

Offre n°2022-05093

PhD Position F/M Methods for big-data neuroimaging analyses

Le descriptif de l'offre ci-dessous est en Anglais

Type de contrat : CDD

Niveau de diplôme exigé : Bac + 5 ou équivalent

Fonction : Doctorant

Contexte et atouts du poste

The field of neuroimaging is at a turning point, owing to the availability of several large datasets such as the UKBiobank, which comprises more than 40,000 volunteers from the general population with deep phenotyping, multimodal MRI and genotyping data. In comparison, clinical samples currently comprise a few thousands of individuals at most, though larger samples should be available soon. For example, the ARAMIS team is working at analysing the AP-HP (Assistance Publique des Hôpitaux Parisiens) data comprising tens of thousands of individuals with diagnosis information and brain MRI. **Such large data promise a finer understanding of the brain association with disorders as well as improved risk prediction, though they also raise computational and methodological challenges.**

In particular, performing association and building prediction algorithms able to deal with the large number of features that still far exceeds the number of participants. We require efficient algorithms and models that can scale up to the data (UKB sample is expected to grow to 100,000 participants) and that can combine information from different samples [Couvry-Duchesne et al., 2021]. Current approaches in neuroimaging, include univariate association analyses, which we showed to exhibit a high false positive rate due to unaccounted data structure [Couvry-Duchesne et al., 2022]. In addition, prediction often relies on penalised regression or convolutional neural networks (CNNs) that **become extremely costly to train or update on large sample sizes, and often require to pull raw data together from the different studies.** A specific limitation of the current population samples, is that the **number of cases is often too limited to study clinical phenotypes**, which prevents from improving disease risk prediction based upon smaller clinical samples. Finally, **we lack methods for understanding and predicting disease progression from cross-sectional data**, until large longitudinal datasets become available. In particular, we would like to identify early markers of the disease, which could serve for risk prediction, prevention and early intervention. More generally, understanding the cascade of brain changes occurring in neurological or psychiatric disorders can clarify the aetiology of the disorder, but also progress our prediction of individual's risk and trajectories.

This thesis is funded by an Inria "starting package", which supports newly recruited researchers in developing their research axes. This PhD project integrates with the neuroimaging research conducted at the ARAMIS lab.

The ARAMIS Inria project team is integrated within the [Brain and Spine Institute](#) (ICM). It is a joint team with CNRS, Inserm and Sorbonne University. The ICM is a neuroscience center based in the Pitié-Salpêtrière hospital in Paris, which is the largest adult hospital in Europe and has a long tradition of neuroscience and neurology. This rich environment allows direct and fruitful collaborations with medical and biological teams, which is crucial for the design of meaningful methods and for the translation to clinical applications.

The ARAMIS team is devoted to the **design of computational, mathematical and statistical approaches for the analysis of multimodal patient data, with an emphasis on neuroimaging data**. The core methodological domains of our team are: machine learning, statistical modeling of complex geometric data, connectivity and network analysis. These new approaches are applied to clinical research in neurological diseases in collaboration with other teams of the ICM, clinical departments of the Pitié-Salpêtrière hospital and external partners. **The team has a pluridisciplinary composition**, bringing together researchers in mathematics, computer science and engineering.

Mission confiée

The PhD student will develop or adapt statistical methods, to tackle the challenges of big-data neuroimaging described above.

Each method/approach will be extensively tested and evaluated on simulated and real biobank data (open-access), already available and maintained in the ARAMIS project team.

The methods will be implemented in open source software and packages.

The PhD project will also imply extensive data management and some MRI image processing.

The candidate will be encouraged to attend scientific seminars to develop a strong and general scientific culture.

The candidate will be encouraged to present at international conferences, whose cost will be supported by the project team.

The candidate is expected to publish scientific articles.

Principales activités

Process and analyse MRI data

Develop statistical methods and tools

Write scientific articles

Compétences

Technical skills and level required :

Languages :

Relational skills :

Other valued appreciated :

Avantages

- Subsidized meals
- Partial reimbursement of public transport costs
- Leave: 7 weeks of annual leave + 10 extra days off due to RTT (statutory reduction in working hours) + possibility of exceptional leave (sick children, moving home, etc.)
- Possibility of teleworking (after 6 months of employment) and flexible organization of working hours
- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports events and activities
- Access to vocational training
- Social security coverage

Informations générales

- Thème/Domaine : Neurosciences et médecine numériques Statistiques (Big data) (BAP E)
- Ville : Paris
- Centre Inria : [Centre Inria de Paris](#)
- Date de prise de fonction souhaitée : 2022-09-01
- Durée de contrat : 3 ans
- Date limite pour postuler : 2022-07-10

Contacts

- Équipe Inria : [ARAMIS](#)
- Directeur de thèse :
Couvry-duchesne Baptiste / baptiste.couvy-duchesne@inria.fr

A propos d'Inria

Inria est l'institut national de recherche dédié aux sciences et technologies du numérique. Il emploie 2600 personnes. Ses 215 équipes-projets agiles, en général communes avec des partenaires académiques, impliquent plus de 3900 scientifiques pour relever les défis du numérique, souvent à l'interface d'autres disciplines. L'institut fait appel à de nombreux talents dans plus d'une quarantaine de métiers différents. 900 personnels d'appui à la recherche et à l'innovation contribuent à faire émerger et grandir des projets scientifiques ou entrepreneurial qui impactent le monde. Inria travaille avec de nombreuses entreprises et a accompagné la création de plus de 200 start-up. L'institut s'efforce ainsi de répondre aux enjeux de la transformation numérique de la science, de la société et de l'économie.

L'essentiel pour réussir

There you can provide a "broad outline" of the collaborator you are looking for what you consider to be necessary and sufficient, and which may combine :

- tastes and appetencies,
- area of excellence,

- personality or character traits,
- cross-disciplinary knowledge and expertise...

This section enables the more formal list of skills to be completed and 'lightened' (reduced) :

- "Essential qualities in order to fulfil this assignment are feeling at ease in an environment of scientific dynamics and wanting to learn and listen."
- " Passionate about innovation, with expertise in Ruby on Rails development and strong influencing skills. A thesis in the field of **** is a real asset."

Attention: Les candidatures doivent être déposées en ligne sur le site Inria. Le traitement des candidatures adressées par d'autres canaux n'est pas garanti.

Consignes pour postuler

Sécurité défense :

Ce poste est susceptible d'être affecté dans une zone à régime restrictif (ZRR), telle que définie dans le décret n°2011-1425 relatif à la protection du potentiel scientifique et technique de la nation (PPST). L'autorisation d'accès à une zone est délivrée par le chef d'établissement, après avis ministériel favorable, tel que défini dans l'arrêté du 03 juillet 2012, relatif à la PPST. Un avis ministériel défavorable pour un poste affecté dans une ZRR aurait pour conséquence l'annulation du recrutement.

Politique de recrutement :

Dans le cadre de sa politique diversité, tous les postes Inria sont accessibles aux personnes en situation de handicap.