mNC³

Médecine **N**umérique **C**erveau **C**ognition **C**omportement
*Computational Medicine Brain Cognition Behavior*

Internship offer

Learning anatomical and genetic variability in very large clinical databases

Project Description:
Genetic variants often have only a small effect on disease risk or other quantitative phenotype such as measures derived from brain imaging. Thus, in order to gather sufficient statistical power to detect significant associations large samples sizes are required typically in the range of 10,000s subjects.

Current large biobank and clinical studies, such as UK Biobank and ADNI, provide for the first time the researchers with very large collections of brain imaging and genetic data for cohorts of thousands of individuals. Thus, today we have a unique opportunity to study the relationship between genetic variation and brain changes on data samples of unprecedented sample size. The inherent challenge is represented by the ability of developing novel and efficient computational and statistical methods for analyzing the relationship between very heterogeneous imaging and genetic data.
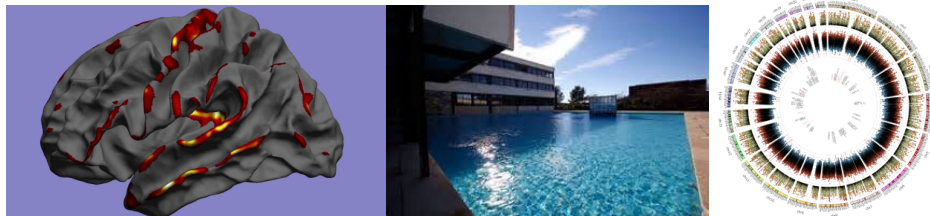
This project aims at implementing effective processing workflows for treating complex and heterogeneous medical data, and to study and implement novel statistical methods based on online learning for the analysis of the joint variation between genetic and imaging features.

Hosting groups:
The Asclepios team (Inria Sophia Antipolis) is located in the tech Park of Sophia Antipolis and in Nice, in the French Riviera. The internship is within the context of an excellence project on digital healthcare for neurological and psychiatric disorders (MNC3). The aim of this multidisciplinary and multi-centric project is to jointly analyze neuroimaging, behavioral/cognition, and biological data for better diagnosis and

treatment of brain disorders. The internship is aimed to prepare the candidate for a possible *subsequent PhD project* within MNC3.

Main activities:
- Processing and feature extraction from brain imaging data (anatomical and functional magnetic resonance images), by using supervised methods based on anatomical parcellation of the brain areas;
- Pre-processing and analysis of high-throughput sequencing data;
- Development and testing of efficient multivariate statistical approaches for the analysis of the joint variability between imaging and genetic features;
- Collection of the results and redactions of a scientific report.

During the internship the candidate will:
- Acquire skills in the advanced processing of medical images;
- Become familiar with the treatment and analysis of sequencing data;
- Design and implement statistical learning frameworks for the analysis the joint variation between imaging and genetic data;
- Interact with INRIA students and researchers, and participate to scientific life of the team.

Required competences:
Competences in statistical learning and mathematical modeling are essential, as well as knowledge in medical imaging, signal and image processing (Master 2 level). Experience in biostatistics, as well as in the analysis of genomic sequencing data is a plus. Solid programming and IT skills are necessary (Python, bash scripting, version control systems), along with strong communication abilities.

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References:
- Lorenzi et al, ISBI 2016;
- Lorenzi et al, Alzheimer's Association International Conference, 2016;
- Lorenzi et al, SIPAIM 2016.