PHILIPS

Clinical Elements

Accuracy of automated contouring validated in MR-only prostate radiotherapy workflow

Purpose of this study

To assess and validate the performance of a fully automated MRI segmentation tool (Auto-Contouring) for prostate cancer radiotherapy, investigators at Turku University Hospital (Finland) compared the accuracy and repeatability of manual and automated contouring of targets and OARs. The following is a summary of the study published by A. Kuisma et al. in Physics and Imaging in Radiation Oncology (2020).

Automation for condensing the contouring workload

As clinicians exploit technological developments in radiotherapy imaging, planning and delivery to increase the conformality of dose distributions, precisely delineating targets and organs-at-risk has become increasingly important.

The contouring step in the workflow, however, remains time-consuming and resource intensive, even for skilled professionals. For example, it took the clinical investigator (CI) in this report a mean time of 26 minutes to manually contour the CTV and all organs-at-risk.

In their MR-only prostate radiotherapy workflow, the researchers evaluated the accuracy and reproducibility of Philips' automated segmentation tool (Auto-Contouring) against the manual contouring of the CI and several radiation oncologists (RO). Auto-Contouring – a model-based adaptive algorithm on Ingenia MR-RT that runs in parallel with MR-only simulation – creates standard anatomical structures required for prostate cancer treatment planning.

The prospective study included 65 prostate cancer patients referred for treatment.

Automated segmentation comparable to manual segmentation

The metrics used to evaluate the agreement between manual and auto-contoured volumes included the Dice similarity coefficient (DSC), the Hausdorff distance (HD95) and absolute volume difference (AVD). The CTV and organs at risks contoured were the prostate, rectum, bladder, seminal vesicles and penile bulb.

After visual inspection obvious outliers were excluded from further analysis, which included 8 prostate (12%), 4 rectum (6%), 4 bladder (6%) and 14 SV (22%) contours.

The contours of the manually (CI)-delineated prostate, bladder and rectum were in high agreement with the Auto-Contours. The DSC mean, SD for prostate was 0.84 (0.04), for bladder 0.92 (0.04) and 0.85 (0.08) for rectum.

The DSC, HD95 and AVD between the CI, the RO, and the Auto-Contours, indicated no clinically relevant differences in these structures.
The similarity of the manually and automatically segmented contours for seminal vesicles and penile bulb was slightly lower but in line with the differences between the CI and RO.

For fifteen patients a second MR scan was acquired to assess the repeatability of the prostate contours. The DSC between the repeated Auto-Contours and the manually (CI)-delineated prostate was analyzed.
Comparing original and repeated contours, the mean DSC was 0.89 (range 0.85–0.94) for the Auto-Contours and 0.82 (range 0.73-0.89) for the CI-delineated contours.

The case for automated MRI segmentation

Compared with benchmark manual segmentation, fully automated MR-based Auto-Contouring showed good agreement and repeatability. Using Auto-Contouring clinically will most likely decrease total contouring time, as for most structures the delineations were accepted with only minimal deviations compared to manual contouring.

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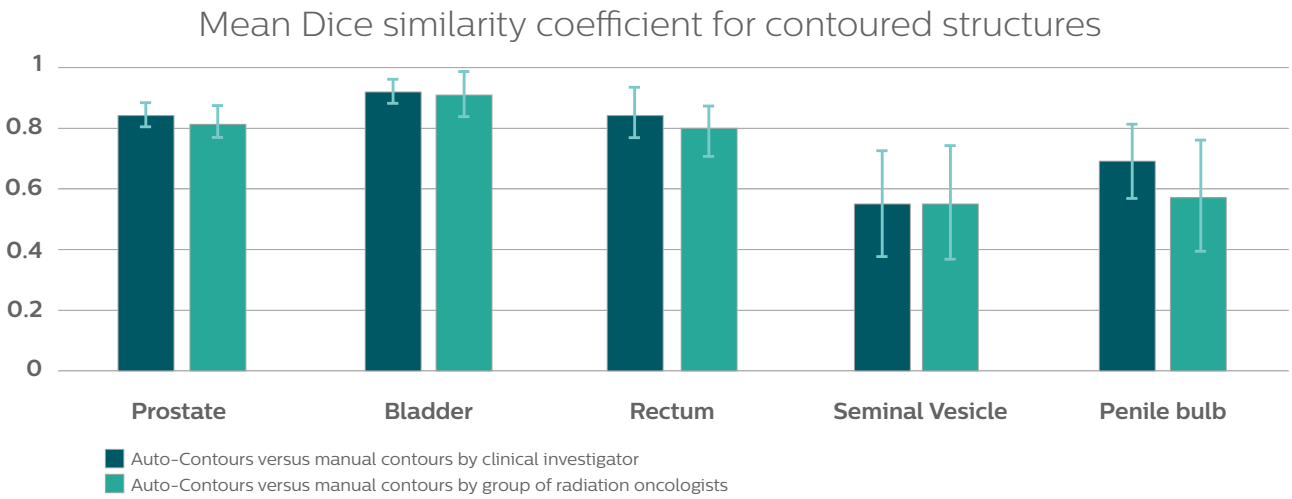

Results from case studies are not predictive of results in other cases. Results in other cases may vary.

Kuisma et al. Validation of automated magnetic resonance image segmentation for radiation therapy planning in prostate cancer. Phys Imag Radiat Oncol 13: 14-20 (2020).

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