Offer #2024-08273

Classification of astrocytic calcium signals observed with 3D lattice light sheet fluorescence microscopy

Contract type : Internship agreement

Level of qualifications required : Master's or equivalent

Fonction : Internship Research

About the research centre or Inria department

The Inria center at the University of Rennes is one of eight Inria centers and has more than thirty research teams. The Inria center is a major and recognized player in the field of digital sciences. It is at the heart of a rich ecosystem of R&D and innovation, including highly innovative SMEs, large industrial groups, competitiveness clusters, research and higher education institutions, centers of excellence, and technological research institutes.

Context

Astrocytes are glial cells in the central nervous system that recently emerged as key partners of neurons for the processing of information. Astrocytic calcium signals are involved in many key brain functions (e.g., memory and learning), and their alterations can lead to brain diseases. These signals also exhibit an important spatiotemporal diversity, and it is still unknown whether this variability relates to their role in distinct neurobiological functions. Not surprisingly, decoding this calcium code is a leading topic in neuroscience. The recent emergence of lattice light sheet microscopy (LLSM) now enables a 3D imaging with high spatiotemporal resolution of these signals. Unfortunately, the community is currently lacking of image analysis tools to detect, segment and quantify these signals in LLSM images.

In this context, we are developing an image processing tool for neurobiologists which 1) detects and segments calcium signals in 3D+time LLSM images, and 2) classifies these signals based on their 3D space-time morphological characterization.

Assignment

A method to segment calcium signals in 3D+time LLSM images has already been developed by the team. The goal of the internship is to develop a method to classify the segmented astrocytic calcium signals into the ones that are localized within microdomains and the ones that propagate within the astrocyte. Because of the lack of reliable labeled annotations, we will mainly focus on unsupervised 3D methods (applied mathematics and deep learning). A synthetic dataset simulating astrocytic calcium dynamics, developed by the team, could be used to evaluate the method.

For this purpose, the candidate will:

- perform an extensive study of the literature for calcium classification in 2D+time and 3D+time;
- focus both on classical clustering methods as k-means and unsupervised deep learning;
- may use dimensionality reduction techniques as kymograph or principal component analysis.

Skills

- Image processing and analysis;
- Machine learning;
- Deep learning (CNNs);
- Applied mathematics;
- Python.

Benefits package

- 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

Remuneration

650 per month

General Information

- **Theme/Domain :** Computational Biology
  Data production, processing, analysis (BAP D)
- **Town/city :** Rennes
- **Inria Center :** Centre Inria de l'Université de Rennes
- **Starting date :** 2025-02-01
- **Duration of contract :** 6 months
- **Deadline to apply :** 2024-11-22

Contacts

- **Inria Team :** SAIRPICO
- **Recruiter :**
  Badoual Anais / anais.badoual@inria.fr

About Inria

Inria is the French national research institute dedicated to digital science and technology. It employs 2,600 people. Its 200 agile project teams, generally run jointly with academic partners, include more than 3,500 scientists and engineers working to meet the challenges of digital technology, often at the interface with other disciplines. The Institute also employs numerous talents in over forty different professions. 900 research support staff contribute to the preparation and development of scientific and entrepreneurial projects that have a worldwide impact.

Warning : you must enter your e-mail address in order to save your application to Inria. Applications must be submitted online on the Inria website. Processing of applications sent from other channels is not guaranteed.

Instruction to apply

Defence Security :
This position is likely to be situated in a restricted area (ZRR), as defined in Decree No. 2011-1425 relating to the protection of national scientific and technical potential (PPST).Authorisation to enter an area is granted by the director of the unit, following a favourable Ministerial decision, as defined in the decree of 3 July 2012 relating to the PPST. An unfavourable Ministerial decision in respect of a position situated in a ZRR would result in the cancellation of the appointment.

Recruitment Policy :
As part of its diversity policy, all Inria positions are accessible to people with disabilities.