CREATIS **Postdoc position –** "Learning hierarchies from cardiac imaging data and real life costs."

Context: Cardiac diseases directly impact cardiac mechanics and lead to a decrease in the pumping performance. Standard imaging protocols include measurements on static and dynamics images in different views to examine both the myocardial wall and the cardiac chambers, and may sometimes require choosing between several modalities or acquisition protocols. The hierarchy in these protocols is generally based on guidelines, clinical evidence, and experience, but is not taken into account into computer-based population analyses, although it could profoundly challenge the design of data integration schemes.

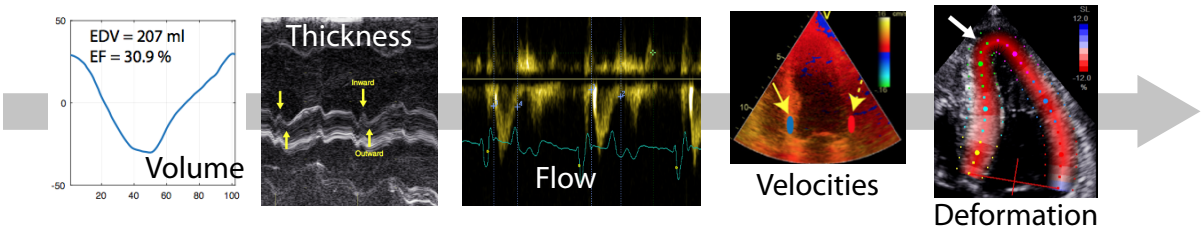

Figure: Example of descriptors of increasing complexity from a 2D echocardiographic protocol [WHA-15].

Objectives: We would like to better consider the amount of data collected in routine imaging protocols through **statistical analysis and machine learning** techniques that represent disease traits within a population. Data descriptors are **complex, high dimensional, and of heterogeneous types**, which requires specific methods to mix multiple descriptors and respect the data properties, as we already investigated [SAN-17]. These data integration schemes can be adapted to an imposed existing data hierarchy, but we would like to challenge them by **explicitly learning how to prioritize data, and in particular how to consider their real life costs** in addition to their explanatory value.
This project therefore addresses both methodological challenges around hierarchical data integration and machine learning, and applicative challenges guided by the clinical context, in close collaboration with our clinical collaborators.

Profile: We look for a highly motivated candidate, with:
- PhD in data science and/or machine learning and/or applied mathematics, preferentially for medical imaging
- Motivated by the clinical application
- Good programming skills (MATLAB, Python, or C/C++)
- Fluent in English (reading, writing, speaking)

Practical information:
- The postdoc is part of the **ANR JCJC project MIC-MAC** (2019-2022, PI: N. Duchateau), which focuses on new strategies to model hierarchy between cardiac descriptors with machine learning.
- It will take place at **CREATIS Lyon**, reference French lab in medical imaging, which consists of ~160 people grouped in 5 research teams. It will be supervised by N. Duchateau (Associate Professor) and P. Clarysse (Research Director) within the team "Modeling and Imaging of Vessels, Thorax and Brain".
- Duration: **2 years, possibility to start from October 2019**.

Contact: Send your CV, motivation letter, and references to: nicolas.duchateau@creatis.insa-lyon.fr

References:
[SAN-17] Sanchez-Martinez S, Duchateau N, Erdei T, et al. Characterization of myocardial motion patterns by unsupervised multiple kernel learning. *Med Image Anal*. 2017;35:70-82.
[WHA-15] Wharton G, Steeds R, Allen J, et al. A minimum dataset for a standard adult transthoracic echocardiogram: a guideline protocol from the British Society of Echocardiography. *Echo Res Pract.* 2015;2:G9-24.