**M.Sc. projects: Applications of AI and Deep learning in Radiotherapy**

Netherlands Cancer Institute / Antoni van Leeuwenhoek

Within the department of radiotherapy at the Antoni van Leeuwenhoek, we are working actively on the development and clinical implementation of AI and deep learning techniques.

A description of one of the projects we are working on is provided below, but do not hestitate to contact us to learn about other ongoing projects. For the duration of your project, you will be embedded within the clinical data science group of the department of radiotherapy. Naturally, you are also encouraged to participate in weekly journal clubs, and R&D meetings. When you decide to do your master thesis at the Antoni van Leeuwenhoek, you will have the exciting opportunity to experience working at a hospital with a strong focus on research and innovation.

**Sample project description**

Online adaptive radiotherapy is a technique where the treatment is continuously adapted to the changing patient anatomy. Such a treatment allows for a more precise delivery of the ionizing radiation, leading to less radiation induced side effects and opening the potential for further dose escalation.
A crucial step in this process is the segmentation of the tumour and healthy tissues on daily acquired medical images (MRI or CT). Manual segmentation however is time consuming, prone to variation between clinicians and a logistic burden due to specialist staff requirements. As such, segmentation is typically considered the weakest link in radiotherapy. Therefore, there is a clear clinical need for a fast, comprehensive automated segmentation workflow.
Artificial intelligence, and in particular deep convolutional neural networks, have shown potential of automated segmentation; however, in practice the clinical use is very limited. One of the reasons for this is that the obligatory manual verification of auto-segmentation is time consuming and it is hard for clinicians to recognize quickly where a segmentation requires correction.

The aim of this project is to develop AI tools to study the quality of (automated) segmentations in online adaptive radiotherapy. These tools should lead to a framework that allows clinicians to automatically recognize those regions of a segmentation that likely require clinically relevant corrections. In this way, we expect efficiency and quality of treatments to improve. This is not just fundamental research, at the end of the project the tools will be implemented in our clinical practice. Clinical indications involved are MR-guided online adaptive radiotherapy for rectal cancer and CT-guided adaptive photon and proton therapy for head and neck cancer.

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