Offer #2025-08762

PhD Position F/M Construction of a simulation-ready torso conductivity map library and data generation for the electrical impedance tomography (EIT) Bayesian inverse problem

Contract type : Fixed-term contract

Level of qualifications required : Graduate degree or equivalent

Other valued qualifications : Master's degree in Applied Mathematics

Fonction : PhD Position

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

This PhD project is a part of a new collaboration between Idefix Team (Inria Saclay) and Carmen Team (Inria

Bordeaux).

The project is financed by Inria program Action Exploratoire REALPRIOREIT. The co-PI of the project is Lisl Weynans of Equipe Carmen, Inria Bordeaux.

The PhD student will be based in the Idefix Team, Inria-Saclay, located at ENSTA Paris, Unité de Mathématiques Appliquées (UMA) 828, Boulevard des Maréchaux, 91762 Palaiseau, France.

There will be some travel between Saclay and Bordeaux. There will be regular meetings by video-conference with supervisers. Shared code development will be on GitHub.

Assignment

In this project, we study the reconstruction capabilities of Bayesian inference methods for biomedical inverse problems. The primary application is electrical impedance tomography (EIT). In particular, we plan to construct statistical distributions of realistic human torso volume geometries and incorporate them in Bayesian inference methods for the EIT inverse problem. This a priori information will be obtained from publicly available CT and MRI images as well as artificially generated images from training images.

Our starting point will be publicly available CT images in two repositories. The CT images will be used to construct a library of realistic conductivity maps that serve as inputs to the forward solver of the EIT problem. The forward solver will be an immersed boundary method to which the pixelated conductivity maps can be coupled in a natural way. A large number of numerical simulations will beperformed to generate EIT data under a variety of experimental conditions for the conductivity maps in the library.

The constructed data libraries will be used to provide prior distribution information on the conductivity maps to be estimated in the EIT torso inverse problem. We will also provide statistical distributions of biological and geometrical parameters associated with the conductivity maps in the library. We expect to incorporate the libraries and the statistical information in a Bayesian inversion algorithm.

The methodology will be developed in two dimensions and extended to three dimensions using HPC tools. Both the conductivity maplibrary and the simulated EIT data library will be made publicly available.

Main activities

Use software from medical imaging to perform automatic segmentation;

Compute statistical information about the segmented organs;

Couple pixelated conductivity maps to the EIT forward solver, analyze sensitivity;

Work with collaborators in Bordeaux to constructe data libraries to provide prior distribution information for the EIT torso inverse problem.

Code in Python and Matlab;

Write up results in Latex;

Skills

Master diploma in Applied Mathematics; Course work in partial differential equations and their numerical discretization, statistics and machine learning. Coding in Matlab and Python;

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 : 2.200 euros/month

General Information

- **Theme/Domain :** Numerical schemes and simulations
  Scientific computing (BAP E)
- **Town/city :** Palaiseau
- **Inria Center :** Centre Inria de Saclay

- **Starting date :** 2025-10-01
- **Duration of contract :** 3 years
- **Deadline to apply :** 2025-06-30

Contacts

- **Inria Team :** IDEFIX
- **PhD Supervisor :**
  Li-schlittgen Jing-rebecca / jing-rebecca.li@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

Coding competence;

Mathematical analytical skills;

Writing in English;

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.