, send a file containing CV, list of publications (if possible), motivation letter, rank transcripts, defense report (if possible) as well as any documents likely to strengthen the application.

REFERENCES:

Coupe, P., J. V. Manjon, V. Fonov, J. Pruessner, M. Robles and D. L. Collins (2011). "Patch-based segmentation using expert priors: application to hippocampus and ventricle segmentation." Neuroimage **54**(2): 940-954.

Manjon, J. V. and P. Coupe (2016). "volBrain: An Online MRI Brain Volumetry System." Front Neuroinform **10**: 30.