Title: A deep learning-based tumor auto-contouring algorithm for real-time tumor tracking using linac-MR Session: Point/Counterpoint Live Debate: Artificial Intelligence Will Soon Change the Landscape of Medical Physics Research and Practice **Presenting author: Jihyun Yun, Ph.D, MCCPM** Date & Time: August 02, 2018 – 9:00 am Significant geometric margin reduction around tumor expected \rightarrow Ultimate goal of radiotherapy • Why real-time tumor tracking? **Only modality providing real-time MR images of tumor while beam-on** • Why linac-MR? Fast, reliable tumor auto-contouring from each MR image • What's the most important step? Best way to mimic human experts' thought process in tumor contouring • Why deep learning? Input MR Lung tumor Tumor Manual o **Modified U-net** (zoomed in) (Human boundary image (Fully convolutional neural networks) 64 64 Distinct 8 → 3x3 conv + **Partial** 128 256 128 128 ReLU omission ⇒ copy & conc atenate 2 \rightarrow 1x1 conv Э Ш 256 Diffuse 2x2 max. pool X L boundary 2x2 up-conv \sum

 $\star \star \star$ Deep learning based algorithm takes both (1) abstract, knowledge-based tumor shape, and (2) pixel-by-pixel details at tumor/healthy tissue boundaries into account simultaneously for tumor segmentation.



contour expert)	Auto-contour (Prev. algo.)	Auto-contour (Deep learning)	Dice similarity index Manual & Auto cont
	$\langle \rangle$	$\langle 0 \rangle$	Prev. algo. vs Deep lea 94 % vs 94
2	0	0	89 % vs 97
3			78 % vs 91

Exactly what human experts do!





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