PHILIPS

Cardiac tissue characterization and wall stress from US and numerical modeling

Duration: 6 months
Preferred start date: February 2019
Localization: Suresnes (92)
Contacts: caroline.raynaud@philips.com hernan.morales@philips.com
Supervisors: Odile Bonnefous, Mathieu De Craene, Hernan Morales

Host entity

Philips is a world leader in medical imaging. Its products cover the full range of imaging modalities: X-Rays, MRI, Ultrasound, CT, etc. The company is internationally recognized for the excellence of its technology, developed within innovative research groups.

Philips Research Paris - Medisys is based in Suresnes (92) and is dedicated to medical image processing. The team, with about thirty researchers and engineers, is focused on delivering the most innovative solutions in the domain and is in close contact with famous universities and clinical sites in France and abroad. In particular, this internship is coordinated by Philips Research Paris and the Universitat UPF in Barcelona, Spain.

Internship description

Cardiovascular pathologies are one of the main cause of death in industrialized countries. The development of robust and reliable tools to help physicians in the diagnosis of these pathologies is essential for a proper quantification of the patient condition.

In this context, the numerical simulation of the filling/ejection phases in the cardiac cavities can provide test cases, with controlled mechanical properties of tissue and fluids. These models can be personalized with information coming from ultrasound (US) images that provide the geometry but also in/outflow at the valves. US imaging can also quantify the deformation of the heart muscle. By locally analyzing wall stresses, this project has the long-term objective of developing cardiac wall characterization tools. These tools are expected to integrate coherently both tissue deformation and blood flow for locally estimating myocardial tissue properties.

The purpose of this internship is twofold: 1) to develop a simulation-based pipeline of image-based cardiac models, taking into account actual image flow and deformation signals taken from medical images; 2) To simulate specific situations of high wall stress, such as those resulting from intense and extended sport. In this second application, the goal is to identify the regions in the myocardium where higher stress can potentially trigger fiber disarray and fibrosis (in a later stage).

Candidate profile

- Training : Third year of engineer school/ Master 2 Recherche, with specialty in applied mathematics
- Image processing competencies, for 3D and temporal acquisitions
- Solid knowledge of classical mechanics and numerical modeling (FEM for instance)
- Basic knowledge of image processing, especially in medical images
- Programming skills: C++ and python
- Good communication skills and ability to work in a team