PhD student position

Location: Lausanne University Hospital (CHUV)

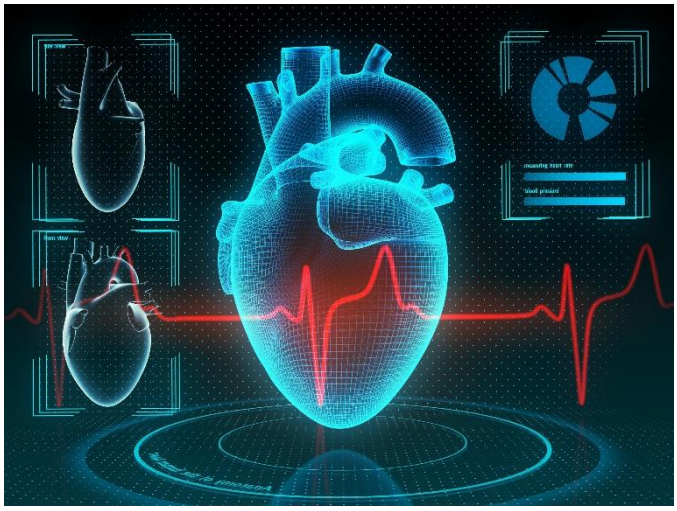
Dates/Duration: 4 years

Using artificial intelligence to design new free-running cardiovascular MRI techniques

BACKGROUND: Despite cardiovascular disease being the leading cause of death in the western world, MRI, a non-invasive and safe diagnostic imaging modality, is still not routinely used to image the heart in the clinic. This is because most cardiac MRI is time-inefficient due to its need for triggering and gating, and because it requires operator expertise to properly account for all the motion that can distort the images. We recently developed a new technique called free-running MRI, which bypasses these problems by first acquiring data continuously and then sorting out the motion-free parts later. Free-running MRI has opened up a whole new area of cardiovascular imaging, and new contrasts to highlight disease are ready to be explored. The goal of this PhD thesis is therefore to explore the use of artificial intelligence (AI) to design the radiofrequency (RF) pulses that generate the MR signal: they can be made more selective for certain tissues, more robust against distortions, or to quantify tissue properties. The project is funded by the Swiss National Science Foundation (SNSF).

PROJECT DESCRIPTION: After familiarizing yourself with both the MR and the AI sides of the project, you will start by developing AI algorithms to design a fat suppression RF pulse that enables robust free-running imaging of the coronary arteries. We will leverage and advance recent work in deep learning, including hybrid model-driven/data-driven networks and deep reinforcement learning. Initial development and simulation will be in Python and Matlab, followed by validation in phantoms, healthy volunteers, and patients. In a second step, RF pulses will be designed and validated for the mapping of relaxation times.

LOCATION: This PhD project will take place in the Department of Radiology at the Lausanne University Hospital (CHUV) and the University of Lausanne (UNIL) in Switzerland under the supervision of Prof. Matthias Stuber and PD Dr. Ruud van Heeswijk. You will be part of a group of ~15 engineers and physicists that is embedded in the hospital. The group has access to 4 state-of-the-art clinical MRI scanners, ample GPU computing, and you will actively collaborate with the groups of Dr. Jonas Richiardi (on AI), Siemens Healthcare (on programming the scanners), as well as the CHUV Cardiology Service (on patient studies).



APPLICATION: The application deadline is December 31, 2020.

Supervisor

- **Main Supervisor:** Prof. Matthias Stuber, University of Lausanne and Lausanne University Hospital (CHUV), Lausanne, Switzerland, Matthias.Stuber@chuv.ch
- **Co-Supervisor:** Dr. Ruud van Heeswijk, University of Lausanne and Lausanne University Hospital (CHUV), Lausanne, Switzerland, Ruud.van-Heeswijk@chuv.ch
- **Collaborators:** Jonas Richiardi, University of Lausanne and Lausanne University Hospital (CHUV), Lausanne, Switzerland, Jonas.Richiardi@chuv.ch

Skills

- **Qualifications, previous experience and background:** master's degree in engineering, physics, life science or a similar degree, preferably at ease with AI or applied mathematics. Advanced grasp of English.

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.

cibm.ch