Ph.D. position

AI and MRI analysis tools to characterize brain alterations: applications to intellectual disability disorders

SECTOR: Higher Education Institution

LOCATION: France, Grenoble

RESEARCHER PROFILE:
- First stage researcher

INSTITUTION: Univ. Grenoble Alpes, University of Innovation

One of the major research-intensive French universities, Univ. Grenoble Alpes**1 enjoys an international reputation in many scientific fields, as confirmed by international rankings. It benefits from the implementation of major European instruments (ESRF, ILL, EMBL, IRAM, EMFL*2). The dynamic ecosystem, grounded on a close interaction between research, education and companies, has earned Grenoble to be ranked as the 5th most innovative city in the world. Surrounded by mountains, the campus benefits from a natural environment and a high quality of life and work environment. With 7000 foreign students and the annual visit of more than 8000 researchers from all over the world, Univ. Grenoble Alps is an internationally engaged university.

A personalized Welcome Center for international students, PhDs and researchers facilitates your arrival and installation.

In 2016, Univ. Grenoble Alpes was labeled « Initiative of Excellence ». This label aims at the emergence of around ten French world class research universities. By joining Univ. Grenoble Alpes, you have the opportunity to conduct world-class research, and to contribute to the social and economic challenges of the 21st century ("sustainable planet and society", "health, well-being and technology", "understanding and supporting innovation: culture, technology, organizations" "Digital technology").

* ESRF (European Synchrotron Radiation Facility), ILL (Institut Laue-Langevin), IRAM (International Institute for Radio Astronomy), EMBL (European Molecular Biology Laboratory), EMFL (European Magnetic Field Laboratory)

Key figures:
- >50,000 students including 7,000 international students
- 3,700 PhD students, 45% international
- 5,500 faculty members
- 180 different nationalities
- 1st city in France where it feels good to study and 5th city where it feels good to work
- ISSO: International Students & Scholars Office affiliated to EURAXESS

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1 Univ. Grenoble Alpes
MANDATORY REFERENCES:
IDEIX PROJECT TITLE: MIAI
SUBJECT TITLE: AI and MRI analysis tools to characterize brain alterations: applications to intellectual disability disorders
RESEARCH FIELD: Engineering Computer science Mathematics
DOCTORAL SCHOOL’S: Physics
SUPERVISOR’S NAME: Emmanuel BARBIER

SUBJECT DESCRIPTION:
Neuroimaging genomics or neurogenomics is a relatively rapidly evolving field that integrates brain imaging and individual-level genetic data to investigate the genetic risk factors shaping variations in brain phenotypes. Several large research programs have been initiated worldwide, including the Enigma cohort (http://enigma.ini.usc.edu) or the UK Biobank (https://www.ukbiobank.ac.uk)\(^1\).

In France, the cohort DEFIADIAG (PI. H. Dollfus) is dedicated to intellectual disability disorders, a frequent health condition affecting 2-3% of living birth. Most of the etiologies of these disorders are genetics and correspond to a Mendelian disorder. We aim to develop an automated diagnostic method including both imaging and genetics for clinical decision support.

The proposed Ph.D. project focuses on the MR imaging part and is supported by MIAI@Grenoble-Alpes project.

The proposed PhD project focuses on the development of tools to extract imaging features from MR brain scans in patient suffering from intellectual disability disorders. The steps of the project are:
- To select datasets that can be used to train machine learning algorithms. Several databases such as ENIGMA or UKBIOBANK could be used for this purpose. Data acquired on children will also be sought, as the population from the DEFIADIAG cohort ranges from 6 to 16 years old.
- To set-up an ensemble of existing methods to perform computational anatomy: Voxel Based Morphometry (VBM)\(^2\), Sulci analysis\(^3\), and Diffusion Tensor Analysis. These methods developed in Python could be driven via the software under development Populse MIA (https://github.com/populse/populse_mia)
- The main original development is of this Ph.D. project is the search for new strategies to enrich the training datasets using Generative Adversarial Networks (GAN) or variational autoencoders (VAE). These approaches will be used to optimize our ability to detect anomalies in the pathological pediatric brains, i.e. between 6 and 16 years, a period during which the brain evolves rapidly.
- To apply these tools on the MRI data collected during the DEFIADIAG project.

As mentioned data analysis will be performed using existing tools. These tools are developed mostly in Python but Matlab or R may also be useful. Previous experience with machine learning techniques such as GAN or VAE would be appreciated.

**Background:** Master 2 or Engineer level is mandatory. Initial training in applied mathematics and/or medical image processing will be appreciated.

**Project duration:** October 2019-Septembre 2022

**References**


ELIGIBILITY CRITERIA
Applicants must hold a Master’s degree (or be about to earn one) or have a university degree equivalent to a European Master’s (5-year duration).

Applicants will have to send an application letter in English and attach:
- Their last diploma
- Their CV
- Letters of recommendation are welcome.

Address to send their application: Emmanuel Barbier (emmanuel.barbier@univ-grenoble-alpes.fr), Michel Dojat (michel.dojat@univ-grenoble-alpes.fr), Thomas Christen (thomas.christen@univ-grenoble-alpes.fr)