Cardiac MR wall-motion tracking

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Background: Cardiac magnetic resonance (CMR) is an imaging examination that can be used to derive biomarkers that are used in the clinic for e.g. treatment plans of patients with heart disease. AI models are being developed to automate this process, which could lead to more consistent and accessible personalized treatments for diseases such as ischaemic heart disease. In our work, we are interested in deep learning models that accurately segment cardiac MR images (shown in Figure 1), providing an essential step in automatically deriving biomarkers from CMR.

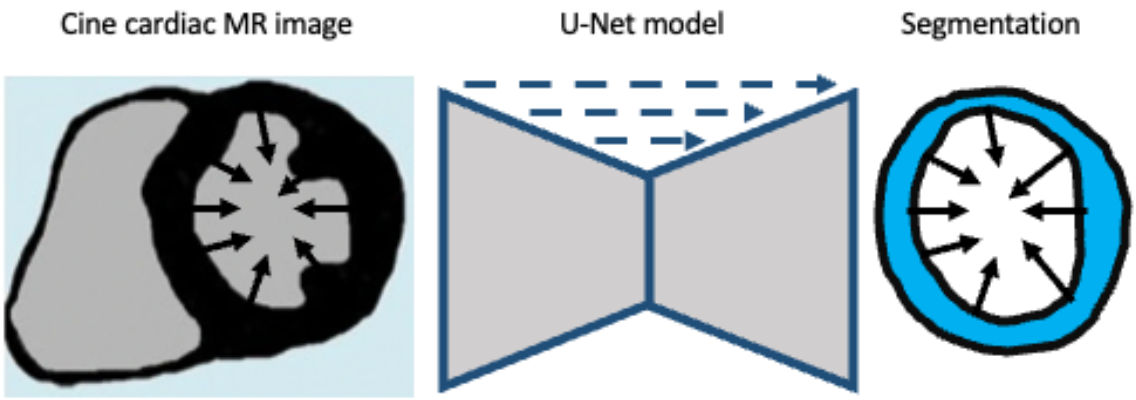

Figure 1: An illustration of the approach, taking a cardiac MR image as input to a U-Net model which predicts a segmentation of the anatomy (the myocardium in this case), in order to automatically measure the volumes of the regions in the heart.

Project: Typically, ejection fraction is used to assess cardiac function. But this is a global measure of pumping function, i.e. it gives one value that describes the overall health of the heart. It would be preferably to assess the contraction of the heart locally to distinguish between disease in different regions (arrows in Fig. 1). This project aims to implement tracking of the inner wall (endocardium) of the heart tissue (myocardium) to measure the inward displacement, and to test the potential of this local measure of wall motion to distinguish between different cardiovascular diseases. In this project, you will work with a framework for training deep learning segmentation models already developed in the group, and aim to:

- Implement algorithms to track segmentations over time.
- Experiment with approaches for visualising wall motion.
- Predict diseases based on your analyses.