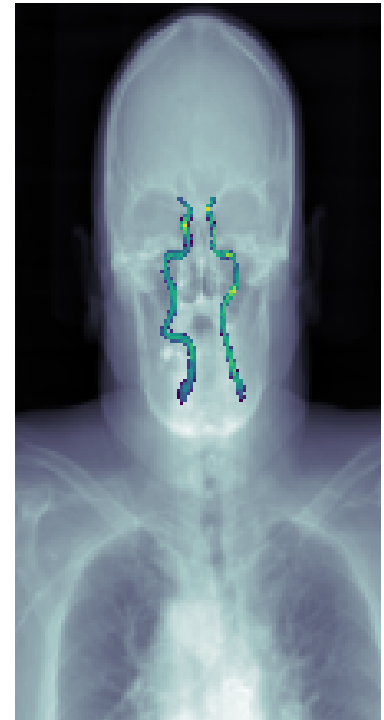# PhD Thesis
## Deep learning approach for segmentation of cervical arteries in CTA images



The accurate segmentation of cervical arteries from computer tomography (CT) images is a difficult challenge in radiology. The image to the right shows a projection of such a segmentation. Automation of the segmentation procedure will allow for a quantitative analysis of arterial geometrical structure for the use in large cohort patient studies. Although convolutional neural networks have achieved state-of-the-art results for numerous segmentation tasks in medical imaging, the large memory requirements for processing 3D CT angiography images as well as a lack of manually annotated training data prevent straightforward application.



Groundtruth

Prediction

Groundtruth

Prediction
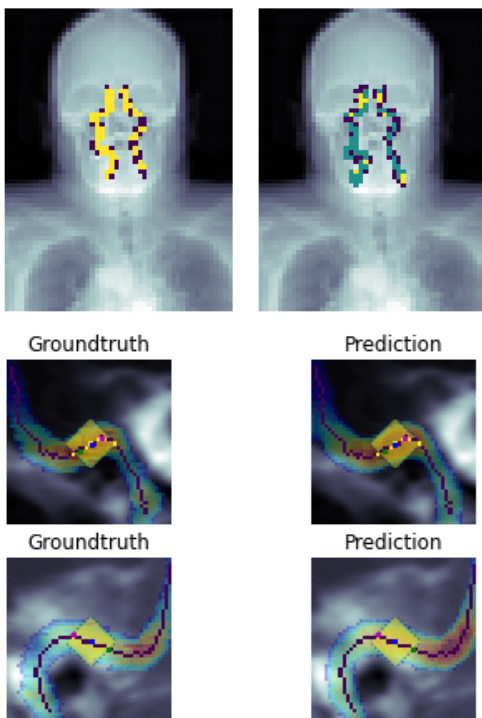
### Aims and Methods

To circumvent the problem of high dimensional input data, we utilize a global-local segmentation approach. The global part consists of strongly downsampling the volume and roughly estimating the course and location of the artery using a 3D U-Net. Next we select a start patch within the volume based on the confidence of the global network. In a repetitive manner, we segment the part of the artery within the patch using again a 3D U-Net, estimate the further course of the artery by calculating the centerline and then extract the next patch according to the estimated course.

### Partners

This is a joint project with M. Tiefenthaler, E.R. Gizewski, S. Mangesius and S. Pereverzyev Jr. from the Medical University Innsbruck. All images shown here were obtained in this collaboration.

### Requirements

Aimed at students of engineering sciences, mathematics or computer sciences with a background in inverse problems and a good working knowledge in Python or Julia. Some knowledge of Tensorflow is beneficial.

### Contact

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