MSc project – Implementation & evaluation of DL contouring for prostate RT

The problem

In MRI guided radiotherapy a new optimal dose plan is created for every radiation treatment of the patient. To make such a plan, currently the radiation oncologist delineates the targets and organs at risk for every treatment. This is a time consuming process that takes up to a quarter of the time the patient is on the treatment table. By use of deep learning we want to accelerate this delineation process to increase patient comfort and make the workflow more efficient.

Current practices/research

Prostate, rectum and bladder are delineated manually based on imaging before the first radiation treatment (pre-treatment imaging). For each radiation treatment session a new MRI is acquired and the prostate is rigidly registered between this new MRI image and the pre-treatment MRI image and then manually edited. For this purpose already a DL model has been created to delineate the prostate. In the current workflow this model has not yet been implemented and a thorough evaluation of the impact on the workflow is needed.

The desired solution

The already developed DL model is to be evaluated and implemented in the clinical workflow at the Catharina Hospital Eindhoven, for use on the MRIdian MR-linac, see https://viewray.com/mridian/discover-mridian/.

The MSc project

The performance of the DL model is evaluated by comparing variation with the observer delineation, time reduction and consistency of the new workflow compared to the delineation from radiotherapists starting the workflow with the rigid registration of the prostate.

Datasets

Two datasets are available for the evaluation:

1) Prostate delineations of 5 patients, delineated by 4 radiotherapists at 1.5T and 0.35T.
2) Prostate delineations of 10 patients, delineated by 4 radiotherapists and 4 radiotherapy technicians, where the delineations were timed.

Evaluation

Evaluation of the model is performed based on overlap, distance and volumetric based measures. The segmentations predicted by the model are compared to the delineation of the radiotherapist. After the evaluation of the model, the time to adapt the segmentation as predicted by the model is compared to the time for the radiotherapist to adapt from the rigid registration.

Reporting

A final report will be written in the form of a scientific article, using the IEEE scientific journal template. Potentially, an abstract about the performed research can be submitted to a scientific conference, and an adapted version of the final report can later on be offered for publication to a scientific journal.

Final presentation & defense

The MSc project is concluded with a 25-min presentation and a 45-min defense session.

Expected skills and experience

- Programming in Python, other languages (e.g. course BMB502417)
- Machine learning / deep learning (e.g. courses 8DM40, 8DM00)
- Medical image analysis (e.g. courses 8DC00, 2DMM10)
- Experimental study design (course 8DM20)
- Written and oral communication in English and Dutch
- Good social skills

Start date & duration

The project can be started as from April 2023 at the Catharina Hospital Eindhoven under the supervision of dr. Hanneke Bluemink and dr. Rob Tijssen.
It concerns a Medical Engineering (ME) MSc project (45 ECT, 7 months full-time).

Contact

Are you interest in this project? Do you want more information? Please contact: m.breeuwer@tue.nl