Institution: Cardio-Vascular Interventional Therapy and Imaging team (CaVItI) - ISIT (Image Science for Interventional Techniques ; 6284 UdA-CNRS)  
Place: IUT, Le Puy-en-Velay (43), France

PhD Présentation du sujet de thèse

1. Background
Cardiovascular diseases remain a main cause of mortality in industrial and developing countries. Among them, our team deals with aortic valve stenosis. It is a symptomatic severe disease that affect more than 4% of North American and Europeans more than 75 years old [Carabello] and which prevalence rose with age [Osnabrugge].

The prognosis gets severe for the short-term while functional symptoms appear.

Image-guided therapies become more and more the treatment of choice to replace classical open surgery and reducing morbidity-mortality. Thus valve prostheses implanted with minimally invasive techniques have been developped.

Transcatheter aortic valve implantation has been developed for the treatment of patients with severe symptomatic aortic stenosis who have an unacceptably high estimated surgical risk. Indications of TAVI are specified in the consensus document [Kappetein] and will be extended to intermediate surgical risk patients in 2016.

The subject of this thesis is the design of an innovative device to assist endovascular interventions.

This thesis will take place in the ISIT ISIT (Image Science for Interventional Techniques ; Unité Mixte de Recherche 6284 UdA-CNRS ; Clermont-Ferrand, France) with the axe 2 of the team CaVITI (Cardio-Vascular Interventional Therapy and Imaging) in collaboration to praticians of the C.H.U de Clermont-Ferrand. It will be supervised by Christophe Lohou and Jonathan Courbon (assistant teacher). Experimentations will occur in the hybrid operating room called IMABLOC in the C.H.U de Clermont-Ferrand.

2. Thesis goals
The main objective of the thesis is the development of an assistance device based on an omnidirectionnal camera. Different features have to be studied : 1) medical imaging device pose estimation without constrast agent injection and without exposition radiation for its (re) positionning, 2) respiratory motion estimation to feed non-rigid registration algorithms and 3) device set-up with calibration and positionning assistance of the device.

3. Thesis organisation
The first year will be dedicated to make a state-of-the-art of medical devices with a focus on endovascular intervention assistance topic, and then to the design of a wide field-of-view camera-based device (pose estimation algorithms, assistance system for C-Arm positionning). The second year will deal with the development of methods to set-up the device. During the third year, the PhD student will work on respiratory motion estimation using the data provided by he device and its integration to overlap peri-operative data taking into account respiratory motions. The manuscript preparation and the PhD defense will be realized during the last months.
**Keywords:** Computer-Assisted Medical Interventions (CAMI); image processing; interventional techniques; omnidirectional cameras

**Applicant profile**

- Master or engineer degree
- Skills: robotics, perception systems, image processing, computer science, C/C++

**Informations about the PhD thesis**

- Duration: 36 months
- Date of hire: 2015 – October 1st
- Net pay: 1 600€/month

**Contact**

Jonathan Courbon: jonathan.courbon@udamail.fr