

INTRODUCTION

Resin Yttrium-90 (Y-90) selective internal radiation therapy (SIRT) is a radioembolization procedure that uses Y-90 microspheres to treat metastatic liver cancer. In the procedure, liver volume and tumor volumes are needed for Y-90 activity calculations, which are delineated by physicians on CT or MR images. Manual delineation of multiple small metastatic liver tumors is time-consuming and labor-intensive. The study aimed to explore the feasibility of using a deep learning-based auto-segmentation approach for tumor delineation in SIRT.

METHODS AND MATERIALS

CT images from ten patients who underwent SIRT at our institution were retrospectively analyzed. TotalSegmentator, a deep learning-based auto-segmentation tool, was applied to automatically delineate metastatic liver tumors. The software was deployed on a GPU-equipped server with DICOM-based workflow integration. After CT images were exported from the clinical database to a designated DICOM directory, monitoring software detected the incoming studies, executed the auto-segmentation, and returned the results to the original clinical location. The auto-segmentation process required approximately 2 minutes. Auto-segmented tumor contours were compared against physician manually delineated contours, which served as the ground truth. Dice similarity coefficient (DSC) and mean distance to agreement (MDA) were calculated.

RESULTS

A total of 114 tumors from 10 patients were analyzed. The average DSC was 0.74, and the average MDA was 3.7 mm. The auto-segmentation performed better in images with good tumor contrast. Lower DSC values were observed in cases with poor contrast between small tumors and surrounding normal tissues.

Table 1. Quantitative evaluation results (N=114)

Metric	Mean $\pm$ SD	Median	Range
DSC	0.74 $\pm$ 0.11	0.72	0.59 – 0.92
MDA (mm)	3.7 $\pm$ 1.6	3.3	1.3 – 6.1

CONCLUSIONS

This preliminary study demonstrates that deep learning-based auto-segmentation shows promise for tumor delineation in Y-90 SIRT. Auto-segmentation may improve workflow efficiency by reducing contouring burden. Further development and optimization are warranted to improve accuracy, particularly for low-contrast lesions.

Contact: Jun.Li@Jefferson.edu

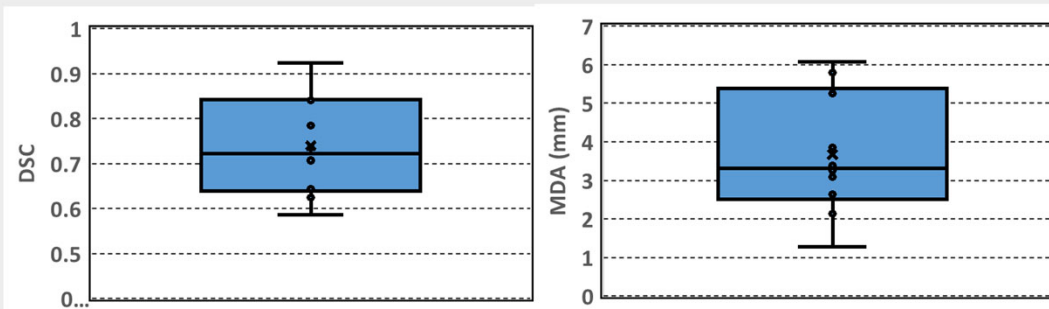


Figure 1. Dice similarity coefficient (DSC) and mean distance to agreement (MDA). N=114.

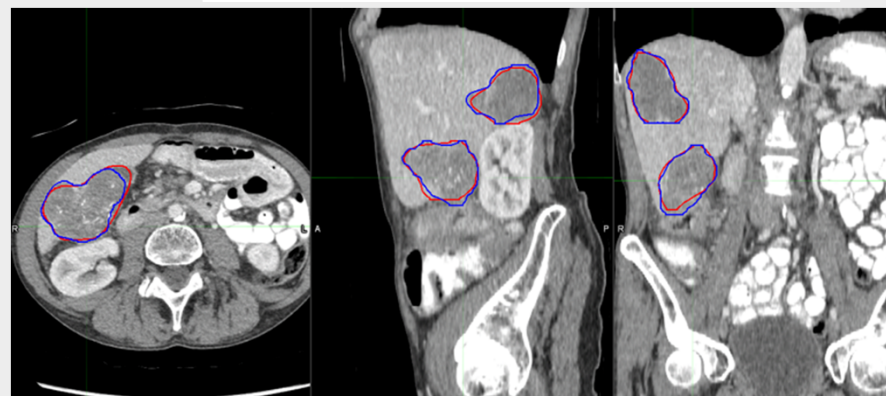


Figure 2. Case with the highest DSC (0.92). Red: manually delineated tumor contour; dark blue: auto-segmented tumor contour.

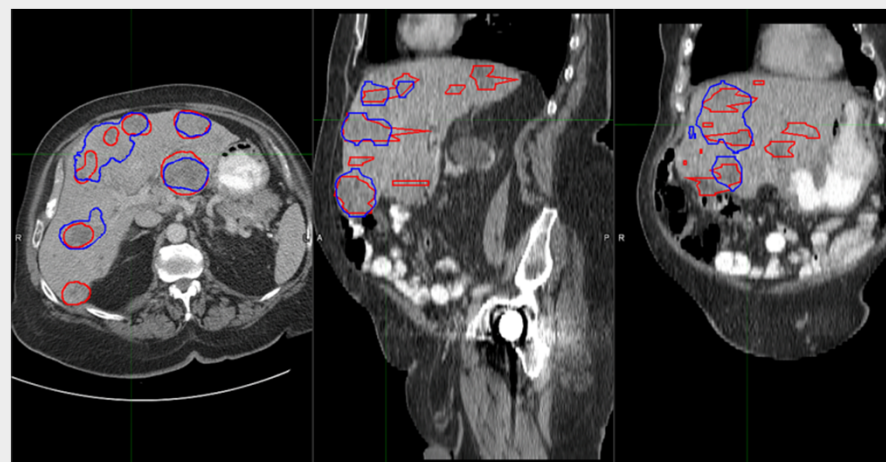


Figure 3. Case with the lowest DSC (0.59). Red: manually delineated tumor contour; dark blue: auto-segmented tumor contour. The contrast between the tumors and the surrounding normal tissues was poor.