

From Supervised to Self-Supervised: A JEPA Encoder for Coronary Artery Calcification Detection in 2D Angiography

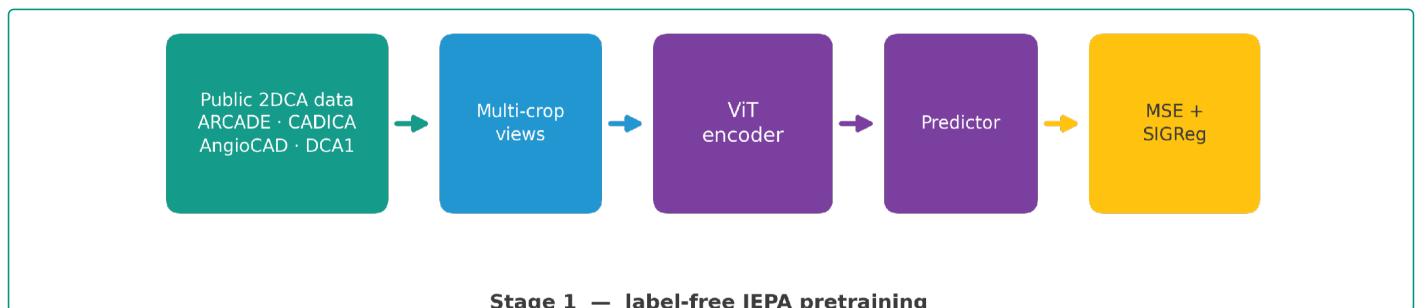
Master thesis

Motivation

Coronary artery calcification (CAC) is a key determinant of the complexity and risk of percutaneous coronary interventions. However, in the catheterisation laboratory, CAC is still primarily assessed through visual inspection of 2D coronary angiography (2DCA) images, which can be subjective and challenging.

Our group recently developed a deep learning workflow for automatic CAC detection based on a double-head ResNet-18 encoder and a U-Net-like decoder [1]. However, the encoder is trained from scratch on a relatively small annotated cohort, which may limit the robustness and generalisability of the resulting model.

Joint Embedding Predictive Architectures (JEPA) offer an alternative approach by learning meaningful visual representations from large collections of unlabelled images, without relying on negative sampling. This makes them particularly promising for medical imaging, where large annotated datasets are often difficult to obtain. In this thesis, a JEPA-based vision encoder will be pretrained on large public coronary angiography datasets and subsequently integrated into the existing CAC detection workflow, replacing its supervised backbone.



Student Project

The project aims to assess whether self-supervised pretraining on public angiography data improves CAC identification over the current supervised baseline.

- Collection and harmonisation of public 2DCA datasets (ARCADE, CADICA, AngioCAD)
- Self-supervised pretraining of a ViT encoder with a LeJEPA / SIGReg objective
- Integration of the pretrained encoder into the existing double-head workflow
- Benchmarking against the published baseline (F1-score, IoM, Hausdorff distance)

[1] De Rose & Raggio et al. "A multi-model deep learning approach for the identification of coronary artery calcifications within 2D coronary angiography images". In: *International Journal of Computer Assisted Radiology and Surgery* 20 (2025), pp. 1273–1281.

Notes

Application documents: Curriculum vitae and transcript of records

Research Area

Medical Image Analysis, Deep Learning

Course of Studies

Computer Science, Biomedical Engineering

Starting Date

As soon as possible

Posted Date

September 29, 2026

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