



Offer #2024-07822

Post-Doctoral Research Visit F/M Distributed Voronoi diagrams for large-scale optimal transport

Contract type : Fixed-term contract

Renewable contract : Yes

Level of qualifications required : PhD or equivalent

Other valued qualifications : Doctor degree (Ph.D.)

Fonction : Post-Doctoral Research Visit

Level of experience : Recently graduated

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**.

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 people, scientists and research and innovation support staff, including 44 different nationalities.

Context

Within the framework of the COSMOGRAM project, in the PARAM project-team

- The COSMOGRAM project, currently funded by an Inria exploratory action (AeX grant)
- COSMOGRAM aims at developing new geometric methods for computational cosmology

Participation to one international conference per year is foreseen for this post

travel expenses are covered within the limits of the scale in force.

Assignment

Assignments :

With the help of Bruno Lévy, the recruited person will be taken to develop a novel algorithm to compute large-scale Voronoi diagrams on PC clusters.

For a better knowledge of the proposed research subject :

- Description of the theoretical algorithm for Distributed Voronoi Diagrams: <https://arxiv.org/abs/2406.04192>
- Tutorial article on Optimal Transport: <https://hal.science/hal-01717967>
- Application of Optimal Transport in cosmology: <https://arxiv.org/abs/2012.09074>
- Optimal Transport for fluid dynamics: <https://arxiv.org/abs/2106.03936>
- Bruno Lévy's website: <https://brunolevy.github.io/>

Collaboration :

The recruited person will work in close collaboration with Bruno Lévy, in Nancy, and will work in collaboration with the other members of the PARMA team in Orsay (mainly Quentin Mérigot and Hugo Leclerc)

Responsibilities :

The person recruited is responsible for developing and implementing a new algorithm for computed gigantic generalized Voronoi diagrams on a PC cluster. An abstract theoretical algorithm is described in: <https://arxiv.org/abs/2406.04192>.

- Transform the abstract algorithm into a practical algorithm, that can be effectively implemented on a PC cluster
- Implement and conduct practical experiments using the Grid5000 infrastructure, computing large scale Voronoi diagrams
- Connect it to the existing semi-discrete optimal transport code, conduct large-scale optimal-

- transport computations
- Possible project extension (2nd year): beyond the L2 cost, propose algorithms for partial optimal transport (intersection between Laguerre diagram and spheres), and Laguerre cells with more complicated shapes. Explore generalizations in higher dimensions.

Main activities

Main activities (5 maximum) :

- Algorithmic design
- Mathematical analysis
- Implementation in C++ / MPI
- Experimentation with Grid5000

Additional activities (3 maximum) :

- Redaction of scientific articles (targets: Journal of Computational Physics, Physical Review, ACM Trans on Graphics)
- Presentation at conferences (target: Supercomputing)

Skills

Technical skills and level required : Ph.D in computer science

Languages : English

Relational skills : Ability to work in a research group, and to interact with researchers of other fields (mathematicians, physicists)

Other valued appreciated : curiosity, sense of humour

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

Monthly gross salary : 2.788 euros

General Information

- **Theme/Domain** : Distributed and High Performance Computing
Scientific computing (BAP E)
- **Town/city** : Nancy
- **Inria Center** : [Centre Inria de Saclay](#)
- **Starting date** : 2024-10-01
- **Duration of contract** : 1 year
- **Deadline to apply** : 2024-09-30

Contacts

- **Inria Team** : [PARMA](#)
- **Recruiter** :
Levy Bruno / bruno.levy@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

Qualities that we are seeking:

- tastes and appetencies: taste for the blend of mathematics and computer programming that can solve problems that seem impossible to solve
- area of excellence: geometry processing, data structures, C++ programming
- personality or character traits: curiosity, sense of communication, ability to work in a group
- cross-disciplinary knowledge and expertise:

Skills :

- Scientific expertise in geometric computing (Delaunay / Voronoi)
- Taste and expertise in software development, experience in C++ programming
- A plus: experience in parallel computing, openMP and MPI

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.