



**Offre n°2024-07077**

## **Post-Doctoral Research Visit F/M Interpretability of persistent homology**

*Le descriptif de l'offre ci-dessous est en Anglais*

**Type de contrat :** CDD

**Niveau de diplôme exigé :** Thèse ou équivalent

**Fonction :** Post-Doctorant

### **Contexte et atouts du poste**

The post-holder will be a member of the DataShape team, and work under the supervision of Nina Otter.

DataShape is a research team in Topological Data Analysis (TDA), constituted of researchers from Inria-Saclay, Inria Sophia Antipolis, and from the Laboratoire de Mathématiques d'Orsay. TDA is a recent field whose aim is to uncover, understand and exploit the topological and geometric structure underlying complex and possibly high-dimensional data. The DataShape team gathers a unique variety of expertise that allows it to embrace the mathematical, statistical, algorithmic and applied aspects of the field in a common framework ranging from fundamental theoretical studies to experimental research and software development.

### **Mission confiée**

**More information on the proposed research subject :**

Persistent homology (PH) is one of the most successful methods in the field of topological data analysis (TDA). In recent years, PH has seen important theoretical advancements on the one hand, and hundreds of successful applications on the other. There is, however, a lack of understanding on why PH is successful in these applications, as it is still elusive what type of topological and geometric features are captured with the long and short persistence intervals, which provide information about the connected components, holes and cycles in higher dimensions. The main overall objective of this project is to make first steps in bridging this gap, by gaining an understanding on why and when PH works. In particular, we will develop methods to study regions of data that are most relevant for a particular PH-based classification or regression pipeline, and subsequently use this framework to gain a better understanding on both new as well as existing successful applications of PH. New applications that will be investigated will stem from the fields of operations research (i.e., optimisation of humanitarian-aid relief networks) and medical imaging (i.e., breast-cancer prediction).

**Collaboration:**

The post-holder will closely work with Nina Otter.

**Responsibilities:**

The person recruited is responsible for conducting research, preparing articles for peer-reviewed publications, disseminating research at local, national and international seminars and conferences.

### **Principales activités**

**Main activities:**

- Propose a framework to study relevance of regions in data for PH-based pipelines
- Develop Python code to test such framework on a variety of synthetic and real-world data sets
- Test, change up until validation
- Write documentation and reports
- Prepare manuscript for submission in peer-reviewed journals or conference proceedings
- Present the work's progress to other DataShape group members during the DataShape seminar

**Additional activities:**

- Participation in local, national and international seminars and conferences

## Compétences

**Technical skills and level required:** PhD in mathematics, computer science, or other relevant domain; strong background in Topological Data Analysis, and research experience in the field.

**Languages:** English.

**Relational skills:** Experience in working in scientific collaborations.

## Avantages

- 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

## Informations générales

- **Thème/Domaine :** Optimisation, apprentissage et méthodes statistiques Statistiques (Big data) (BAP E)
- **Ville :** Orsay
- **Centre Inria :** [Centre Inria de Saclay](#)
- **Date de prise de fonction souhaitée :** 2024-06-01
- **Durée de contrat :** 12 mois
- **Date limite pour postuler :** 2024-05-31

## Contacts

- **Équipe Inria :** [DATASHAPE](#)
- **Recruteur :**  
Otter Nina Lisann / [nina-lisann.otter@inria.fr](mailto:nina-lisann.otter@inria.fr)

## A propos d'Inria

Inria est l'institut national de recherche dédié aux sciences et technologies du numérique. Il emploie 2600 personnes. Ses 215 équipes-projets agiles, en général communes avec des partenaires académiques, impliquent plus de 3900 scientifiques pour relever les défis du numérique, souvent à l'interface d'autres disciplines. L'institut fait appel à de nombreux talents dans plus d'une quarantaine de métiers différents. 900 personnels d'appui à la recherche et à l'innovation contribuent à faire émerger et grandir des projets scientifiques ou entrepreneuriaux qui impactent le monde. Inria travaille avec de nombreuses entreprises et a accompagné la création de plus de 200 start-up. L'institut s'efforce ainsi de répondre aux enjeux de la transformation numérique de la science, de la société et de l'économie.

## L'essentiel pour réussir

Essential qualities in order to fulfil this assignment are a strong experience in working with applications in Topological Data Analysis, a genuine interest for investigating the interpretability of persistent homology, proficiency in Python, and working knowledge with several state-of-the-art neural network architectures.

Cross-disciplinary knowledge and expertise in the area of operations research is a real asset for this position.

**Attention:** Les candidatures doivent être déposées en ligne sur le site Inria. Le traitement des candidatures adressées par d'autres canaux n'est pas garanti.

## Consignes pour postuler

**Sécurité défense :**

Ce poste est susceptible d'être affecté dans une zone à régime restrictif (ZRR), telle que définie dans le

décret n°2011-1425 relatif à la protection du potentiel scientifique et technique de la nation (PPST). L'autorisation d'accès à une zone est délivrée par le chef d'établissement, après avis ministériel favorable, tel que défini dans l'arrêté du 03 juillet 2012, relatif à la PPST. Un avis ministériel défavorable pour un poste affecté dans une ZRR aurait pour conséquence l'annulation du recrutement.

**Politique de recrutement :**

Dans le cadre de sa politique diversité, tous les postes Inria sont accessibles aux personnes en situation de handicap.