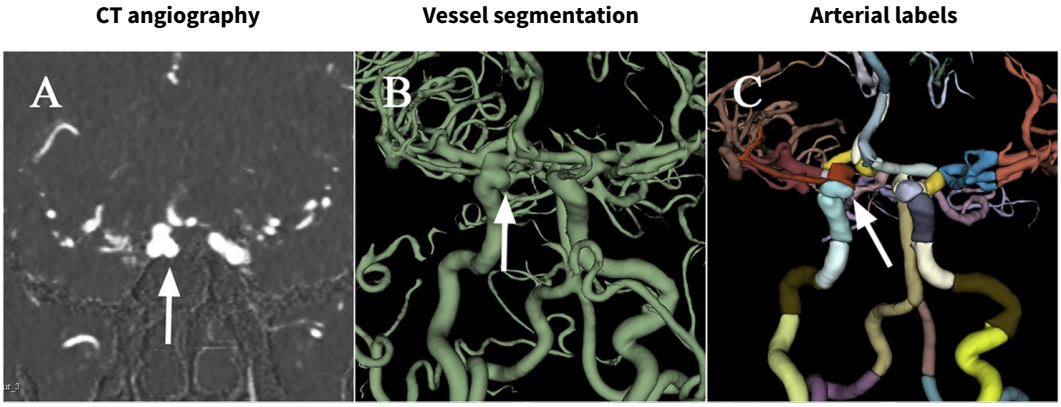
Master Project in Medical Image Analysis: Brain Vessel Segmentation and Object Detection

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Teach a machine learning model to map the arteries of the brain, with input from the stroke team at Sahlgrenska.

What You'll Work On

Stroke is one of the leading causes of death and disability worldwide, and in stroke care every minute counts: the sooner a blocked artery is found and reopened, the more of the brain survives. Treatment decisions rest on the rapid reading of complex three-dimensional images of the brain and its blood vessels, often in the middle of the night. AI is already changing this. A recent study co-authored by Alexandros Rentzos at Sahlgrenska University Hospital found that introducing AI-supported stroke-imaging software across the region shortened the time from imaging to treatment.

This project takes on the anatomy itself. The brain is supplied by a tree of arteries whose branches vary from person to person, and knowing which branch is blocked, and how to reach it, guides the choice of treatment. You will build, train and evaluate a deep learning model that segments the cerebral arteries and locates and identifies the major arterial branches in CT angiography: CT scans acquired while a contrast agent lights up the blood vessels. An automated map of the arterial tree could make the reading of stroke scans faster and more complete, and is a building block for locating the blockage itself. Which branches to target will be decided together with the clinical team.

You will be based in the geometric deep learning group GAPinDNNs at the Department of Mathematical Sciences at Chalmers, working day to day with its researchers and with Sindrion Technologies as industrial partner. The clinical side is anchored at Sahlgrenska, where resident doctors and doctoral students help prepare the annotated training data. You will implement and train a deep learning baseline, investigate a focused improvement of your own, and evaluate how well the model segments the vessels and identifies the branches on patients it has never seen. Failure cases are reviewed together with the clinical team, so you learn how radiologists read these images and where the model goes wrong. The outcome is a trained model, documented research code and an honest assessment of the model's strengths and limitations.

Prerequisites

A solid understanding of Python and experience implementing deep learning models are required. Familiarity with PyTorch, computer vision or three-dimensional image analysis is useful. Prior medical knowledge is not required. We are looking for an ambitious student who wants to work on an open research problem with real clinical stakes. Contact Daniel Persson at daniel.persson@chalmers.se to discuss the project.

Start Exploring

- Karlsson et al. (2026), *Implementation of an AI-supported decision-making tool in a high-volume stroke system with routine perfusion imaging*. *European Stroke Journal*. doi.org/10.1093/esj/aakag098
- nnU-Net, the standard baseline for medical image segmentation: Isensee et al. (2021), *Nature Methods* 18, 203–211. doi.org/10.1038/s41592-020-01008-z
- MONAI, the PyTorch-based framework for deep learning in medical imaging that the project will build on: project-monai.github.io