Deep Learning-Based CT Segmentation of Omental Metastases Helps Detect Recurrence in Ovarian Cancer: A Multicenter Study

Mengge He1 , Fan Huang1, Elaine Yuen Phin Lee1*

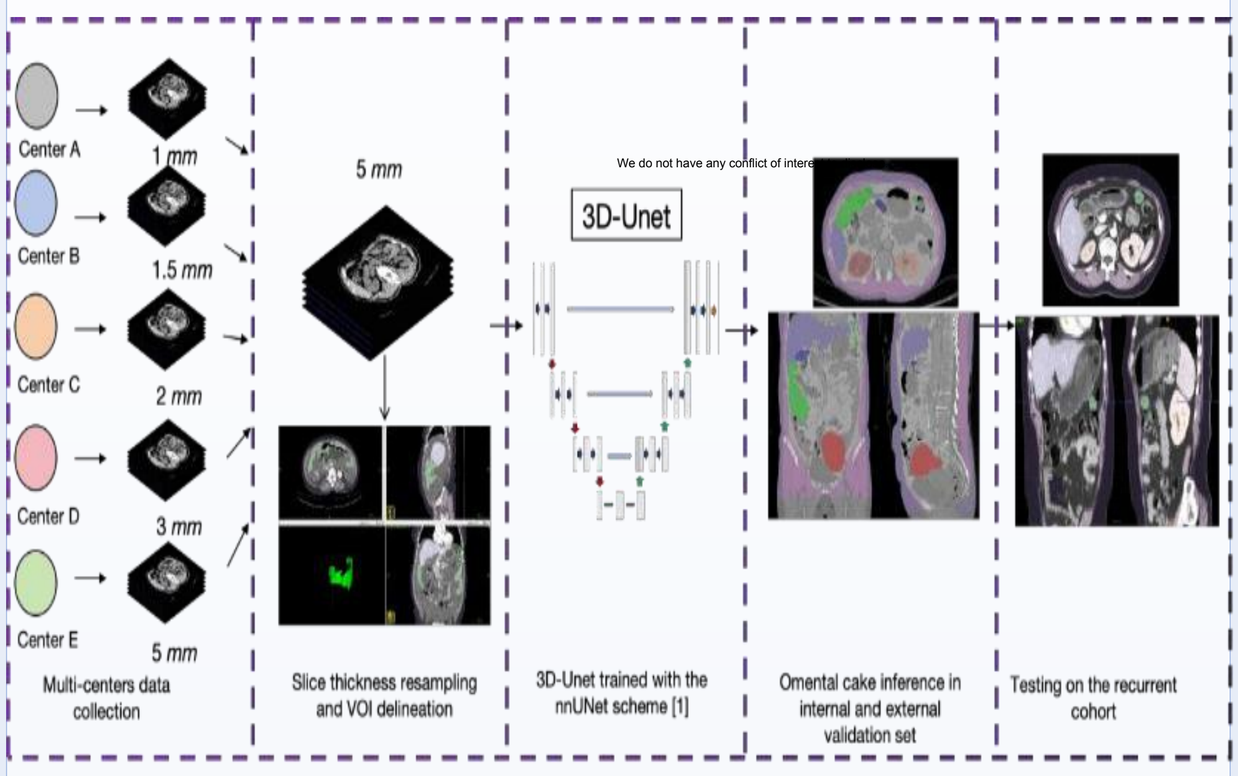
1Department of Diagnostic Radiology, the LKS Faculty of Medicine, the University of Hong Kong

Purpose

To develop a deep learning algorithm in segmentation of omental metastases of ovarian cancer (OC) on contrast-enhanced CT (ceCT) images and to test its utility in recurrence detection.

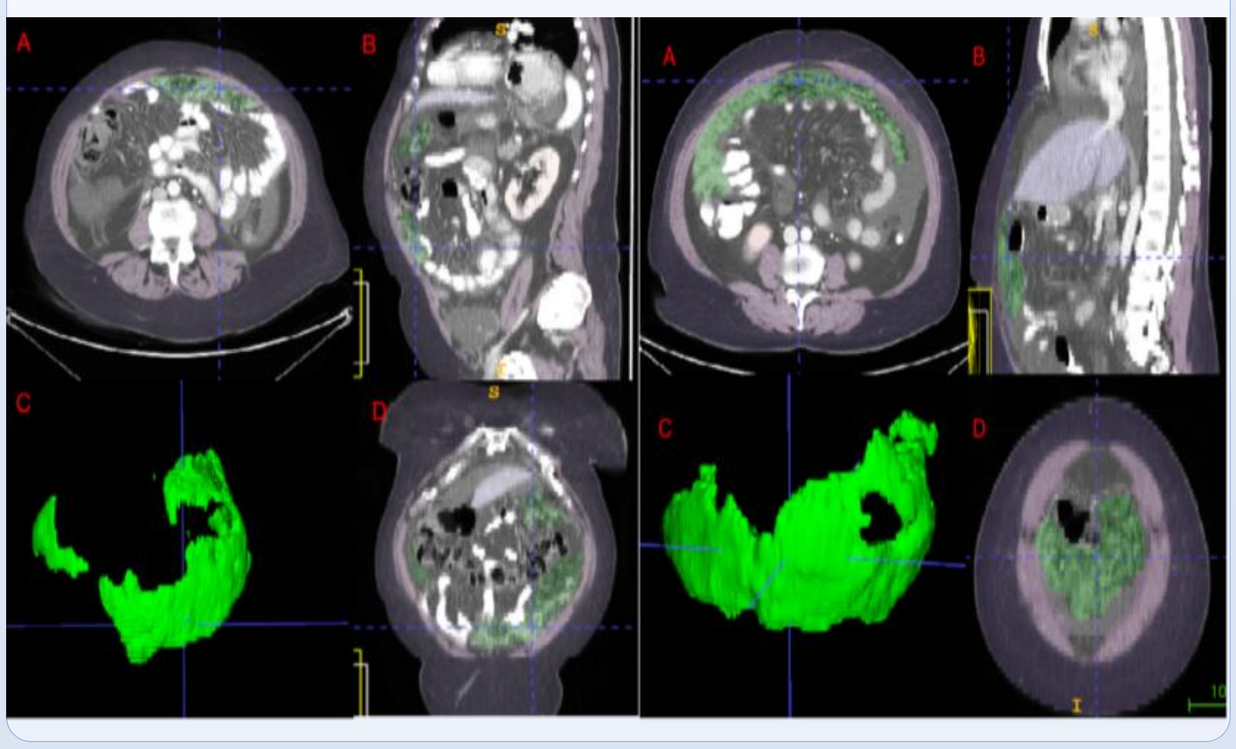
Material and Methods

Staging ceCT scans of OC patients with omental metastases were retrospectively collected from 6 institutions. A cascade training configuration was used, which included 5-fold cross-validation with the image data in lower resolution followed by allimages in full resolution. A fat threshold (-150 to - 50 HU) was applied in both auto-segmentation and ground truth to exclude fat around the omental metastases. Model performance on the internal, external validation and recurrence setting was evaluated by the Dice similarity coefficient (DSC), rectified DSC (excluding fat), tumor-wise DSC, tumor-wise precision and recall. Figure 1



Results

A deep learning nnU-Net segmentation model was built using omental metastases on ceCT images of 627 patients with primary OC (training n=478, internal validation n=74, external validation n=85, recurrence cohort n=80). Figure 2

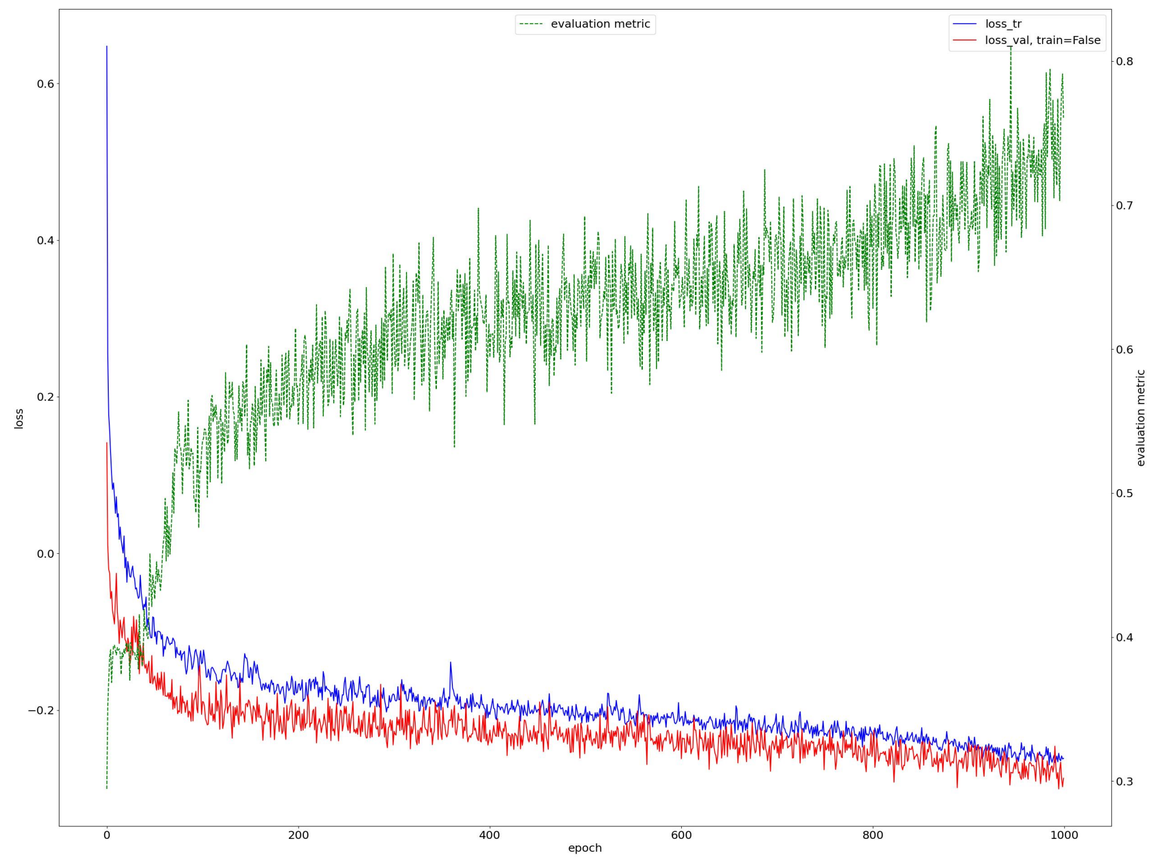


Results

Figure3. Performance of the nnU-Net model.

CohortsParameters	Internal Validation (n=74)	External Validation (n=85)	Recurrence cohort(n=80)
Average volume(cm³)	262.1 ± 250.7	160.9 ± 230.0	62.7 ± 99.9
DSC	69.8 ± 18.3%	88.7 ± 14.1%	61.7 ± 22.7%
Rectified DSC	70.8 ± 18.1%	89.2 ± 13.8%	63.3 ± 21.9%
Tumor-wise DSC	63.3 ± 20.4%	94.1 ± 8.9%	56.6 ± 19.7%
Tumor-wise precision	83.7 ± 19.3%	97.2 ± 7.0%	70.1 ± 26.1%
Tumor-wise recall	57.5 ± 25.4%	92.5 ± 12.9%	58.3 ± 27.4%
MCC	70.7 ± 16.8%	89.4 ± 12.6%	64.0 ± 21.2%
Rectified MCC	71.7 ± 16.6%	89.9 ± 12.3%	65.5 ± 20.5%

Figure 3 Training Curve



Conclusion

A deep learning auto-segmentation of omental metastases on ceCT images was developed and could be applied in recurrence detection.

Interest Conflict

We do not have any conflict of interest to disclose.

Contact

*Corresponding author
Elaine Lee <eyplee77@hku.hk>