Offer #2025-08986

Post-Doctoral Research Visit F/M Event-based unsupervised waveform learning for physiological signals

Contract type : Fixed-term contract

Level of qualifications required : PhD or equivalent

Fonction : Post-Doctoral Research Visit

About the research centre or Inria department

The Inria Saclay Research Centre was established in 2008. It has developed as part of the Saclay site in partnership with Paris-Saclay University and with the Institut Polytechnique de Paris since 2021.

The centre has 39 project teams , 27 of which operate jointly with Paris-Saclay University and the Institut Polytechnique de Paris. Its activities occupy over 600 scientists and research and innovation support staff, including 54 different nationalities.

Context

The postdoc will take place in Inria Saclay, in the MIND team. This is a large team working focused on mathematical methods for statistical modeling of brain function using neuroimaging data (fMRI, MEG, EEG). Particular topics of interest include machine learning techniques, numerical and parallel optimization, applications to human cognitive neuroscience, event detection, and scientific software development. A particular emphasis is put on interdisciplinary projects.

Assignment

A natural way to describe physiological signals that is compatible with events is to consider recurring patterns, whose localization can be seen as a train of events. These descriptions are already used by both learning-based methods and in more manual pipelines. For instance, in neuroscience, the interest in transient waveforms to describe in M/EEG recordings has risen in recent years as markers of cognitive functions or pathologies. The success of these representations mostly depends on the way to select the patterns. However, most methods consider that the occurrences of physiological events are independent and cannot incorporate knowledge from external events. This leads to unreliable event extraction, where spurious and non-plausible events are detected. Moreover, this makes it harder to highlight global properties in the signal, such as the rhythms or the link between different events. The goal of this postdoc will be to develop efficient end-to-end procedures to detect and model events in physiological signals, accounting for their inter-dependence patterns. In particular, we will aim to extend Convolutional Dictionary Learning (CDL) to the case where its activations follow PP models, which describe both the activations and external events. The major challenge will be to propose efficient and reliable solvers to solve the resulting optimization problem. Due to the scale of the problem (commonly over 100,000 time points), this step will require large-scale and distributed optimization, which will benefit from previous work on distributed solvers for CDL in the team.

Main activities

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- Read papers and state of the art
- Benchmark existing algorithms
- Adapt the formulation to the target scenario.
- Program, run, and analyze simulation results.

Complementary activities

- Participate in the team's activities: scientific meetings, seminars, and scientific presentations.

Skills

- Strong mathematical background. Knowledge in machine learning is a plus.

- Good programming skills in Python. Knowledge of a deep learning framework is a plus.

- The candidate should be proficient in English. Knowing French is not necessary, as daily communication in the team is mostly in English due to the strong international environment.

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 and flexible organization of working hours
- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports events and activities

Remuneration

2788 € gross/month

General Information

- **Theme/Domain :** Computational Neuroscience and Medicine Statistics (Big data) (BAP E)
- **Town/city :** Palaiseau
- **Inria Center :** Centre Inria de Saclay
- **Starting date :** 2025-11-01
- **Duration of contract :** 2 years
- **Deadline to apply :** 2025-09-30

Contacts

- **Inria Team :** MIND
- **Recruiter :**
  Moreau Thomas / thomas.moreau@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

We seek candidates strongly motivated by challenging research topics in machine learning for science. Applicants should have a strong mathematical background with knowledge of numerical optimization and machine learning. With regards to software engineering, proficiency in Python is expected, and experience in applying ML to large-scale data is a plus.

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.