CREATIS **Stage de fin d'études / Master 2 – 2021-2022.**

Title: Multiparametric MRI analysis of the evolution of myocardial infarct patterns with representation learning.
Team: MYRIAD = « Modeling & analysis for medical imaging and Diagnosis »
Supervision: Nicolas DUCHATEAU (Associate Professor / U. Lyon 1), Fei ZHENG (post-doc fellow).

Context: Ischemia is a dynamic process leading to myocardial infarction (tissue lesions) and shape abnormalities (remodeling). However, reperfusion as the main therapy to restore blood flow, may cause further critical injuries. The follow-up of patients after revascularization is done by imaging, in particular multiparametric magnetic resonance imaging (MRI) [BUL-18]. Despite its central role in clinical practice, this imaging is underexplored due to a lack of appropriate analysis tools, which might be overcome by statistical analysis and machine learning (representation learning) techniques [DIF-19, DUC-21, FRE-21].

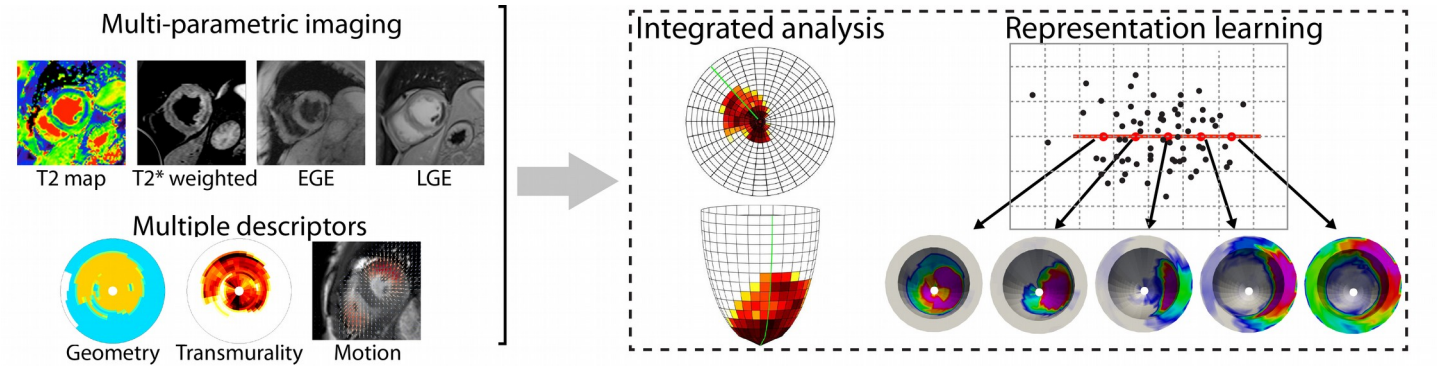

Figure: Overview of the multiparametric integration of MRI data targeted in this project.

Objectives: We target the prediction of myocardial infarct evolution and remodeling from multi-parametric MRI data, to improve patient follow-up and the optimization of associated therapies. This will be achieved by developing novel representation learning methods that allow:
- To integrate several acquisitions and descriptors extracted from images of heterogeneous types,
- To incorporate the temporality of the data (to identify early markers of a disease and follow its evolution).

We will explore existing longitudinal studies of myocardial infarction by multi-parametric MRI, in collaboration with M. Viallon and P. Croisille from CHU St Etienne. Imaging data will consist of information related to perfusion (early and late enhancement images), tissue content (T1, T2, T2* images), and heart shape and deformation (cine sequences).

Practical information:
- Location: DOUA campus, CREATIS lab, Villeurbanne
- Duration: 6 months, starting February-March 2022

Profile:
- MSc student with applied mathematics and/or image processing background
- Good programming skills: Python (preferred). Complementary knowledge on Matlab and/or C++ may help.
- Good English
- Motivated to work on medical applications

Contact: Send your CV, motivation letter, and academic record to: nicolas.duchateau@creatis.insa-lyon.fr
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Bibliography:
[BUL-18] Bulluck et al. *Circulation*. 2018;137:1949-64.
[DIF-19] Di Folco et al. *CNIV congress*. 2019.
[DUC-21] Duchateau et al. *SCMR congress*. 2021.
[FRE-21] Freiche et al. *Proc. MICCAI-STACOM, LNCS*. 2021. In press.