



Offer #2024-07846

PhD Position F/M Surrogate modeling for simulation-based inference with application to genomics data

Contract type : Fixed-term contract

Level of qualifications required : Graduate degree or equivalent

Fonction : PhD Position

About the research centre or Inria department

The Inria Grenoble research center groups together almost 600 people in 23 research teams and 7 research support departments.

Staff is present on three campuses in Grenoble, in close collaboration with other research and higher education institutions (University Grenoble Alpes, CNRS, CEA, INRAE, ...), but also with key economic players in the area.

Inria Grenoble is active in the fields of high-performance computing, verification and embedded systems, modeling of the environment at multiple levels, and data science and artificial intelligence. The center is a top-level scientific institute with an extensive network of international collaborations in Europe and the rest of the world.

Context

Within the framework of a partnership (you can choose between)

- Collaboration with Pedro Rodrigues and Nelle Varoquaux within the BONSAI project (ANR JCJC).

Is regular travel foreseen for this post ? Yes, travel costs will be covered within the limits of the scale in force.

Context and Objective:

Surrogate modeling has recently received increasing attention in the context of simulation-based inference to address the intractability of the likelihood [Brehmer et al, 2020]. All these approaches amortize the approximation by learning the joint dependence on the simulated data and the simulator's parameters. While such amortization yields computational benefits, modeling the joint dependence as a smooth function is rather restrictive as it can fail to capture discontinuities arising from phenomena such as phase transitions and which are of particular interest in physics experiments [Ricci-Tersenghi et al, 2019]. In this work project, we aim to leverage the flexibility of deep learning to learn surrogate models for simulation-based inference without suffering from the limitations of amortization. We propose instead to decouple the surrogate model from the simulator's parameter for more flexibility. Such a decoupling effectively results in a bilevel optimization problem where the upper-level objective learns the simulator's parameters while the lower-level objective learns a surrogate model for a given parameter value. We divide the work into three tasks: task 1 introduces a framework for black-box simulators. Task 2 introduces a framework for white-box simulators, those for which additional information is available, while task 3 applies such as framework to a real-world application from genomics.

Assignment

Assignments :

The PhD project aims at developing methods based on surrogate modeling for simulation-based inference, with application to genomic data.

Responsibilities: The recruited person will take initiatives to formulate the problem and address it in a rigorous manner.

Main activities

Mains activities:

- Publish in top tier conferences and journals
- Produce high quality open-source software
- Participate to the research community (participation to conferences, workshops, etc)

Skills

Technical skills and level required : Excellent coding skills, strong mathematical background.

Languages : English

Interpersonal skills : Drive and perseverance

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 (90 days / year) 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
- Complementary health insurance under conditions

Remuneration

1st and 2nd year: 2 100 euros gross salary /month

3rd year: 2 190 euros gross salary / month

General Information

- **Theme/Domain** : Optimization, machine learning and statistical methods
Statistics (Big data) (BAP E)
- **Town/city** : Montbonnot
- **Inria Center** : [Centre Inria de l'Université Grenoble Alpes](#)
- **Starting date** : 2024-10-01
- **Duration of contract** : 3 years
- **Deadline to apply** : 2024-06-24

Contacts

- **Inria Team** : [THOTH](#)
- **PhD Supervisor** :
Arbel Michael / michael.arbel@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

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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.