



Offre n°2025-09025

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

Type de contrat : Fixed-term contract

Niveau de diplôme exigé : Graduate degree or equivalent

Fonction : PhD Position

Niveau d'expérience souhaité : Recently graduated

A propos du centre ou de la direction fonctionnelle

The Inria centre at the University of Bordeaux is one of nine Inria centres in France and has around twenty research teams. The Inria centre is a major and recognised player in the field of digital sciences. It is at the heart of a rich ecosystem of R&D and innovation: highly innovative SMEs, major industrial groups, competitive clusters, research and higher education players, laboratories of excellence, technological research institutes, etc.

Contexte et atouts du poste

The aim of this thesis project is to study the reconstruction capabilities of Bayesian inference methods for the inverse problem of electrical impedance tomography of the human torso.

The project is related to the global topic of detecting cardiac arrhythmias, in particular ventricular fibrillation. More specifically, it aims to improve a medical imaging modality (electrocardiographic imaging - ECGi) used to non-invasively reconstruct the heart's electrical activity. One of the main aims of this imaging technique is to detect individuals at high risk of ventricular fibrillation. However, it is not yet possible to detect high-risk individuals in the general population, because current techniques for imaging the heart's electrical activity are not sufficiently accurate or reliable.

Electrical Impedance Tomography (EIT) is a potential solution for obtaining additional information. It is a non-invasive technique for reconstructing inclusions

and internal conductivities from electrical measurements at the body surface. The direct problem of EIT is to determine the electrical potential in the domain for a given conductivity distribution and for a set of currents injected through the electrodes. The inverse problem involves estimating the conductivities themselves from measurements made at the body surface. Current applications of EIT include detecting breast cancer or acute strokes, monitoring lung ventilation and sometimes monitoring cardiac activity. However, to our knowledge, EIT has never been applied in ECGi to enrich the description of the volume of the torso and its internal conductivities.

The person recruited will work as part of the Inria CARMEN team (Inria Centre at the University of Bordeaux), which specialises in digital models dedicated to cardiac arrhythmias, at the IHU-Liryc, the Institute of Electrophysiology and Cardiac Modelling, dedicated to cardiac rhythm disorders. This project is part of a collaboration with an Inria Paris-Saclay researcher: Jing-Rebecca Li.

Mission confiée

The aim of this project is to construct and incorporate statistical distributions of realistic human torso

volume geometries from a large set of realistic biological images. This a priori information will be obtained

from publicly available CT and MRI images as well as artificially generated images from training images.

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 be performed to generate EIT data under a variety of experimental conditions for the conductivity maps in the library

in the library.

Principales activités

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 map library and the simulated EIT data library will be made publicly available.

Compétences

Numerical analysis of PDEs or analysis of PDEs with a strong interest in applications and programming. Some knowledge of probability would be desirable.

Avantages

- Subsidised catering
- Public transport partially reimbursed
- Leave: 7 weeks' annual leave + 10 days' RTT (full-time basis) + possibility of exceptional leave (e.g. sick children, moving house)
- Possibility of partial teleworking and reorganisation of working hours
- Professional equipment available (videoconferencing, loan of IT equipment, etc.)
- Social, cultural and sports benefits (Association de gestion des œuvres sociales d'Inria)

Rémunération

The gross monthly salary will be €2,200 (before social security contributions and income tax) over 2025 and €2,300 from 01/01/2026.

Informations générales

- **Thème/Domaine** : Modeling and Control for Life Sciences
Scientific computing (BAP E)
- **Ville** : Talence
- **Centre Inria** : [Centre Inria de l'université de Bordeaux](#)
- **Date de prise de fonction souhaitée** : 2025-10-01
- **Durée de contrat** : 3 years
- **Date limite pour postuler** : 2025-07-10

Contacts

- **Équipe Inria** : [CARMEN](#)
- **Directeur de thèse** :
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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

recent Master 2 or engineering school graduate

Diploma required: Master's degree or engineering school in applied mathematics

The candidate should be able to work in a team, communicate results clearly and be interested in modelling and the application of mathematics to real-life problems.

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

Please apply via the jobs.inria website by sending the following documents:

- CV
- covering letter -
- letter of recommendation (if applicable)
- transcripts and rankings of Master's years (or equivalent)

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.