PhD in Cardiac Ultrasound Modelling at Inria Sophia Antipolis

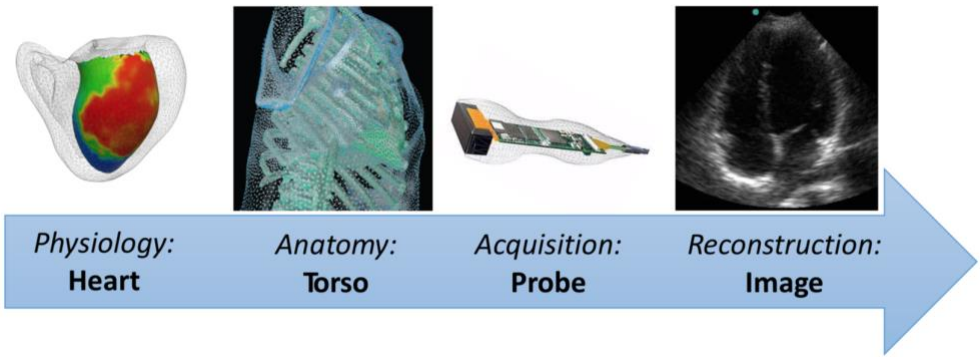
in collaboration with General Electric Healthcare

Context

Ultrasound is by far the most widely used medical imaging modality. The performance of such a system is largely dependent on the characteristics of the electro-acoustic elements, called the transducer. There is a fundamental relationship between the properties of the ultrasound beam generated by the transducer and the quality of the resulting image. This is the reason why probe specification is generally based on transducer performances. But for other applications, like cardiac imaging, the presence of parasitic reflectors (bones, lung, etc.) in the vicinity of the imaged area generates a significant number of interactions, responsible for image artifacts.

Position Description

This PhD thesis is dedicated to the simulation of ultrasound imaging systems, from the transducer to the image through the body, to evaluate global performances in realistic conditions. The benefits of such a tool are manifold. First, it can improve the comprehension of image artifacts that appear in some clinical conditions. Second, it can be used to evaluate the performances of new beamforming algorithms. Third, it can be used to optimise probe design regarding specific applications (numerical phantoms, see figure below). Last, it can help in defining probe specification based on resulting image quality instead of considering the acoustic performances of the transducer only.



Recent developments in artificial intelligence (AI) using deep neural networks could be leveraged to speed up the image generation process, improve the simulated resolution, and optimise the design parameters. AI has been shown to be very efficient in speeding up equation solving, estimating reduced order models and process spatio-temporal data.

This PhD thesis is the result of a collaboration between General Electric Healthcare (GEHC), the French National Research Institute for Digital Science and Technology (Inria), and Nice University Hospital (CHU Nice), started in 2017. It will leverage expertise of all these partners: GEHC in transducer design and cardiac imaging, Inria in cardiac modelling, and CHU Nice in clinical echocardiography.

Searched profiles

- MSc in Applied Mathematics or Computer Science
- Good knowledge of 3D modelling / simulation, physics
- Eager to learn and take initiatives

Job location: GE Healthcare & Inria, 06 902 Sophia Antipolis, France
Start: 2022
Duration: 3 years. It can start with a 6 months MSc thesis.
Send resume, references & motivation letter to: maxime.sermesant@inria.fr, jean.bulte@ge.com