# Inria

# Offer #2024-07539

## PhD Position F/M PhD F/H Shape analysis of microstructure-augmented whiter matter fascicles

**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 Centre at Rennes University is one of Inria's nine centres and has more than thirty research teams. The Inria Centre is a major and recognized player in the field of digital sciences. It is at the heart of a rich R&D and innovation ecosystem: highly innovative PMEs, large industrial groups, competitiveness clusters, research and higher education players, laboratories of excellence, technological research institute, etc.

## Context

Magnetic resonance imaging (MRI) and in particular diffusion MRI (dMRI) provide detailed information about the macroscopic organisation of brain white matter (WM) fiber bundles (see Figure), with a method called fiber tractography. Complementary to the geometry of fibers, dMRI is also sensitive to the microscopic tissue structure and its alteration with pathology. The joint analysis of white matter fascicles and their associated microstructure organisation requires the development of specific mathematical representations.

## Assignment

The main objective of this thesis will be the development of mathematical models of microstructure-augmented fascicle (MAF), which convey both the macro-structural information provided by tractography and the microstructural information provided by the diffusion models along the WM fascicles. In the context of the PASTRAMI (**Pa**tient-specific **s**tatistics for micros**tr**ucture-**a**ugmented connecto**mi**cs) collaborative project (funded by the PRC program, agence nationale de la recherche, 2023-2028), these representations will be used to derive patient-specific biomarkers of functional recovery in patients suffering from severe traumatic brain injury.

## Main activities

We will develop upon a shape analysis frameworks such as the LDDMM (Large Diffeomorphic Metric Mapping) framework that relies on Riemannian geometry and is well adapted to the study of anatomical structures, to construct the models for the representation of fiber bundles (which can be defined as 1-dimensional curves or 2-dimentional surfaces in R3) and their associated microstructure. In continuation, we will also analyse the brain connectome, which represents the network of connected gray matter regions in the brain. We will build upon methods developed for the analysis of graphs with complex data.

## Skills

We look for candidates strongly motivated by challenging research topics in neuroimaging. The applicant should present a good background in applied mathematics. Basic knowledge in image processing would be a plus. Good knowledge of computer science aspects is also mandatory, especially in Python and C++.

## Benefits package

- Subsidized meals
- Partial reimbursement of public transport costs
- Possibility of teleworking (90 days per year) and flexible organization of working hours
- Partial payment of insurance costs

## Remuneration

Monthly gross salary amounting to 2100 euros for the first and second years and 2190 euros for the third year

# General Information

- **Theme/Domain :** Computational Neuroscience and Medicine
  Biologie et santé, Sciences de la vie et de la terre (BAP A)
- **Town/city :** Rennes
- **Inria Center :** [Centre Inria de l'Université de Rennes](#)
- **Starting date :** 2024-10-01
- **Duration of contract :** 3 years
- **Deadline to apply :** 2024-05-31

# Contacts

- **Inria Team :** [EMPENN](#)
- **PhD Supervisor :**
  Coloigner Julie / [julie.coloigner@irisa.fr](mailto:julie.coloigner@irisa.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

Vous pouvez donner là, un portrait à "gros traits" du (de la) collaborateur(trice) attendu(e) : ce que vous voyez comme nécessaire et suffisant et qui peut associer :

- goûts et appétences,
- domaine d'excellence,
- éléments de personnalité ou de caractère,
- savoir et savoir faire transversaux...

Cette rubrique permet de compléter et alléger (réduire) la liste plus formelle des compétences :

- "Se sentir à l'aise dans un environnement de dynamique scientifique, aimer apprendre et écouter sont des qualités essentielles pour réussir cette mission."
- " Passionné(e) par l'innovation, avec une expertise dans le développement Ruby on Rail et une grande capacité de conviction. Une thèse dans le domaine *** constitue un réel atout."

> **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

Please submit online : your resume, cover letter and letters of recommendation eventually

**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.