

Offre n°2024-07108

Post-Doctoral Research Visit F/M Deep learning models for automatic ovarian follicle detection from 2D and 3D imaging data

Contract type : Fixed-term contract

Level of qualifications required : PhD or equivalent

Fonction : Post-Doctoral Research Visit

Level of experience : Up to 3 years

About the research centre or Inria department

Le centre de recherche Inria de Saclay a été créé en 2008. Sa dynamique s'inscrit dans le développement du plateau de Saclay, en partenariat étroit d'une part avec le pôle de l'**Université Paris-Saclay** et d'autre part avec le pôle de l'**Institut Polytechnique de Paris**. Afin de construire une politique de site ambitieuse, le centre Inria de Saclay a signé en 2021 des accords stratégiques avec ces deux partenaires territoriaux privilégiés.

Le centre compte **39 équipes-projets**, dont 27 sont communes avec l'Université Paris-Saclay ou l'Institut Polytechnique de Paris. Son action mobilise **plus de 600 personnes**, scientifiques et personnels d'appui à la recherche et à l'innovation, issues de 54 nationalités.

Le centre Inria Saclay – Île-de-France est un acteur essentiel de la recherche en sciences du numérique sur le plateau de Saclay. Il porte les valeurs et les projets qui font l'originalité d'Inria dans le paysage de la recherche : l'excellence scientifique, le transfert technologique, les partenariats pluridisciplinaires avec des établissements aux compétences complémentaires aux nôtres, afin de maximiser l'impact scientifique, économique et sociétal d'Inria.

Context

As part of the ANR OVOPAUSE project (ANR-22-CE45-0017), the objective is to develop a model for the automatic detection and classification of ovarian follicles, based on 2D histological sections in mice and 3D imaging from clearing tissue in fish. Ovarian follicles are multi-cellular structures that contain female germ cells. The maturation of the follicles goes through successive growth stages until, for some of them, ovulation or laying and the release of the mature oocyte. The distribution of follicles in the different stages of maturity, during life, determines the reproductive state of individuals and certain fertility disorders are associated with a disturbed distribution. The counting of ovarian follicles, and their classification, is therefore a major challenge both for research in reproductive biology and in clinical applications.

Manual counting of ovarian follicles remains an extremely tedious task and has led to the recent development of artificial intelligence approaches. However, to date, no method is fully satisfactory and a global improvement in automatic follicle classification and counting is awaited in this field.

This post-doctoral position will be carried out in a highly interdisciplinary environment, close to experts in reproductive biology and modeling. A sufficient body of data has already been acquired in two model species, the mouse and the medaka.

The contract can start now and, at the latest, before November 1st 2024.

Assignment

An overview of the OVOPAUSE project is available [here](#). The main objective of this post-doctoral work is the development of algorithms and codes, freely accessible to the scientific community, allowing the precise assessment of the number of ovarian follicles from 2D histological images of ovaries, and to classify follicles according to their different stages of maturity and their health status. This work will be based on a corpus of images annotated by experts, available within the team. The candidate will use innovative deep learning techniques to resolve detection challenges due to the fact (i) that there is a large contrast in follicle sizes, with a range of the order 10^2 between the smallest and largest follicles; (ii) that the same follicles are present on several successive sections (with tracking issue); (iii) that the availability of a sufficient number of instances of each category to be classified in the training dataset is limiting.

The candidate will develop solutions based on existing methods from the literature in this field and in related fields, as well as from solutions developed in the team and in collaboration, an overview of which

is available [here](#).

In a second step, the performance of the detection and classification of follicles from 2D sections will be compared to the automatic analysis by 3D imaging, following the methodology developed by our collaborators [[Lesage et al. 2023](#)]. Several perspectives could then be addressed during this work:

- the optimization of follicular counting protocols from 2D histological sections, using available 3D information.
- the use of cell markers to improve estimates in 2D and 3D, and/or transfer of digital markers.
- statistical analysis of the spatial distribution of ovarian follicles.

The recruited fellow will be responsible for the development of the different solutions envisaged, and will be able to interact with the modelers and biological experts present within the consortium (MUSCA, University Paris-Cité, INRAE Rennes), as well as the artificial intelligence experts with whom we collaborate.

Main activities

Main activities :

- Analyze existing solutions for the detection of ovarian follicles from 2D histological sections and 3D imaging.
- Propose, implement and test new solutions for detection and classification of ovarian follicles based on annotated data from 2D histological sections.
- Develop a user-friendly program for biological experts, allowing the easy and fast detection and classification of ovarian follicles on new 2D sections.
- Propose new avenues of research to improve the prediction performance of ovarian follicle detection and classification algorithms, adapted to 2D and 3D data.
- Write and disseminate the results obtained to the scientific community

Skills

- PhD in Computer Science or Computational Biology or related domains.
- Experience in machine learning (particularly deep learning).
- Strong programming skills (python, C++).
- Will be appreciated:
 - Familiarity with 2D or 3D imaging dataset, computer vision.
 - Experience with developing user-friendly tools and algorithms.
 - Knowledge of spatial statistics.

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

Rémunération : 2.788 euros brut/mois

General Information

- **Theme/Domain** : Computational Biology
Biologie et santé, Sciences de la vie et de la terre (BAP A)
- **Town/city** : Palaiseau
- **Inria Center** : [Centre Inria de Saclay](#)
- **Starting date** : 2024-09-01
- **Duration of contract** : 2 years
- **Date limite pour postuler** : 2024-03-30

Contacts

- **Inria Team** : [MUSCA](#)
- **Recruiter** :
Yvinec Romain / romain.yvinec@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.

The keys to success

- A strong motivation for interdisciplinarity and applications to cell biology.
- Feel comfortable in a multi-site and multidisciplinary scientific consortium environment.

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.