Offre n°2025-08701

PhD Position F/M Analysis and model of MR-related artifacts on EEG signal when recorded during a fMRI sequence

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

Type de contrat : CDD

Niveau de diplôme exigé : Bac + 5 ou équivalent

Fonction : Doctorant

A propos du centre ou de la direction fonctionnelle

The Inria Rennes - Bretagne Atlantique Centre is one of Inria's eight centres and has more than thirty research teams. The Inria Center 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.

Contexte et atouts du poste

This PhD thesis is part and funded by the ANR NIRVANA project, which aims to unravel bimodal neurofeedback efficiency for dynamic non-invasive brain rehabilitation. The PhD thesis is part of the work-package 2 which challenge is to model online correction of EEG's MR-related artefacts, in collaboration with Elise Bannier MR-physicist at Rennes University Hospital, and Frédéric Grouiller Head of the Clinical MR imaging section of the CBIM at the University of Geneva. Some visits to Geneva are planed during the duration of the PhD thesis.

This project aims to clean EEG with as little lag time as possible, to accurately estimate EEG-NF scores when recorded under MRI. During EEG-fMRI recordings, EEG signals are altered by strong gradient artifacts that a hybrid mean and median moving average can fairly correct [REF]. EEG is also altered by artifacts induced by any motion or vibration in the strong static magnetic field (law of induction) such as head motion, pulsatile motion of scalp arteries or any cardiac-related motion and vibrations from the ventilation system or Helium pump.

Adding Carbon-Wire Loops (CWL) on the EEG cap appears to be the best asset today for EEG real-time correction under MRI [REF]. This project aims to understand how residual artifacts, mainly due to unpredictable movements, impact the EEG signals and to propose a method to evaluate in real-time the quality of the EEG signals across channels, to have the possibility to adjust the estimation of EEG features, and eventually have the possibility to use connectivity measures for the design of EEG-NF target. Indeed, it is not reasonable today to use EEG connectivity measures when recorded under MRI, as correlated artifacts across channels exist and can have a strong amplitude (for example the one due to cardiac activity).

In this project, we assume that collecting a ground truth dataset would be precious to split the recorded signal into the theoretical EEG signal and the MR-related artefacts. Using CWL, it will allow us to model the remaining artefacts and measure EEG signal distortions induced by artefact correction. I make the hypothesis that those remaining artefacts can be modeled and analysed using the ECG channel, well-known EEG features during specific tasks, electrodes polarities, and fMRI-derived head positions over time. Once the noise is modeled and characterised, we will be able to correct the EEG signal efficiently over time.

Mission confiée

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Principales activités

The PhD candidate will have to :

- develop an acquisition protocol in Rennes for Alive Phantom, after a visit to Geneva where they already acquired such data from one participant.
- understand the physic behind the CWL.
- process the acquired signals
- develop a model to characterise the recorded noise on the EEG signals

Several visits to the CBIM at University of Geneva will be planned, to acquire data on other MRI scanners and to exchange with local partners of the project.

Compétences

Signal processing

Knowledge in electromagnetism, EEG and/or MRI

Statistics

Machine learning (regression)

Avantages

- 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

Rémunération

monthly gross salary amounting to 2200 euros

Informations générales

- **Thème/Domaine :** Neurosciences et médecine numériques
  Production, traitement et analyse des données (BAP D)
- **Ville :** Rennes
- **Centre Inria :** Centre Inria de l'Université de Rennes
- **Date de prise de fonction souhaitée :** 2025-06-02
- **Durée de contrat :** 3 ans
- **Date limite pour postuler :** 2025-05-11

Contacts

- **Équipe Inria :** EMPENN
- **Directeur de thèse :**
  Cury Claire / claire.cury@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.

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.