Guidelines-based automatic segmentation improvements

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Purpose/Objective:

Automatic segmentation (AS) of Organs-at-risk (OARs) for radiation therapy (RT) treatments encounters challenges due to the variability amon delineators and the lack of standardized delineation practices among centers [1,2]. Moreover, AS models, usually trained on manual contours, are mainly evaluated using gemortic overlap measures between the guidelines adopted by the centers and require more time to manually adjust based on clinical practice preferences. Although using AS clinically acceptable contours can be obtained, post processing, contour adaptation based on guidelines could provide improved alignment with expert-based delineation especially for more challenging structures such as the clinical target volume (CTVs) and allow the experts to choose the reference guidelines. We proposed a new approach, consisting of adapting the contours of OARs and CTVs according to anatomical landmarks (or "anatomical contours") and rules (margins or limits) based on these landmarks as dictated in the guidelines. This approach aims to mitigate both inter and intra-expert variability in contouring by adhering strictly to established consensus guidelines. In this abstract, we present preliminary results concerning the delineation of the prostate, seminal vesicles, and lymph nodes, as described in international guidelines [3,4].

Material/Methods:

We automatically segmented OARs and prostate and lymph nodes CTV using ART-Plan annotate (TheraPanacea). last processing based on the guidelines including margin correction (eg: correct margin around vessels), morphological operations and other image processing operations such as intersection union and subtraction (eg: exclusion of the muscles and the bones, commencing lymph node delineation at the oartic bifurcation, etc.) between delineations are applied to adapt contours based on the guidelines [3,4]. Raw automatically segmented contours and post-processed guidelines-based adapted contours have been presented to two experts together with the following questionnaire:

	Question
1	Which one do you prefer in absolute terms? Green or red model? (Green – raw contours; red – post-processed contour)
2	What subjective score would you give them out of 10?
3	what objective grade would you give each scanner on the following scale: A+: hunters are better than what you would have done in routine practice A: no rework required the patient could be treated with these contours B: some rework, mostly minor deformities C: a lot of manual corrections to do and/or some organs to be redone completely D: almost all countries need to be redone
4	How long do you think it would take to correct each of the models before being put into processing (outside of OAR)?

Table 1. Qualitative contour assessment questionnaire.

Results:

Overall the experts indicated the preference for the post-processed contours (in green, Figure 1). One expert (MR) rated the raw contours as 6/10 and 8/10 for the post-processed contours. The raw contours were mostly rated as C (corrections on the extreme slices and/or some organs to be redone completely) versus post-processed contours as B+ (better than some rework, mostly minor deformities). Moreover, he estimated contours corrections as low as 5 minutes for the guideline-adjusted contours vs 20-30 minutes for the raw contours. Similarly, the second expert (SS) indicated his preference towards the guideline-based adapted contours and expressed the interest and potential of using this method for contour uniformization in clinical trial studies

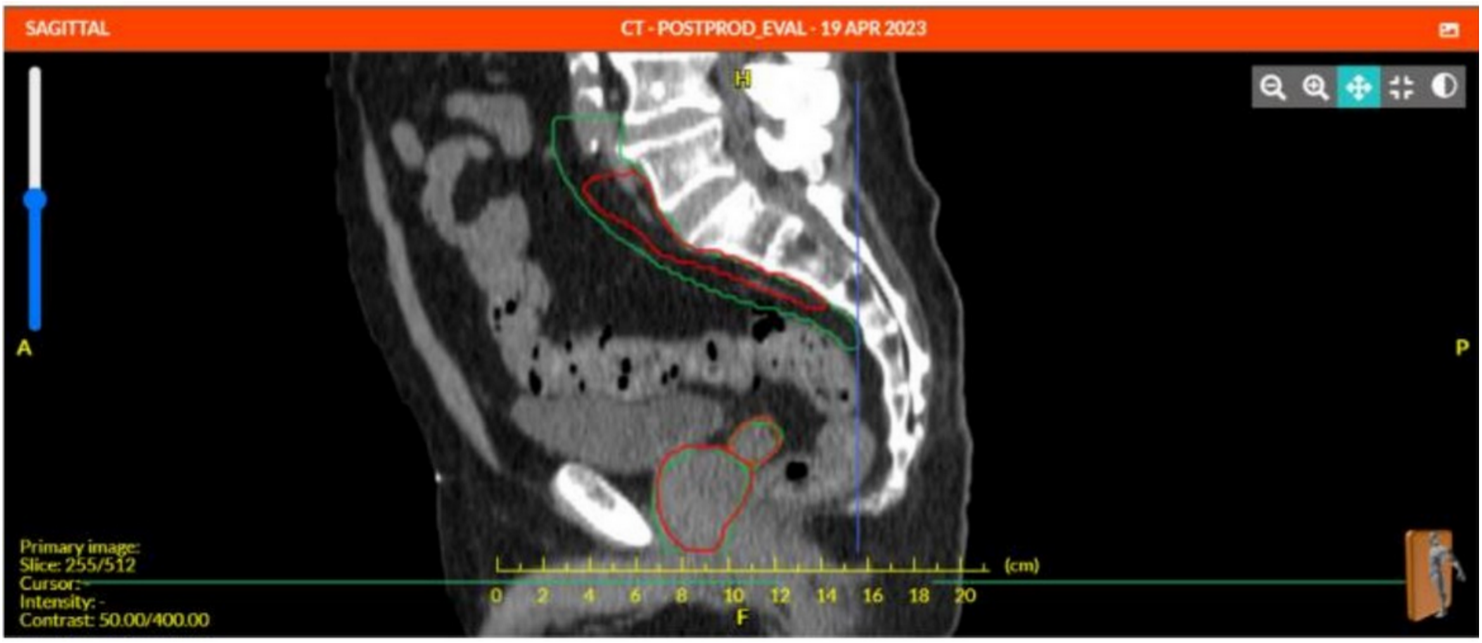

Figure 1: Sagittal view, raw automatically contours (in red), guideline-based post-processed contours (in green).

Conclusion:

This study shows promising results for a guideline-focused pipeline of AS. The preliminary qualitative evaluation serves as proof of concept on the pelvis, whereas the upcoming studies will focus on the quantitative assessment of the generated contours. Although current aS methods provide clinically acceptable contours, this method allows easy parameter modification and potentially improved automatic delineation process by enabling better alignments with guidelines adopted by centers.

Keywords: automatic contouring, guidelines

References:

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