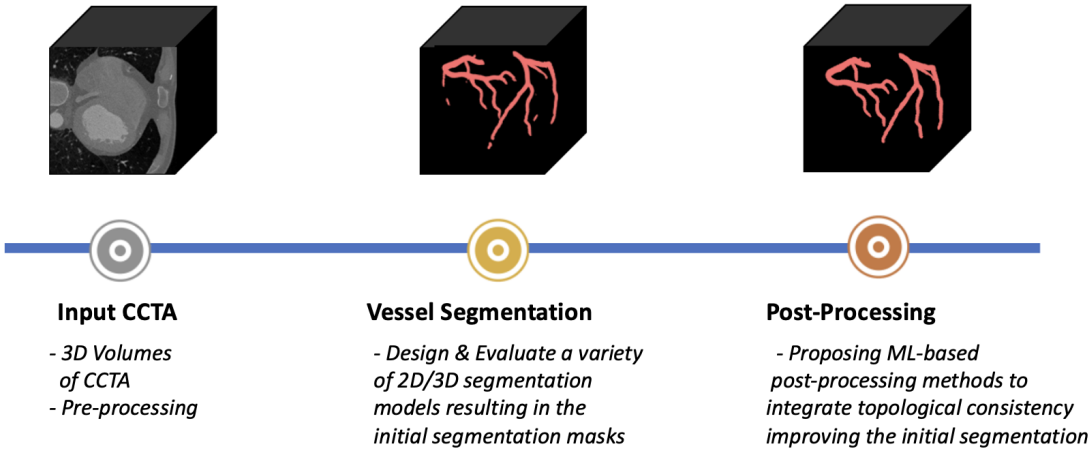
Integrating Topological Consistency in Coronary Artery Segmentation of CCTA Images using ML Techniques



Coronary Computed Tomography Angiography (CCTA) is a non-invasive imaging technique widely used to assess structural abnormalities, blockages, or narrowing (stenosis) of coronary arteries, thereby aiding in the diagnosis and management of coronary heart diseases (CHD). To assist clinicians in the assessment process, various AI-based methods have been proposed, both for 2D and 3D data, to accurately extract / segment the coronary arterial tree [1]. Although most of these methods manage to achieve high segmentation accuracy, they often struggle to preserve the topological structure of the vessel. This results in broken vessels or false branches, limiting the clinical applicability of these methods. This project aims to design a generalizable, ML-based post-processing technique that can enforce topological consistency in coronary artery segmentation, regardless of the upstream segmentation model.

[1] Zheng et al., "ImageCAS: A large-scale dataset and benchmark for coronary artery segmentation based on computed tomography angiography images", Computerized Medical Imaging and Graphics 2023.

Goals & Tasks

- Review of state-of-the-art on CCTA segmentation.
- Designing and evaluating ML-based post-processing module to integrate topological consistency in CCTA segmentation.
- Comparing the performance of the module paired up with a variety of segmentation models.

Qualifications

- Interest in medical imaging analysis and ML/DL techniques.
- Experience with the Python based deep learning framework PyTorch.
- Registered to one of the following:
  - ☐ **Bachelor Thesis**
  - ✓ **Seminar Project**
  - ✓ **Master Thesis**

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