Offre n°2025-08837

PhD Position F/M Bayesian methods for electrical impedance tomography

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

These methods have already been used on occasion for EIT. However, in the work available in the literature, most of the test cases for conductivity configurations are greatly simplified and idealised compared with the real configurations of the organ in the torso. These configurations are often created by hand or ad hoc, limited to two dimensions, with simple shapes embedded in the geometric domain. The resolution methods used do not take into account realistic a priori assumptions about the shape of the organs.

The aim here is to develop Bayesian inference methods for EIT, by constructing and incorporating statistical distributions of realistic geometries of the volume of the human torso.

Principales activités

The aim will be to study the classic Bayesian impedance resolution methods and adapt them to the EIT problem. In addition, it will be necessary to determine how to model physiological a-priori on the human torso in this formalism, obtained from

medical images. As far as possible, the algorithms resulting from these studies will be validated by comparison with experimental data.

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 :** 2025-09-01
- **Durée de contrat :** 3 years
- **Date limite pour postuler :** 2025-06-16

Contacts

- **Équipe Inria :** CARMEN
- **Directeur de thèse :**
  Weynans Lisl / Lisl.Weynans@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'e?orce 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.