Postdoctoral position
Multimodal Contrastive Learning for Pulmonary Embolism Risk Stratification Models

Context

Acute pulmonary embolism (PE) is caused by the obstruction of a pulmonary artery by a blood clot, called thrombus, and is the third cause of cardiovascular death in Europe [4]. Upon diagnosis confirmation, clinicians evaluate the patient prognosis from low to high-risk of death, a process known as risk stratification, to guide patient management decisions [5]. Currently, this involves assessing functional biomarkers such as plasma troponin and B-type natriuretic peptide (BNP), and only one morphological biomarker : the right ventricle to left ventricle size ratio (RV/LV) (see Fig 1). While transthoracic echocardiography (TTE) is ideal for RV/LV ratio assessment, computed tomography pulmonary angiography (CTPA) is the most commonly performed imagery in clinical practice. However, recent studies showed that CTPA-based estimation is less correlated to patient prognosis than the TTE one [1], probably because the CTPA is not synchronized to the heart rate, blurring the image. As more than 90% of PE are diagnosed with CTPA, it is crucial to improve the ability of CTPA to stratify the prognosis of PE patients in order to improve their management, and thus, outcome.

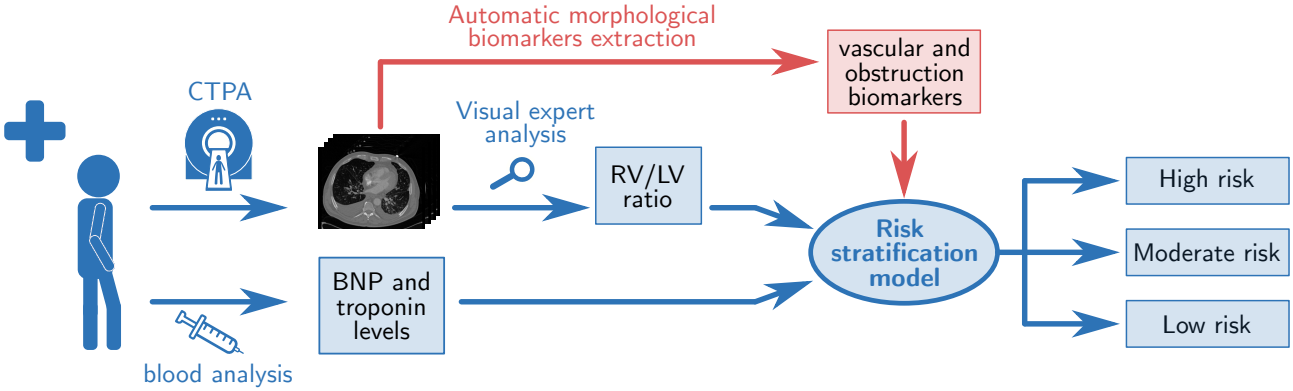

Figure 1: Current PE patient prognosis evaluation procedure depicted in blue, and the proposed modifications highlighted in red. A more accurate risk stratification model will be developed by including new morphological PE biomarkers with no additional clinical exam.

Subject

This postdoctoral research aims to establish new clinical practices for PE management by learning innovative biomarkers, in close partnership with leading clinicians. Our primary goal is to leverage state-of-the-art multi-modal contrastive learning [2, 3] on our unique dataset of over 400 patients to develop an embedding unifying CTPA, tabular patient data and the aforementioned biomarkers. This embedding will first be used to develop novel risk stratification models. Then, the learned embedding will be analyzed to evaluate the individual contribution of each biomarker towards the stratification task. This will open the way to larger-scale clinical studies of these biomarkers to define future PE clinical practices.

Job requirements

- A PhD degree in computer sciences, image processing or related disciplines
- A previous experience of deep learning, preferably applied to medical imaging.
- Excellent knowledge of Python and Pytorch, with additional expertise in MONAI considered advantageous.
- Strong motivation and ability to collaborate closely with clinicians on research projects
- Excellent written and verbal communication skills in English

Conditions of employment

- A two-year full time position beginning anytime from now until January 2025.
- A monthly net salary ranging from 2200 to 2400 euros upon the candidate's level of experience.
- An exciting work environment in Lyon, in a large lab dedicated to medical imaging and a team developing cutting-edge deep learning approaches

Applications

Applications should be sent by mail to odyssee.merveille@creatis.insa-lyon.fr with:

- A detailed CV detailing academic background, research experience, publications, and relevant skills.
- A cover letter outlining your motivation for applying to this position
- Contact information for at least one reference who can speak to your qualifications

References

[1] Cecilia Becattini et al. "Right ventricle assessment in patients with pulmonary embolism at low risk for death based on clinical models: an individual patient data meta-analysis". *European Heart Journal* 42.33 (2021), pp. 3190–3199.

[2] Paul Hager, Martin J Menten, and Daniel Rueckert. "Best of both worlds: Multimodal contrastive learning with tabular and imaging data". *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*. 2023, pp. 23924–23935.

[3] Weichen Huang. "Multimodal Contrastive Learning and Tabular Attention for Automated Alzheimer's Disease Prediction". *Proceedings of the IEEE/CVF International Conference on Computer Vision*. 2023, pp. 2473–2482.

[4] Stavros V Konstantinides et al. "2019 ESC Guidelines for the diagnosis and management of acute pulmonary embolism developed in collaboration with the European Respiratory Society (ERS) The Task Force for the diagnosis and management of acute pulmonary embolism of the European Society of Cardiology (ESC)". *European heart journal* 41.4 (2020), pp. 543–603.

[5] Connor Tice et al. "Management of acute pulmonary embolism". *Current Cardiovascular Risk Reports* 14.12 (2020), pp. 1–11.