

Evaluation of an AI-based autosegmentation software for head and neck vessels contouring

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Purpose/Objective:

Deep learning solutions are becoming the standard of care to overcome the tedious and error-prone task of manual delineation. This is especially relevant for head and neck (H&N) vessels, which are small and subject to observer variability. Delineating these vessels may be of importance to try to limit the dose to the immune system on the contralateral neck to maintain an immune response. This study evaluates an AI-based auto-contouring solution and compares its clinical acceptability to expert-drawn contours.

Material/Methods:

We trained a 3D U-net deep-learning model [1] for automatic contouring of 5 bilateral H&N vessels (common carotid, external and internal carotid, external and internal jugular) using 485 annotated injected CT scans. Quantitative performance was assessed using an external cohort of 27 patients, with the Dice coefficient (DSC) for: 1) the automatic segmentation contours 2) manual contours from two experts. Two senior experts conducted a qualitative evaluation on 18 patients, assessing 18 manual and 18 AI generated contours in a blinded comparison. The scoring system used was: A/ Acceptable without changes, B/ Acceptable with minor adjustments, C/ Not acceptable for clinical use.

Results:

Across all contours, DSC for AI-solution was 0.80 whereas was 0.82 for the experts (Table 1). For qualitative assessment the C rate was low for both automatic contours 3% and manual contours 2.4%. The average clinical acceptability score (A+B) across all contours for AI generated automatic contours was 97% for the AI solution whereas was 97.6% for experts (Table 1).

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Organs	(A+B)% (manual contours)	C % (manual contours)	(A+B)% (AI contours)	C% (AI contours)	Mean AI DSC	Mean experts DSC
Lt common carotid artery	100	0	100	0	0.87	0.88
Lt external carotid artery	98	2	100	0	0.72	0.76
Lt external jugular vein	95	5	78	22	0.75	0.73
Lt internal carotid artery	98	2	100	0	0.81	0.84
Lt internal jugular vein	97	3	95	5	0.87	0.86
Rt common carotid artery	100	0	100	0	0.85	0.86
Rt external carotid artery	94	6	100	0	0.69	0.75
Rt external jugular vein	94	6	97	3	0.77	0.75
Rt internal carotid artery	100	0	100	0	0.82	0.84
Rt internal jugular vein	100	0	100	0	0.89	0.89

Table 1: Qualitative and quantitative assessment results for both manual and AI-based automatic contours.

Conclusion:

Our findings indicate that the deep learning model could be a viable clinical alternative, providing treatment standardization and potentially improving outcomes.

Keywords: Autosegmentation, H&N vessels, deep learning