

PhD thesis

Location: Lausanne University Hospital (CHUV)

Dates/Duration: 4 years, ideally starting 1/9/21

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.

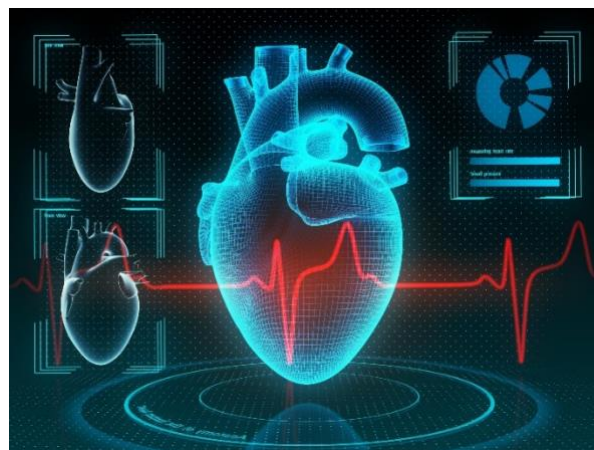
The CHUV Radiology Department has a strong research focus, with several groups dedicated to advancing magnetic resonance imaging (MRI) techniques, improving image processing and machine learning for radiology, as well as radiologists that are very active in clinical research. The department is also part 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.

Supervisor

Main Supervisor: [Dr. Ruud van Heeswijk](#), Quantitative MR group, Department of Radiology, Lausanne University Hospital (CHUV), Lausanne, Switzerland, Ruud.van-Heeswijk@chuv.ch

Direct collaborators:

- Dr. Jonas Richiardi, PhD, Translational Machine Learning group, Department of Radiology, CHUV, Lausanne, Switzerland, Jonas.Richiardi@chuv.ch
- Prof. Roger Hullin, MD, Cardiology Service, CHUV, Lausanne, Switzerland, Roger.Hullin@chuv.ch
- Dr. Philippe Meyer, MD, Cardiology Service, Geneva University Hospitals (HUG), Geneva, Switzerland, Philippe.Meyer@hcuge.ch

Skills

Your qualifications, previous experience and background:

- 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

How to apply: Please send your CV, two references and a motivation letter to Ruud.van-Heeswijk@chuv.ch

About CIBM

The CIBM Center for Biomedical Imaging was founded in 2004 and is the result of a major research and teaching initiative of the partners in the Science-Vie-Société (SVS) project between the Ecole Polytechnique Fédérale de Lausanne (EPFL), the Université de Lausanne (UNIL), Université de Genève (UNIGE), the Hôpitaux Universitaires de Genève (HUG) and the Centre Hospitalier Universitaire Vaudois (CHUV), with the generous support from the Fondation Leenaards and Fondation Louis-Jeantet.

CIBM brings together highly qualified, diverse, complementary and multidisciplinary groups of people with common interest in biomedical imaging.

We welcome you in joining the CIBM Community.

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