Graphs in Medicine: Working with Blood Vessel Networks

An open problem in the field of medicine is taking images of blood vessels and generating a mathematical object that can be used for downstream tasks. Such a task is to measure the tortuosity of blood vessels, which can be used as a medical sign.

In this project, we want to take 3D images of blood vessels and generate a weighted graph representation. This involves constructing a 3D view of the blood vessels, finding the centerlines and junctures/bifurcations, constructing the graph, and determining the edge weights (tortuosity).

The important aspects of this task are accurate locations of the junctures/bifurcations, and accurate values of the edge weights.

The exact scope of the project is not yet fixed and is up for discussion; we are looking for motivated students who are excited to work on blood vessels through the eye of geometric graphs.

Requirements:

- Programming skills (Python, C/C++, ...) and knowledge of machine learning. Prior experience on working with graphs, image segmentation, computer graphics, or fluid dynamics is an advantage.
- We will have weekly meetings to address questions together, discuss progress, and think about future ideas.

Contact

In a few short sentences, please tell us why you are interested in the project and about your coding and machine learning background (i.e., your own projects or courses).

- Andreas Plesner: aplesner@ethz.ch, ETZ G95
- Joël Mathys: jmathys@ethz.ch, ETZ G63