Four-year PhD position in machine learning for integrative heart failure patient subtyping

BACKGROUND The Lausanne University Hospital (CHUV) is one of five Swiss university hospitals. Through its collaboration with the Faculty of Biology and Medicine of the University of Lausanne and the EPFL, CHUV plays a leading role in the areas of medical care, medical research and training.

The Radiology Department has a strong research focus, with several groups dedicated to advancing magnetic resonance (MR) acquisition, improving image processing and machine learning for radiology, as well as radiologists that are very active in clinical research. The department is also part of the Center for Biomedical Imaging, a joint undertaking of the EPFL, University of Geneva, University of Lausanne, and Geneva University Hospital, and enjoys regular collaborations with these institutions.

The four-year HEARTMAGIC project, funded by the Swiss National Science Foundation, aims at a breakthrough in understanding of heart failure with preserved ejection fraction, by developing novel cardiac magnetic resonance imaging (MRI) techniques, using deep phenotyping including genetics and metabolomics, and developing novel machine learning and statistical inference techniques for imaging genetics. The project will be led in close collaboration between experts in cardiovascular magnetic resonance imaging and machine learning for biomedical data at the Lausanne University Hospital/University of Lausanne, senior cardiologists at the Lausanne and Geneva University Hospitals, as well as experts in statistical genetics, metabolomics, cardiac radiology, hospital data science, and cardiac segmentation.

PROJECT DESCRIPTION Patients with heart failure with preserved ejection fraction (HFpEF) constitute approximately half of all heart failure patients presenting in hospitals, and have poor prognosis. We postulate that this is due in part to the heterogeneity of the HFpEF diagnosis, each putative patient subtype needing specific therapeutic options.

The goal of this doctoral position, in collaboration with a new postdoctoral researcher on the same team and our other project partners, will be to develop new machine learning algorithms for supervised and unsupervised patient subtyping and survival modeling using imaging and -omics data. We will focus on graph-based representations to capture quantitative tissue properties from relaxometry, mechanical properties, and structural properties of the heart as well as flow-related quantities using a unified representation. We will approach unsupervised subtyping as a deep community detection problem on a multiplex graph, and also use graphs to represent patient-related events, ending in an outcome-driven learning approach to subtyping. On the -omics side, we will have access to state-of-the art genome-wide genotyping (Axiom PMDA), full blood transcriptomics (RNA-Seq) and metabolomics (UPLC/HRMS). Our analysis will combine data from the UK Biobank, which has many subjects but lacks detailed -omics and uses standard imaging, and data from HFpEF patients that will be recruited and deeply phenotyped over the duration of the study.

The candidate will be expected to develop and implement new algorithms, present work at conferences and in journal publications, collaborate with local and international researchers, and to interact fruitfully with other lab members, clinicians, bioinformaticians, physicists, engineers, and radiologists. This project will take place under the supervision of Dr Jonas Richiardi, PhD. There are ample computing resources including GPUs, and you will actively collaborate with the HEARTMAGIC consortium.

CANDIDATE PROFILE

- MSc in computer science, electrical engineering, biomedical engineering, statistical physics, statistics, or related field
- Good training in linear algebra, calculus, statistics
- Good knowledge of Python 3, including relevant machine learning libraries such as scikit-learn, Pytorch 1.5+,Tensorflow 2.
- English proficiency necessary, French knowledge an asset
- Demonstrated previous experience in machine learning and deep learning required

Experience in medical imaging, graph representations, image processing, and bioinformatics are all an advantage.

You will be part of a team of scientists and PhD students from multiple partners, which requires a strong team spirit and professionalism. Excellent communication and inter-personal skills are as important as technical skills. This project will also require creative spirit and the ability to work autonomously, although you will collaborate very closely with postdoctoral scholars and other PhD students who will be hired at the same time.

WE OFFER Competitive salary with regular progression, high social benefits, three days of training per year, 25 working days of vacation per year, and good staff cafeteria with preferential rates.

CONTACT AND APPLICATION Send your application package (cover letter, CV, publications list, and the name of three references) to jonas.richiardi@chuv.ch until the 10th of July, 2021. Informal inquiries welcome.