Postdoctoral fellowship:

Medical image analysis based on Artificial Intelligence tools to assess radiation-induced neurotoxicity

Context

Radiotherapy (RT) is one of the most important treatments of primary brain tumors, of which 60% are high grade. However, its potential neurotoxicity on the central nervous system is a highly relevant clinical issue. 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. Currently, the most frequent and threatening mid to long-term neurotoxic complication of brain RT is cognitive dysfunction related to radiation-induced leukoencephalopathy (RIL). Image-based biomarkers for RIL include diffuse supratentorial white-matter lesions (WML), ventricular dilatation, and brain atrophy (BA). The associated cognitive impairments can dramatically reduce the quality of life for long-term survivors. The neurocognitive status is also an important end-point in clinical trials. However, the underlying physiopathology of radiation-induced neurotoxicity in normal tissues and organs is poorly understood as well as its potential links with the initiation and temporal progression of specific cognitive dysfunctions.

Proposal Description

Based on the multimodal data from an ongoing cohort (n=224; 2/3 are already collected), the main objectives of this multidisciplinary project are to develop advanced spatio-temporal models and innovative AI tools for brain MRI data processing to i) generate new knowledge about the underlying neurotoxic mechanisms implied in the initiation and temporal progression of specific cognitive dysfunctions following brain RT and the radioresistance of targeted anatomic and functional structures, accounting for the tumor- response status as essential contextual data and to ii) predict individual cognitive side-effects at early stage after brain RT to set up mitigation measures to preserve the quality of life for survivors

The successful applicant will involve in several crucial imaging processing steps: the harmonization of multi-center and multi-modality MR images, the automatic segmentation of the brain alterations and the follow-up of their evolution. The candidate will start with two previous deep learning architectures developed in the team (1,2).

Prerequisites

The applicant should have a strong expertise in MR imaging and image analysis, especially in machine learning techniques. Moreover, Python programming skills is a key prerequisite. Knowledge in brain physiopathology will also be strongly valued. The candidate should be fluent in English (and preferably in French which will be the working language), have a good communication skills and organizational skills and a PhD in a relevant area. Candidates are expected to be highly motivated and to work independently with a strong work ethic.

Environment

The RadioAide project will offer a stimulating research environment gathering experts in Image processing, Neurosciences & Neuroimaging, in Advanced Statistical and Machine Learning methods with a strong collaboration with neuroradiologists and neurooncologists. The candidate will be based in Grenoble and supervised by two mentors: M. Dojat and B. Lemasson and will be part of our GIN research team currently composed of 15 PhD students and 2 postdoctoral fellows.

Key words: Machine learning; Multidimensional data, Segmentation, Glioblastomas, Radiotherapy, MRI.

How to apply

Send applications directly to the supervisors including a cover letter, a detailed CV including a publication list and contacts of up to three referees. Applications will be accepted up to the 31st of August.

Location	Grenoble Institute of Neurosciences, Grenoble, France
Contact	Between 18 and 24 months (depending of experience).
Salary	Depending of experiences and according to Inserm Grid
Funds	ANR; project RADIO-AIDE
Contact	Both michel.dojat@univ-grenoble-alpes.fr and Benjamin.lemasson@univ-grenoble-alpes.fr
Starting date	Autumn 2022

1) Lambert, B., Forbes, F., Doyle, S., Tucholka, A., Dojat, M., 2022. Multi-Scale Evaluation of Uncertainty Quantification Techniques for Deep Learning based MRI Segmentation. ISMRMB, London (UK).
2) Cackowski, S., Barbier, E., Dojat , M., Christen, T., 2021. ImUnity: a generalizable VAE-GAN solution for multicenter MR image harmonization. arxiv https://arxiv.org/abs/2109.06756.