

Lightweight 3D neural networks for segmentation and characterization of lung nodules

Full-time 18-month postdoctoral position

A full-time 18-month postdoctoral position is available at CREATIS Laboratory in partnership with the cancer Centre Léon Bérard in Lyon, FRANCE.

Keywords: lung nodule segmentation, deep learning, lightweight neural network, GAN, multitask learning, multiple instance learning

OBJECTIVE

The goal of this project is to develop a framework for lung nodule detection, segmentation and characterization with deep neural networks.

MEDICAL CONTEXT

During the last years, lung cancer therapy strategy has been improved thanks to the emergence of targeted therapies and immunotherapy. In this context, the non-invasive identification of tumor histological subtypes and phenotype is crucial to stratify the patients and monitor the therapy.

Radiomic aims at uncovering tumor characteristics at macroscopic scale (from images) (1-3), sometime coupled with microscopic scales data (histologic, cellular, molecular, genetics). It can be formalized as a classification problem from image data. In lots of works with few data, classification is done with handcrafted features, usually requiring the segmentation of the nodule.

CHALLENGES AND POTENTIAL METHODOLOGICAL INVESTIGATION

The first objective is to setup a segmentation network for lung nodule. On these large size CT scans, (GPU) memory is a limiting factor for a correctly account for the 3D nature of the images. We will investigate the use of lightweight architectures based on reversible networks fully use 3D information.

When tumors are located in tissue surrounding the lung, contrast between the tumors and healthy tissue can be poor and can be missed by the expert or can be the subject of discussion between trained radiologists. For this problem, we consider using the very large healthy subject dataset from Léon Bérard Center to enhance our detection/segmentation system with approaches such as semi or weakly supervised learning, anomaly detection or GANs.

DATA

A database of manually annotated images is available and will grow along the project.

PROFILE

The successful applicant will have a strong expertise in image analysis with deep learning, should be fluent in English, have good communication and organizational skills, and a PhD in a relevant area (Biomedical engineering, applied mathematics, computer sciences, ...).

Candidates are expected to be highly motivated and to be autonomous.

COMPETENCE / SKILLS

Very good programming skills are required. Knowledge of Python and the practical use of any deep learning framework (pytorch, keras, tensorflow,...) are key prerequisites

SALARY

Depending to candidate experiences.

LOCATION / PARTNER

The 18 months position has been funded by the IRP3 of the SIRIC LYriCAN.

The successful candidate will be integrated in a project between CREATIS www.creatis.insa-lyon.fr and the cancer research hospital Center Léon Bérard (CLB) www.centreleonberard.fr/en.

The proposed work involves transversal partnership with CLB radiologists CREATIS researchers.

The successful candidate will be located at CREATIS, Lyon, FRANCE

CONTACTS

To apply, please send extended *curriculum vitae* with research and programming experiences and a detailed list of publications (English); a cover letter stating your interests and future goals; and possible referents to:

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- olivier.beuf@creatis.insa-lyon.fr

References

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