Automated quality assurance of deep learning contours in head-and-neck radiotherapy

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Automated Quality Assurance of Deep Learning Contours in Head-and-Neck Radiotherapy

Prerak Mody

Colophon

About the cover:

The cover page was designed by Prerak Mody. On the front cover, you see an ensemble of contours in the middle represented by swirling strokes. The individual contours are depicted with various colors and represent the central theme of this thesis i.e., contouring of regions of interest within medical scans. These contours are made in collaboration by two parties: a human (clinician) and an AI. The AI (i.e., deep learning) has been anthromorphized and thus depicted via a human-like hand with a mesh design. The human and AI hands are collaborating on the contour which is the motivating factor for this thesis.

This inside cover envisions the future of radiotherapy, showcasing a clinician (in white coat) editing AI-generated contours of the head-and-neck area in real-time. As the patient is positioned on the linear accelerator gantry, the clinician uses automated quality assurance tools to quickly adjust the treatment plan based on the patient's latest anatomical scans, ensuring highly precise and adaptive treatment delivery. A technician (in blue overalls) helps the patient position themselves on the gantry.

Google Gemini, a visual language model (VLM) was used to assist with these designs.

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Contents

List of abbreviations

QA	quality assessment
CT	computed tomography
PET	positron emission tomography
HN	head-and-neck
RT	radiotherapy
OAR	organ at risk
DL	deep learning
CTV	clinical target volume
RoI	region of interest
NTCP	normal tissue complication probability
AI	artificial intelligence
AvU	accuracy-vs-uncertainty
ECE	expected calibration error
R-AvU	region-based accuracy-vs-uncertainty
CE	cross entropy
PTV	planning target volume
DICE	Sørensen–Dice coefficient
D_{mean}	mean dose
D0.03cc	dose to 0.03 cubic centimeters of tissue
EUD	equivalent uniform dose
MaxEUD	maximum equivalent uniform dose
OOD	out of distribution