Four-year PhD position –
Developing whole-heart quantitative MRI to characterize heart failure

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

The CHUV Radiology Department has a strong research focus, with several groups dedicated to advancing magnetic resonance imaging (MRI) techniques, 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 (CIBM), a joint undertaking of the CHUV, UNIL, EPFL, University of Geneva, and Geneva University Hospital, and enjoys regular collaborations with these institutions.

In the four-year HEARTMAGIC project, funded by the Swiss National Science Foundation (SNSF), we aim at a breakthrough in the understanding of heart failure with preserved ejection fraction (HFpEF) by developing novel cardiac MRI techniques, using deep phenotyping including genetics and metabolomics, and developing novel machine learning and statistical inference techniques for imaging genetics data. The project will be led in close collaboration between experts in cardiovascular MRI and machine learning for biomedical data at the CHUV/UNIL, 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: Heart failure with preserved ejection fraction (HFpEF) affects about 2% of the adult population world-wide, has a very poor prognosis, and has no effective therapy despite a series of clinical trials. In the HEARTMAGIC consortium, we postulate that this is due in part to the existence of multiple subtypes of HFpEF, where each patient subtype needs specific therapeutic options. The ultimate goal of the project is to elucidate these subtypes and to find potential therapeutic targets for each subtype.

The aim of this PhD project, in collaboration with a new postdoctoral fellow on the same team and our other project partners, will be to develop new quantitative cardiac MRI techniques (such as T1 and T2 mapping) that cover the entire heart and that can be applied to the patients that will be scanned in this study. We will initially focus on fixing an acquisition protocol for the start of the clinical trial, followed by an a thorough optimization of the image reconstruction. In parallel, we will develop automated image segmentation and analysis tools for these techniques in collaboration with HEARTMAGIC and commercial partners.

The candidate will be expected to develop and implement new image acquisition, reconstruction and analysis algorithms, present work at conferences and in journal publications, collaborate with local and international researchers, coordinate data curation for the consortium, help supervise Master students, and to interact fruitfully with clinicians, bioinformaticians, physicists, engineers, and radiologists. This project will take place under the supervision of Dr. Ruud van Heeswijk. The group has access to 4 state-of-the-art clinical MRI scanners, ample GPU computing, and you will actively collaborate with the HEARTMAGIC consortium.

YOUR PROFILE:

- An MSc degree in engineering, physics, applied mathematics, or equivalent qualification
- At ease with optimization mathematics, image reconstruction, and/or artificial intelligence
- Good knowledge of Matlab and/or Python
- English proficiency necessary, French knowledge an asset
- Prior experience with machine learning and image processing are an advantage

You will be part of a team of scientists and PhD students from multiple institutes, 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 a postdoctoral fellow and several PhD students who will be hired at the same time.

WE OFFER: If you become an employee at the CHUV, we offer a salary with annual progression, high social benefits, 25 working days of vacation per year, and good in-house restaurants with preferential rates.

TIMELINE, CONTACT and APPLICATION: The position is available per September 1; a PhD program will normally take 4 years to complete. For further information or to apply (including a CV and two references), please contact Dr. Ruud van Heeswijk (ruud.van-heeswijk@chuv.ch), or visit www.unil.ch/cvmr.