MSc Internship – Spring 2027.

Title: **Multi-chamber segmentation in 2D echocardiography with deep reinforcement learning.**

Team: MYRIAD = « Modeling & analysis for medical imaging and Diagnosis »

Supervision: Nicolas DUCHATEAU (Full Professor) - Olivier BERNARD (Full Professor)
Collaboration with Sherbrooke University, Canada: Pierre-Marc JODOIN (Full Professor), Arnaud JUDGE (PhD student)

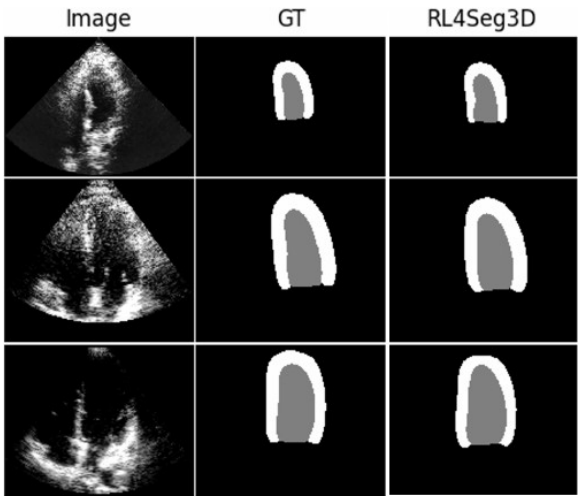


Figure: Segmentation of the LV on a 4-chamber view, using the RL4Seg3D methodology we developed [JUD-26]. GT: ground truth.

Context: Cardiac diseases progressively deteriorate the shape and deformation of the myocardial wall across the cycle. The segmentation of dynamic imaging sequences, such as 2D echocardiography, allows estimating shape and global deformation. However, current methods for myocardial segmentation mostly focus on the left ventricle (LV) and do not consider the other cardiac chambers such as the right ventricle (RV) and the left atrium (LA), resulting in a partial view of the cardiac condition.

We have developed state-of-the-art segmentation based on deep learning specific to 2D echocardiography and the left ventricle. Segmentation relies on reinforcement learning to generalize the results of state-of-the-art models such as U-Net to challenging and unannotated image sequences [JUD-24,JUD-26].

Objectives: This internship will specifically target:
- Mastering the basics of deep reinforcement learning.
- Quality control on available databases, with a specific focus on the RV and LA.
- Extension of the reinforcement learning strategy to the RV and/or the LA. This may require additional annotations and the design of new constraints to guide the learning.
- Evaluation on existing 2D echocardiographic studies from our clinical collaborators.

Practical information:

- Location: DOUA campus, CREATIS lab, Villeurbanne.
- Duration: 6 months, starting February-March 2027.
- Exploratory subject in close collaboration with other researchers focusing on segmentation and tracking.

Profile:

- MSc student with an applied mathematics and/or computer science background.
- Good programming and image processing skills in Python.
- Good English
- Motivated to work on medical applications.

Contact: Send your CV, recommendation letter and/or coordinates of referent professors, and academic record to:
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Bibliography:

[JUD-24] Judge et al. *MICCAI* 2024;15009:235-44.
[JUD-26] Judge et al. *IEEE TMI* 2026;45:4161-73.