Multi-modal implicit neural representations for MRI-guided radiotherapy

Postdoctoral/Research Engineer Position

Internships also available

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Radiotherapy is a standard cancer treatment consisting of delivering a prescribed radiation dose to the tumour while sparing organs at risk (OARs). Computer Tomography (CT) scans are the reference imaging for dose planning in radiotherapy because they provide tissue density information required for dose calculation. However, CT's poor contrast in soft tissues hinders physicians' accurate delineation of the OAR and precise patient repositioning. Conversely, thanks to its high contrast level, Magnetic Resonance Imaging (MRI) is the reference modality for soft tissue imaging and, thus, better for manual delineation of most tumour volumes and OAR. However, MR images do not provide tissue density information and therefore cannot be used for dose calculation. In this context, the long-term goal of the CEMMTAUR project is to develop new methods and tools for MRI-guided radiotherapy, focusing on brain and prostate cancer.

Mission: One of the WP within the CEMMTAUR aims at the simultaneous segmentation and registration of OARs in multi-modal CT/MR images, towards assisting dose calculation in either modality. Building on annotated datasets from local hospitals, the successful candidate will focus on developing a deep-learning addressing three critical challenges:

i) OAR annotations are only available in one of the two modalities,
ii) not all the OARs are manually annotated in every volume where they are present
iii) while OAR may have predefined shapes while healthy, shape priors may be affected by anomalies.

These challenges call for methods capable of dealing with unsupervised domain adaption, shape priors and missing/noisy labels. Two starting points will be our recent works on muscles segmentation from MR images [1] and on domain adaption for CT/MR segmentation [2]. The postdoc will focus on **Implicit Neural Representations.**

Hosting environment: The position is part of the collaborative CEMMTAUR project between the SIMS team at the LS2N Lab (Laboratoire des Sciences du Numérique de Nantes) and the IMPACT team at the LTSI Lab (Laboratoire Traitement du Signal et de l'Image) in Rennes. The candidate will integrate the SIMS (www.ls2n.fr/equipe/sims , https://sims.ls2n.fr) research team.

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Requirements

- A PhD in computer vision, biomedical engineering, signal/image processing, or related fields.
- Excellent programming skills (e.g., in Python)
- Good written and spoken communication skills (English)
- Experiences in the following fields will be will be considered important plus:
    - Medical image analysis, in particular related to radiotherapy.
    - Deep learning.
    - Computer vision or signal and image processing.

Salary and duration: The position is for 12 months, starting earliest in October 2024, latest in January 2025. Remuneration and social benefits are based on the collective wage agreement for public-sector employees at the national French level, considering previous years of experience.

How to apply: Send an e-mail to diana.mateus@ls2n.fr with your CV, publication list and references

[1] Muscle Volume Quantification: Guiding Transformers with Anatomical Priors. Louise Piecuch, Vanessa Gonzales Duque, Aurelie Sarcher, Antoine Nordez, Giuseppe Rabita, Gael Guilhem, Diana Mateus. [ShapeMI Workshop at MICCAI 2023]

[2] OLVA: Optimal Latent Vector Alignment for Unsupervised Domain Adaptation in Medical Image Segmentation. Dawood Al Chanti, Diana Mateus. MICCAI 2021 https://github.com/DawoodChanti/OLVA