PhD Position F/M Exploring the variability induced by different configurations in the neuroimaging analytical space

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

Type de contrat : CDD

Niveau de diplôme exigé : Bac + 5 ou équivalent

Fonction : Doctorant

A propos du centre ou de la direction fonctionnelle

The Inria Centre at Rennes University is one of Inria's eight centres and has more than thirty research teams. The Inria Centre is a major and recognized player in the field of digital sciences. It is at the heart of a rich R&D and innovation ecosystem: highly innovative PMEs, large industrial groups, competitiveness clusters, research and higher education players, laboratories of excellence, technological research institute, etc.

Contexte et atouts du poste

Applications are invited for a PhD fellowship under the supervision of Dr. Camille Maumet and Prof. Mathieu Acher. This position is part of the ANR JCJC project VICUNA.

The goal of brain imaging is to provide in-vivo measures of the human brain to better understand how the brain is structured, connected and functions. Neuroimaging studies are characterised by a very large analysis space and, to build their analyses, practitioners must choose between different software, software versions, algorithms, parameters, etc. For many years, those choices have been considered as “implementation details” but evidence is growing that the exact choices of analysis strategy can lead to different and sometimes contradictory results (Botvinik-Nezer et al., 2020).

The first studies that investigated the variability induced by different analyses (denoted as “analytical variability”) in neuroimaging raised awareness in the community but they only looked at a tiny proportion of the analytical space (see for example (Bowring et al., 2021)). As a very coarse estimation — considering a neuroimaging study with 40 participants, a pipeline of 10 steps with 1000 options (that are easily attained with 5 software packages, 5 versions, 4 algorithms and 10 parameter values) and assuming that 20 min are required to process one subject, we reach $10^{15}$ trillion years to compute all options. This high order of magnitude prevents the use of exhaustive approaches (aka “brute force“) and instead calls for a dedicated methodology. In VICUNA, we propose to view the multiplicity of analytical pipelines as a software configuration problem. Due to their ubiquitousness, software engineering has been increasingly interested in understanding the behavior of software with a very large number of configurations (also known as software product lines). The study of software variability has been focusing on deriving methodologies to “sample, measure and learn“ (Pereira et al., 2021) in large configuration spaces: sampling from the configuration space in order to measure and learn characteristics (e.g. compilation time, configuration failure) to get an overview of the overall behavior over the full set of configurations.

In VICUNA, we will leverage software variability engineering to explore the brain imaging analytical space.

Mission confiée

Supervision:

- Camille MAUMET, Research scientist at Inria, Empenn team (camille.maumet@inria.fr)
- Mathieu ACHER, Professor at INSa, Diverse team (mathieu.acher@irisa.fr)

Location: Rennes – INRIA / IRISA

Teams: Empenn and DIVERSE

Research themes: Data science, software engineering, brain imaging

Keywords: Analytical variability, software configurations, data processing, open science, reproducibility, brain

Start date: between January and October 2024 (Review of applications will begin immediately and will...
The goal of this fellowship will be two-folds: 1/ to provide the first complete model of the task-fMRI analytical space in which analytical pipelines are represented as different configurations and 2/ to explore the analytical space to investigate the main sources of variability. This model will be tested against large-scale real datasets such as NARPS (Botvinik-Nezer et al., 2020) and the Human Connectome Project (Van Essen et al., 2013).

**Compétences**

**Required skills**
- Masters in computer science or any field related to data science
- Interest in medical imaging
- Excellent programming and software engineering skills (including ability to use version control)
- Very good understanding of English
- Ability to work well in a team and exchange and share ideas with other members
- Well-organised with project-management skills

**Desirable**
- Prior experience with processing of neuroimaging data
- Experience in programming in Python

**For more information**

Informal inquiries can be sent to Dr. Camille Maumet (see above). General information on INRIA and on the Empenn team are available on the respective websites (see above).

**References**


**Avantages**
- Subsidized meals
- Partial reimbursement of public transport costs
- Possibility of teleworking (90 days per year) and flexible organization of working hours
- Partial payment of insurance costs

**Rémunération**

Monthly gross salary amounting to 2082 euros for the first and second years and 2190 euros for the third year

**Informations générales**
- **Thème/Domaine**: Neurosciences et médecine numériques
- **Ingénierie logicielle** (BAP E)
- **Ville**: Rennes
- **Centre Inria**: [Centre Inria de l'Université de Rennes](https://www.inria.fr/)
- **Date de prise de fonction souhaitée**: 2024-09-01
- **Durée de contrat**: 3 ans
- **Date limite pour postuler**: 2023-12-23

**Contacts**
- **Équipe Inria**: EMPENN
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 entrepreneuriaux 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.

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

Applications will be reviewed as they are submitted and until the place is filled. Please note that the date included on this job offer is not an application deadline and the offer might be filled before that date.

Please submit online: your resume, cover letter and letters of recommendation eventually.

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.