Offer #2024-07770

Post-Doctoral Research Visit F/M Large Physics Models

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

The Inria Saclay-Île-de-France 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 TAU/A&O team is an Inria joint team with LISN (Laboratoire Interdisciplinaire des Sciences du Numérique), working on Machine Learning and data-based modeling. ML for Numerical Simulation is one of the pillars of TAU research program. In the frame of this project, the team will collaborate with Lionel Mathelin (Dataflot team at LISN) and Alexandre Allauzen (ESPCI). The former will provide his expertise on CFD numerical simulations, while the latter will share his expertise in developing large-scale transformers in the context of natural language applications. Collaboration with the DataMove Inria team is also envisioned, to help tackling the HPC challenges related to data generation and model training.

Assignment

Data-driven ML methods have shown potential in reducing the computational costs of numerical simulations, but they often struggle with scalability and versatility. This project aims to develop a Foundational Large Physics Model for fluid simulations. This large model, based on the Transformer architecture, will be pre-trained to solve 3D simulations across various geometries and flow conditions, requiring only light fine-tuning to optimally adapt it to specific problems. Former members of the TAU team have conducted promising proof-of-concept experiments on challenging CFD datasets, but many challenges remain. We are seeking a highly motivated post-doctoral researcher to manage the operational aspects of the project, which includes:

- Familiarizing with existing solutions developed by the TAU team and studying state-of-the-art approaches that leverage large models for science.
- Managing the data generation process, including creating comprehensive training datasets from diverse CFD sources and augmenting these datasets with high-fidelity numerical simulations.
- Designing an efficient training strategy, potentially leveraging pre-training approaches from other large models.
- Evaluating the model's generalization capabilities when fine-tuned for several specific tasks, and its performance compared to other existing Machine Learning methods for solving partial differential equations.

Main activities

- Maintaining an up-to-date bibliography on the topic of ML for Numerical Simulations
- Conducting state-of-the-art research, including programming and model development.
- Participating to the team activities (seminars,
- Writing scientific papers.
Presenting work at scientific conferences.

Developing potential collaborations with academic and industrial partners.

**Skills**

The ideal candidate should:

- Hold a PhD in a related field such as Machine Learning, Computational Fluid Dynamics, Applied Mathematics, or Physics.
- Have experience with developing and training large-scale ML models.
- Possess strong programming skills (e.g., Python, PyTorch).
- Have the ability to conduct independent research as well as to collaborate within an interdisciplinary team
- Have experience in publishing scientific papers.

**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
- Access to vocational training
- Social security coverage

**Remuneration**

2788 € gross / month

**General Information**

- **Theme/Domain**: Optimization, machine learning and statistical methods
- **Scientific computing** (BAP E)
- **Town/city**: Orsay
- **Inria Center**: Centre Inria de Saclay
- **Starting date**: 2024-08-01
- **Duration of contract**: 2 years
- **Deadline to apply**: 2024-07-31

**Contacts**

- **Inria Team**: TAU (DGD-S)
- **Recruiter**: Schoenauer Marc / Marc.Schoenauer@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 deep interest in bridging the gap between the most recent generative AI/ML methods and large-scale numerical simulations.

**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.