

## The Aramis Lab at Paris Brain Institute/Inria is recruiting a Master student with a possible extension to PhD position.

### Automated MRI Quality Assessment in Clinical Data Warehouses: A Transfer Learning Approach Relying on Artefact Simulation

Beginning of the internship: **Winter/Spring 2024**

Duration: **6 months**

Financial support: **regular internship gratification**

Location: **Institut du Cerveau, ARAMIS team,  
Hôpital Pitié Salpêtrière, 47 Bd. de l'hôpital, 75013 Paris**

**Keywords:** Deep learning, image analysis, medical imaging, quality control, clinical data warehouse, Python, PyTorch

#### The topic

In recent years, very large clinical data warehouses (CDW) have been created containing the medical data of millions of patients. The AP-HP (Assistance Publique-Hôpitaux de Paris) CDW brings together data from all hospitals in the Paris region, including clinical data, diagnoses, medical reports and medical imaging data. This resource provides a fantastic opportunity to train effective machine learning models. The aim of the APPRIMAGE project is to develop and validate deep learning methods for computer-aided diagnosis of neurological disorders using a very large set of MRI scans from the AP-HP data warehouse.

Unlike research datasets, where acquisition protocols are well standardised, the quality of CDW images is very heterogeneous. Many MRIs are unusable because they are corrupted by various artefacts (noise, motion, poor contrast...). Since manual detection is impossible due to the large volume of images, we need to develop tools that can automatically exclude corrupted images to fully benefit from the CDW.

Our team has developed a deep learning model to automatically check the quality of T1-weighted MRI data and thus select the data that can be used to train deep learning models based on the generation of synthetic artefacts [1]. Recently, we proposed a generalisation of our tool to a new sequence of MRI (FLAIR) based on domain adaptation techniques [2].

- [1] Loizillon S, Bottani S, Maire A, Ströer S, Dormont D, Colliot O and Burgos N. Transfer learning from synthetic to routine clinical data for motion artefact detection in brain T1-weighted MRI. In *SPIE Medical Imaging 2023: Image Processing*, 2023 <https://hal.inria.fr/hal-03831746>
- [2] Loizillon S, Colliot O, Chougar L, Stroer S, Jacob Y, Maire A, Dormont D and Burgos N. Semi-supervised Domain Adaptation for Automatic Quality Control of FLAIR MRIs in a Clinical Data Warehouse. In *DART 2023 - 5th MICCAI Workshop on Domain Adaptation and Representation Transfer*, 2023 <https://inria.hal.science/hal-04273997>

## The project

The project consists of developing a new tool for automatic quality control of FLAIR MRIs using a strategy similar to that proposed for the T1-weighted sequence based on artefact generation [1]. A review of the literature will be necessary to identify the best ways of generating synthetic data sets containing artefacts that are both varied and realistic from good quality FLAIR images taken from research studies. Once identified, the techniques will be implemented and tested on research data before being applied to images from the CDW. Finally, experiments will be carried out to determine whether this method leads to a better estimate of the overall image quality than our domain adaptation approach [2].

The internship will also include data management and preparation tasks, installation of code and dependencies in specific environments, and performance benchmarking. The methodological developments will be integrated into ClinicaDL (<https://clinicadl.readthedocs.io>), an open-source software platform designed to enable reproducible neuroimaging processing with deep learning.

## A vibrant scientific, technological and clinical environment

You will work within the ARAMIS Lab ([www.aramislab.fr](http://www.aramislab.fr)) at the Paris Brain Institute (<https://institutduncerveau-icm.org/en>), one of the world top research institutes for neurosciences. The institute is ideally located at the heart of the Pitié-Salpêtrière hospital, downtown Paris. The ARAMIS Lab, which is also part of Inria (the French National Institute for Research in Digital Science and Technology), is dedicated to the development of new computational approaches for the analysis of large neuroimaging and clinical data sets. With about 40 people, the lab has a multidisciplinary composition, bringing together researchers in machine learning and statistics and medical doctors (neurologists, neuroradiologists). You will interact locally with the PhD students and engineers of the lab, as well as our medical collaborators at the Pitié-Salpêtrière hospital.

If successful, the internship could be extended to a PhD position.

## Your profile

- Master's degree or engineering degree with computer science, image analysis and/or applied mathematics profile
- Strong interest for medical applications
- Knowledge of deep learning
- Knowledge in digital image processing and medical imaging
- Good programming skills in Python
- Good writing skills
- Good relational and communication skills to interact with professionals from various backgrounds

## Ready to take up the challenge?

Send your CV to Ninon Burgos ([ninon.burgos@cnr.fr](mailto:ninon.burgos@cnr.fr)) and Olivier Colliot ([olivier.colliot@cnr.fr](mailto:olivier.colliot@cnr.fr)) explaining your motivations.