Leids Universitair Medisch Centrum

Master Thesis project
In Biomedical Machine Learning

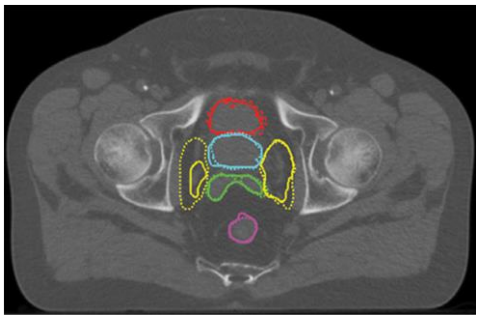
Deep Learning with Transformers for Medical Image Segmentation

Project overview

Convolutional neural networks (CNNs) have dominated the field of medical image segmentation in recent years, outperforming many of the algorithms that are now considered classical. CNN architectures are tailored for images, exploiting spatial invariance of features via learnable filter representations. The downside however of CNNs is that while local information is processed efficiently, the use of more global information (context) requires large receptive fields leading to much increased complexity of the networks and less efficient training.

Progress in the field of natural language translation have led to a new paradigm called transformers that avoid some of the explicit assumptions of CNNs. Transformers allow for efficient encoding of long range relationships in the data, and have set a new state-of-the-art in that field. Recently, this idea has been adopted in the field of computer vision for segmentation purposes, with highly promising results[1].

The **goal** of this MSc thesis is to investigate the use of this exciting new technology called transformers for *medical* image segmentation, optimize the design for this field, and to quantify its performance. The application domain will be that of auto-segmentation in prostate CT data for radiotherapy purposes. Annotated data, compute hardware and software and validated baseline (CNN) networks are readily available.



[1] Sixiao Zheng et al, Rethinking Semantic Segmentation from a Sequence-to-Sequence Perspective with Transformers, http://arxiv.org/abs/2012.15840v1

Where and when?

The project will take place at the Division of Image Processing, Department of Radiology, LUMC, https://lkeb.lumc.nl/. You will be supervised by dr. Marius Staring and Prerak Mody, MSc. Start date of the project is flexible, duration is 8 – 12 months.

Who?

Students with a major in computer science, mathematics, biomedical engineering, artificial intelligence, physics, or a related area in the final stage of master level studies are invited to apply. Affinity with Python programming is required, as well as interest and experience with machine learning and deep learning.

Interested?
Contact: dr. Marius Staring (**m.staring@lumc.nl**)