Offre n°2022-04406

PhD Position F/M Spatio-temporal modeling and AI tools for dose-response analysis and prediction of radiation-induced brain damage and cognitive impairment in patients treated with radiotherapy for glioblastoma.

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

Type de contrat : CDD

Niveau de diplôme exigé : Bac + 5 ou équivalent

Fonction : Doctorant

Contexte et atouts du poste

Employer : Institut de Radioprotection et de Sûreté Nucléaire (IRSN)

Location : IRSN, Fontenay-Aux-Roses (92) – Ile de France – France

Benefits & working conditions : The position corresponds to a 3-year 100% PhD appointment with competitive salary and working conditions. It is co-funded in the framework of the ANR RADIO-AIDE (2022-2026). The PhD candidate will be physically based at the laboratory of epidemiology (LEPID at IRSN, Fontenay-Aux-Roses) with regular trips to INRIA Grenoble (Statify team).

Applications should be sent to : Sophie Ancelet - sophie.ancelet@irsn.fr

Florence Forbes - florence.forbes@inria.fr

Mission confiée

Background :

Radiotherapy (RT) is one of the most important treatments of brain tumours. However, its potential toxicity on the central nervous system is a highly relevant clinical issue [Soussain et al., 2009]. It is also part of the priority research questions in radiation protection, regarding the identification and the prevention of non-cancer side effects related to the use of ionizing radiation (IR) for therapeutic purposes [UNSCEAR, 2010]. Currently, the most frequent and threatening mid to long-term neurotoxic complication of brain RT is cognitive dysfunction mainly related to radiation-induced leukoencephalopathy (RIL). The main modifications observed in Magnetic Reasonance (MR) brain images following RT are diffuse supratentorial white matter hyperintensities (WMH), radionecrosis and brain atrophy (BA), resulting in ventricular dilatation. The symptoms related to cognitive impairments induced by brain RT are quite various (ex: dysfunctions in working memory, psychomotor speed, executive function and attention) and can significantly alter the quality of life of long-term survivors. Currently, the potential association between the spatio-temporal (ST) progression of radiation-induced brain injuries (as observed in MR brain images following RT) and the occurrence of cognitive impairment is poorly understood. This is partly due to complex interactions between tumour-related factors (or possible tumour recurrence) and treatment-induced neurotoxicity [Bompaire et al., 2018]. Most of previous studies did not consider jointly these two dimensions, despite their high level of correlation.

This thesis is part of the ANR research project RADIO-AIDE (*RADIation-induced neurOtoxicity assessed by ST modeling and Artificial Intelligence after brain raDiothErapy*) which will start in spring 2022 for 4 years (2022-2026). Led by IRSN (Coordination : Sophie Ancelet, thesis supervisor), this data science project brings together 7 partners (INRIA Statify team led by Florence Forbes (thesis director), INSERM-GIN, Centre Giovanni Borelli, ICM, AP-HP Pitié-Salpêtrière, Institut de Cancérologie Strasbourg Europe (ICANS, Strasbourg) and the start-up company Pixyl). RADIO-AIDE aims at developing spatio-temporal (ST) models and Artificial Intelligence (AI) tools to better understand the neurotoxic mechanisms underlying the initial localization and ST evolution of brain tissue modifications induced by RT in patients treated with RT for high-grade glioma (glioblastoma thereafter). The developed tools will allow to study the potential links between these MRI lesions and the occurrence of cognitive disorders, to individually predict the cognitive side-effects at early stage after brain RT and to provide to clinicians a usable academic software to perform an automatic processing of patient's MR brain images following brain RT, based on relevant image-based biomarkers of both RT-induced neurotoxicity and potential tumor progression.

Principales activités

This thesis aims at developing probabilistic ST models and AI tools to: a) estimate the potential associations between radiation-induced brain tissue modifications (as observed in MR brain images following RT), the dose of IR absorbed to the brain at a fine spatial scale (e.g. voxels of MR brain images)

and the occurrence of cognitive impairment in patients treated with RT for glioblastoma ; b) predict the individual occurrence of cognitive impairment in these patients at an early stage after RT, with a quantification of the associated prediction uncertainties The work will be based mainly on data from the EpiBrainRad cohort [Durand et al. (2015)], which is one of the largest international prospective cohorts of patients treated with chemo-radiotherapy for glioblastoma and who have undergone standardised neuropsychological assessments. This cohort currently includes 224 adults treated for glioblastoma at the Hôpital de la Pitié-Salpêtrière (Paris) or at ICANS (Strasbourg). Since 2015, data are collected prospectively during the clinical follow-up of patients. For each patient, they include: a) clinical characteristics; b) multimodal MR brain images (collected before surgery, before RT and then every 2-3 months after RT), c) CT images used in the planning of brain RT treatment; d) results of an extensive battery of cognitive tests performed before RT and at 12, 24 and 36 months after RT.

Compétences

Applicants must have :

- validated a MSc's degree (or an equivalent qualification in terms of credits)

- a background in statistics/machine learning/data science

- proficiency in modern high-level programming languages for data analysis (Python, R), probabilistic modelling and Bayesian statistics

- an interest in applications in epidemiology/public health.

Good writing and proficiency in oral and written English are also required.

Avantages

Benefits and working conditions :

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Informations générales

- **Thème/Domaine :** Neurosciences et médecine numériques
  Statistiques (Big data) (BAP E)
- **Ville :** Paris
- **Centre Inria :** Centre Inria de l'Université Grenoble Alpes
- **Date de prise de fonction souhaitée :** 2022-10-03
- **Durée de contrat :** 3 ans
- **Date limite pour postuler :** 2022-09-15

Contacts

- **Équipe Inria :** STATIFY
- **Directeur de thèse :**
  Forbes Florence / florence.forbes@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'efforce ainsi de répondre aux enjeux de la transformation numérique de la science, de la société et de l'économie.

L'essentiel pour réussir

The successful candidate is expected to be willing to work collaboratively in an interdisciplinary team of

mathematicians, data scientists, neuroimaging experts, clinicians, and epidemiologists. He or she is also expected to be independent, highly motivated and able to communicate in scientific terms.

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.