Offre n°2024-07685

Post-Doctoral Research Visit F/M [POSTDOC2024-MATHNEURO] Creating Ageonostics: A New Clinical Tool to Diagnose Ageotypes across Multiscale Human Lifespan Data

Type de contrat : CDD
Niveau de diplôme exigé : Thèse ou équivalent
Fonction : Post-Doctorant

A propos du centre ou de la direction fonctionnelle

The Inria centre at Université Côte d'Azur includes 37 research teams and 8 support services. The centre's staff (about 500 people) is made up of scientists of different nationalities, engineers, technicians and administrative staff. The teams are mainly located on the university campuses of Sophia Antipolis and Nice as well as Montpellier, in close collaboration with research and higher education laboratories and establishments (Université Côte d'Azur, CNRS, INRAE, INSERM ...), but also with the regiona economic players.

With a presence in the fields of computational neuroscience and biology, data science and modeling, software engineering and certification, as well as collaborative robotics, the Inria Centre at Université Côte d'Azur is a major player in terms of scientific excellence through its results and collaborations at both European and international levels.

Contexte et atouts du poste

The MathNeuro project-team in the Inria branch at the University of Montpellier focuses on understanding brain activity at multiple scales (i.e. from single-cell, microcircuits to large scale brain processes). MathNeuro has a core at the intersection of Mathematics and Neuroscience, but it also employs a multidisciplinary approach combining theory, computational modelling, as well as, data science. In line with this, our collaborations involve experts from diverse fields, including experimentalists, clinicians, and data scientists. The research lines of MathNeuro include questions related to plasticity (both synaptic and non-synaptic) and associated learning rules, memory, excitability, with applications in both normal and pathological brain states, as well as, ageing brain. Recent research portfolios include novel mathematical classification of neuronal bursting, explanation of asynchronous neurotransmitter release (via competition of timescales) and application areas such as, understanding migraine, epileptic seizures, Alzheimer's Disease (AD) and ageing.

MathNeuro resides within a rich scientific environment, which includes three permanent members, one postdoc, two phd students, and benefits from a large network of international collaborators. The MathNeuro team is also embedded within the ecosystem of the AI Institute in Nice, co-organized by Inria. Detailed information of MathNeuro can be found at our webpage (here). The successful candidate will have access to a wide range of high-performance computing facilities and will receive guidance from the supervisory team. Moreover, the candidate will be encouraged and supported to write grants and will also be stimulated to participate in our seminar/workshop organisation.

This project will be carried out in close collaboration with Serafim Rodrigues (Ikerbasque & BCAM, Bilbao), head of the "Mathematical, Computational and Experimental" (webpage here) with whom the MathNeuro team has been working closely for many years.

The line managers of the postdoc will be Mathieu Desroches and Fabien Campillo.

Mission confiée

The project underpinning this postdoc position is motivated by unique longitudinal multiscale and multimodal datasets on aging (from genes/multi-omics, inflammatory markers, brain data to environmental factors) to which we have obtained access. Namely, the Baltimore Longitudinal Study on Aging (BLSA, collected by NIH, USA, see here) and the Singapore Longitudinal Ageing Studies (SLAS, see here). The ultimate aim is to develop a toolbox (which we denote Ageonostics) for diagnosing and explaining ageotypes (i.e., pathways to ageing) as observed within the BLSA and SLAS datasets.

Methodologies will involve state-of-the-art combination between data-science tools such as AI, Topological and Geometrical Deep Learning, Structural Recurrence Analysis and multiscale dynamical systems. Indeed, together with our partners on this project, we have all the necessary expertise in order to pursue this endeavor [1-5].
The central hypothesis for this project is based on recent developments that posit the link between long genes and aging as well as age-related diseases. It is found that long-genes are more vulnerable to environmental factors (e.g., toxins, epigenetic factors) which then induce large-scale phenotypes that lead to different ageing pathways (i.e., ageotypes) and neurodegenerative diseases (e.g., AD). We aim to determine key biomarkers of ageing and neurodegenerative diseases under this hypothesis, which will lead to novel ways to diagnose and possibly motivate the design of new drugs.

As mentioned above, this project will benefit from a strong network of collaborators (Prof. Luigi Ferrucci, NIH, USA; Prof. Alan A. Cohen, Columbia University, USA; Prof. Tamas Fülöp, University Hospital Sherbrooke, Canada; Prof. Serafim Rodrigues, BCAM, Spain; Dr. Fernando Santos, University of Amsterdam, Netherlands), a research ecosystem at the forefront of data science, and unique datasets.

**Keywords:** aging studies, multiscale data science, deep learning, topological data analysis.

**References:**


**Principales activités**

The main objective of this postdoc is to perform higher-order multi-layered network analysis of key subparts of the available datasets. We will study complex interactions, identifying higher-order interactions invariances across hierarchical interactome, higher-order hubs and centrality measures based on a number of methods, focusing on deep learning and topological data analysis.

**Compétences**

Candidates should be familiar with Machine learning, Multi-layered network analysis and Topological data analysis.

**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 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
- Contribution to mutual insurance (subject to conditions)

**Rémunération**

Duration: 18 months
Location: Sophia Antipolis, France
Gross Salary per month: 2788€ brut per month

**Informations générales**

- **Thème/Domaine**: Neurosciences et médecine numériques
- **Biologie et santé, Sciences de la vie et de la terre (BAP A)**
- **Ville**: Montpellier
- **Centre Inria**: Centre Inria d’Université Côte d’Azur
- **Date de prise de fonction souhaitée**: 2024-09-02
**Durée de contrat :** 1 an, 4 mois  
**Date limite pour postuler :** 2024-06-26

**Contacts**
- **Équipe Inria :** [MATHNEURO](https://www.mathneuro.eu)  
- **Recruteur :** Desroches Mathieu / [Mathieu.Desroches@inria.fr](mailto:Mathieu.Desroches@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 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**

Before applying, it is strongly recommended that you contact the Scientific manager beforehand.

**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.