

SynSeg-Net: Synthetic Segmentation Without Target Modality Ground Truth

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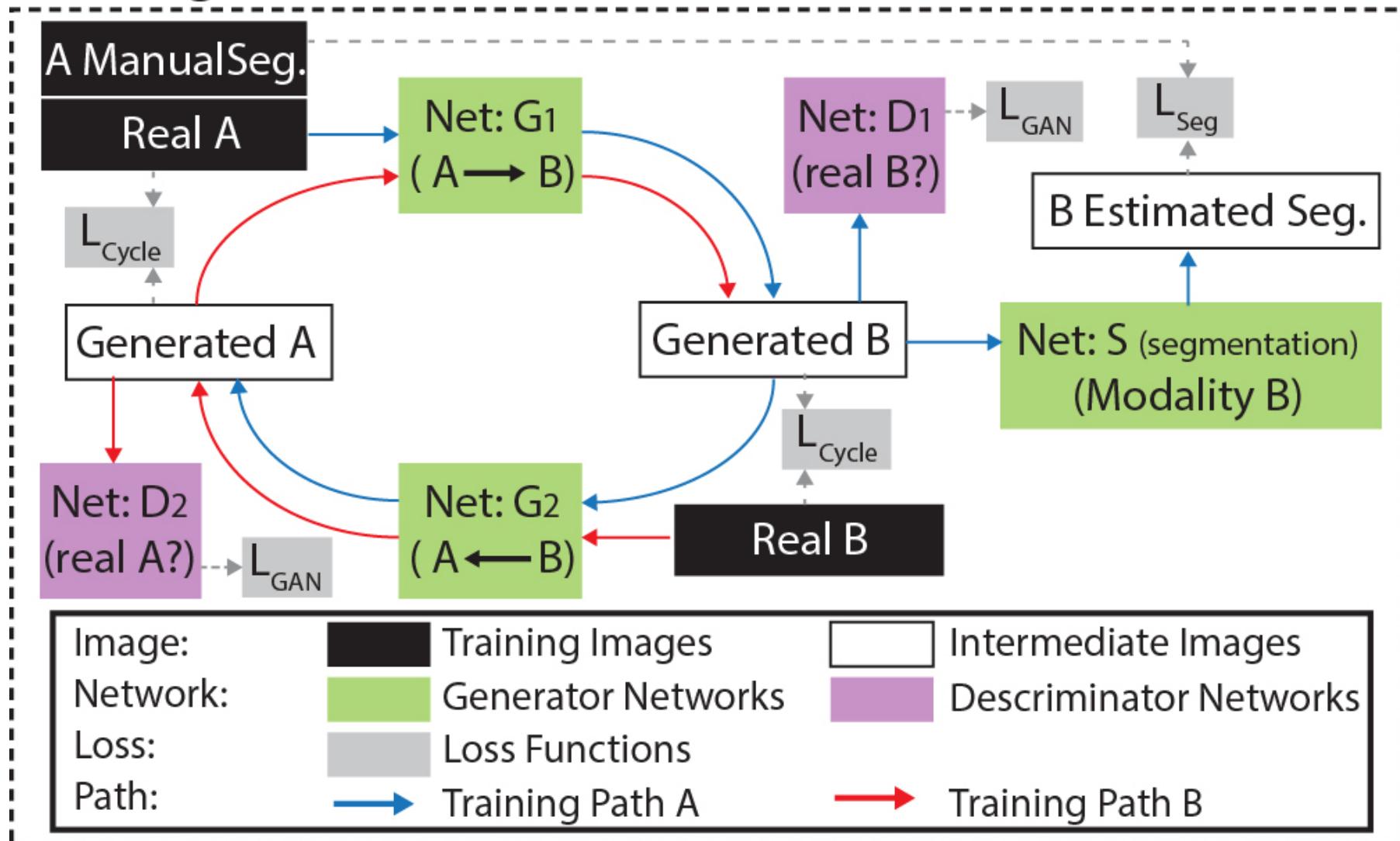
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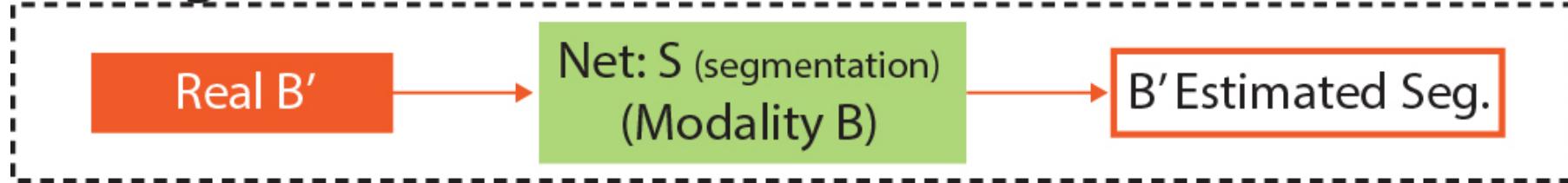
Source code can be found at:

<https://github.com/MASILab/SynSeg-Net>

Training



Testing



Networks

- 9 block ResNet → generators
 - PatchGAN → adversarial discriminators
 - The same 9 block ResNet was used for segmentation.
 - All 2D networks
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- [5] J.-Y. Zhu, T. Park, P. Isola, and A. A. Efros, "Unpaired image-to-image translation using cycle-consistent adversarial networks," arXiv preprint arXiv:1703.10593, 2017.
 - [36] J. Johnson, A. Alahi, and L. Fei-Fei, "Perceptual losses for real-time style transfer and super-resolution," in European Conference on Computer Vision, 2016, pp. 694-711.

Data from splenomegaly patients

- 60 T2w MRI scans
 - 3262 slices
- 19 whole abdomen CT scans
 - 1874 CT slices
- 75 normal spleen CT scan for training SSNet

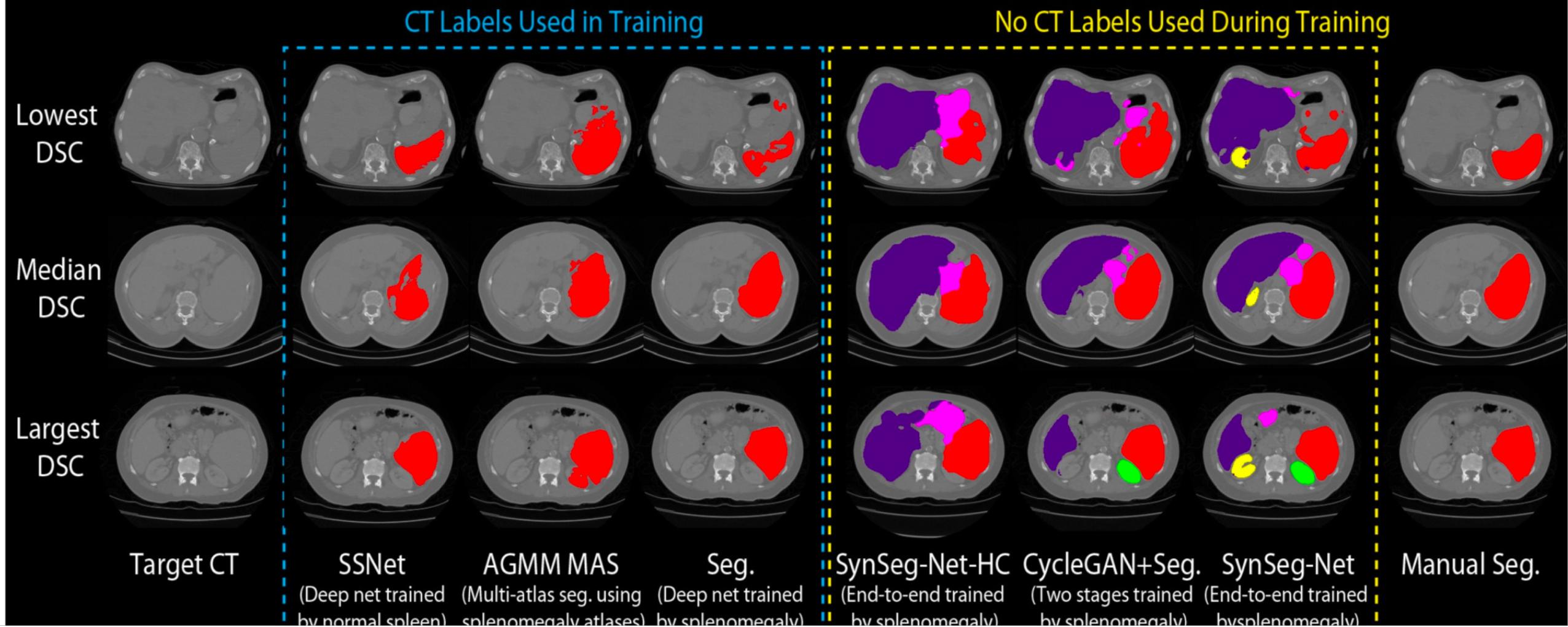
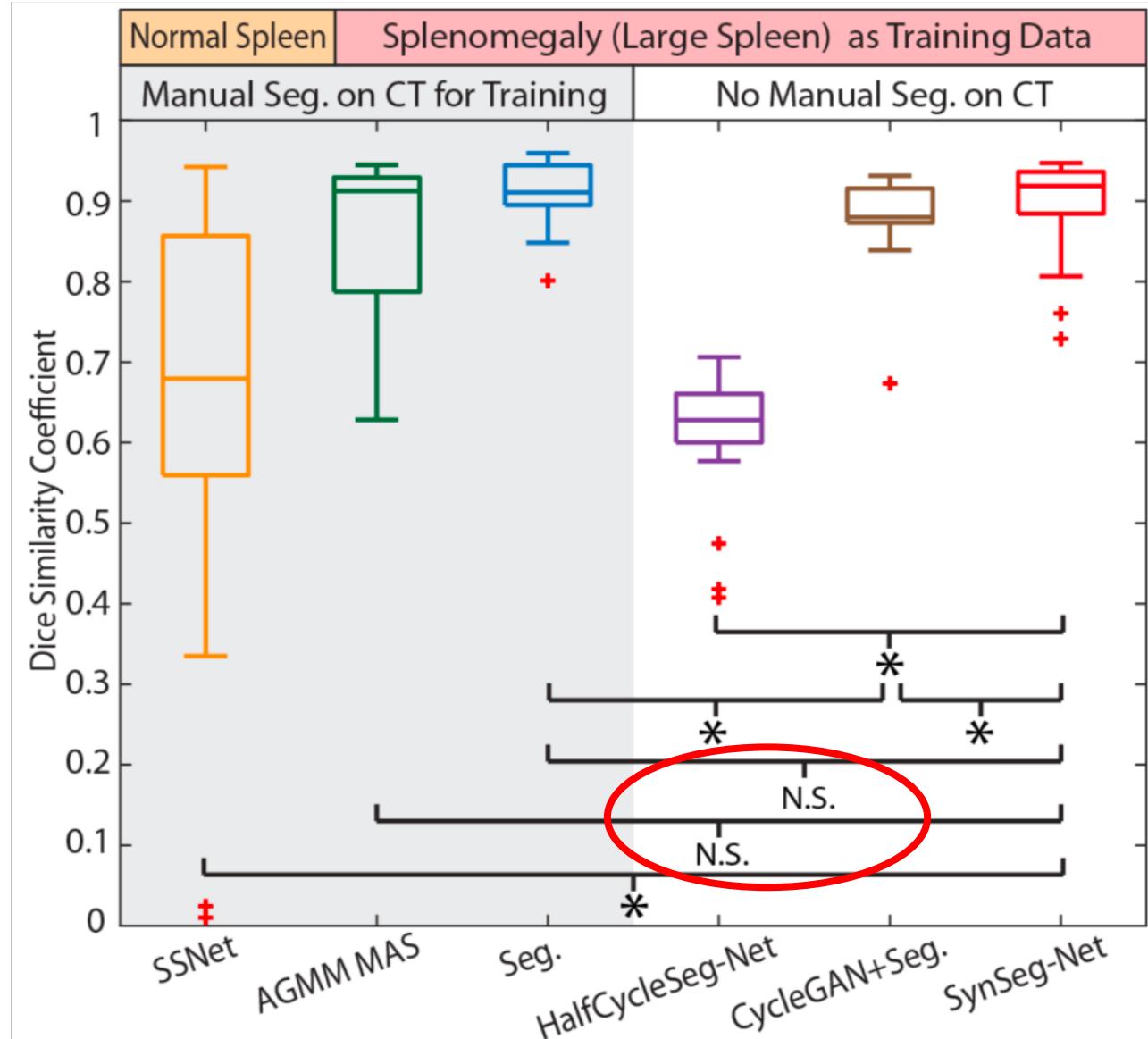


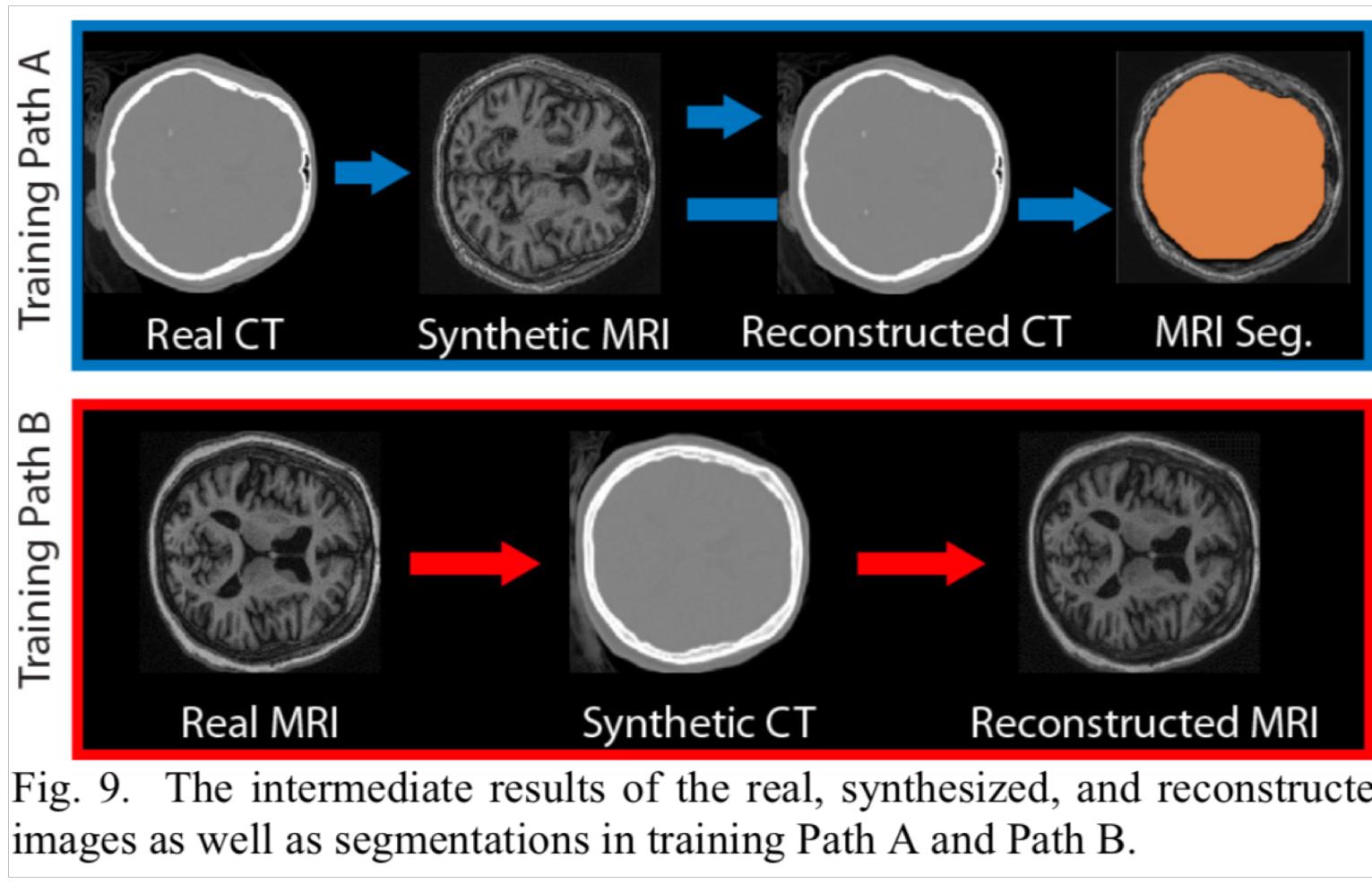
Table 1. Dice similarity score (DSC) and average surface distance (ASD) for CT splenomegaly testing images.

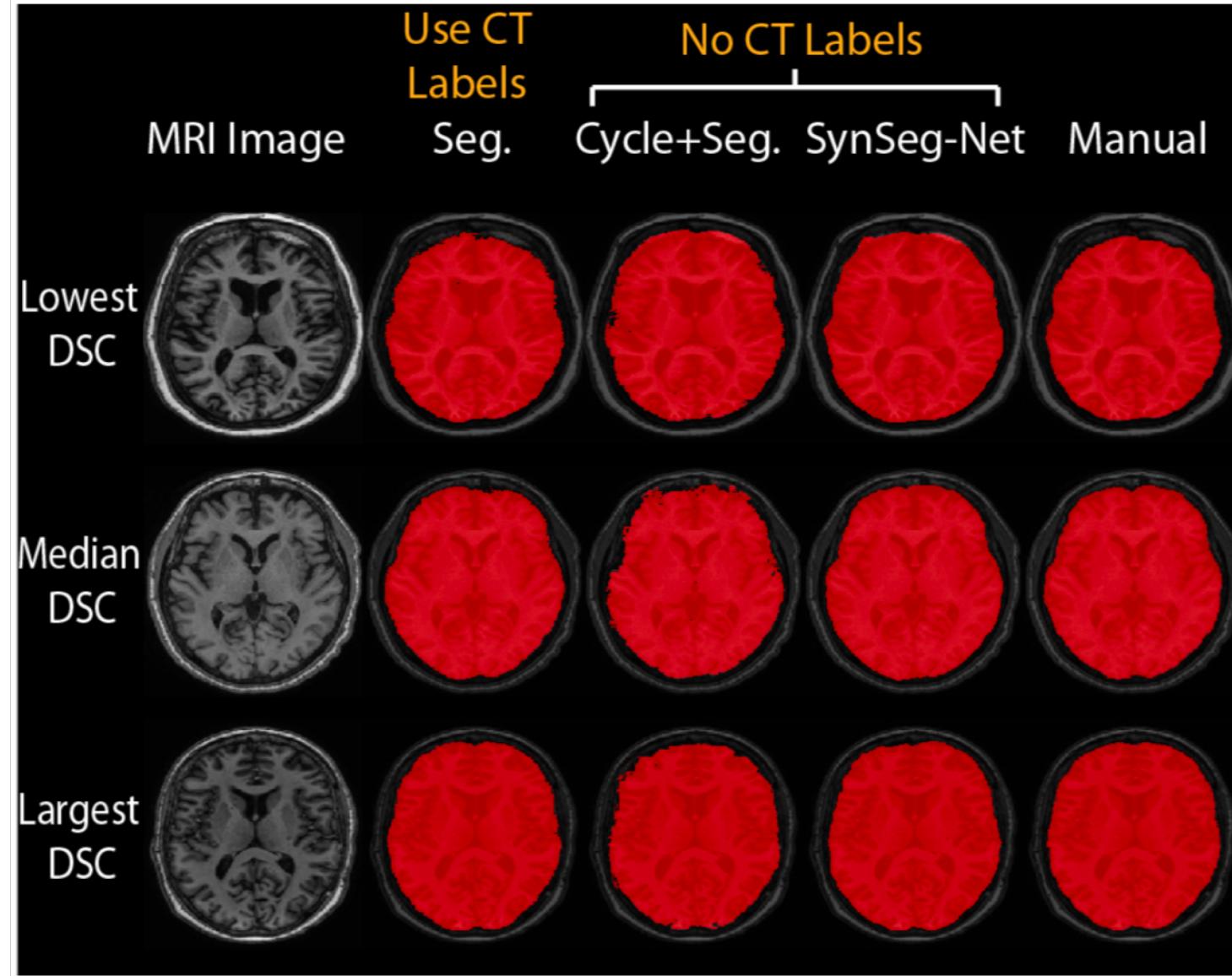
	SSNet	AGMM MAS	Seg.	SynSeg-Net-HC	CycleGAN+Seg.	SynSeg-Net
Median DSC	0.679	0.912	0.911	0.628	0.880	0.919
Mean±Std DSC	0.630 ± 0.269	0.861 ± 0.101	0.911 ± 0.040	0.605 ± 0.084	0.878 ± 0.056	0.895 ± 0.063
Median ASD	8.882	3.164	2.005	15.181	5.835	2.864
Mean±Std ASD	18.340 ± 27.991	6.726 ± 7.710	3.004 ± 2.797	14.383 ± 4.521	5.600 ± 3.619	3.898 ± 3.397

* the unit for ASD related measurements is millimeter (mm).



Brain Segmentation





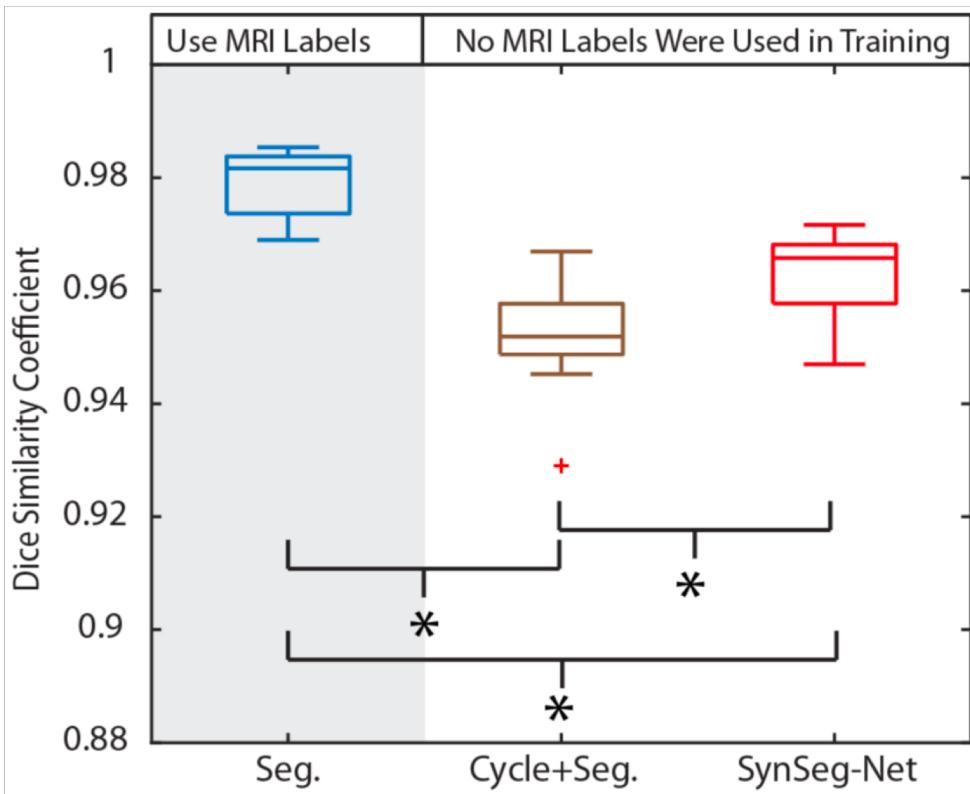


Table 3. Dice similarity score (DSC) and average surface distance (ASD) for MRI TICV testing images.

	Seg.	Cycle+Seg.	SynSeg-Net
Median DSC	0.982	0.952	0.966
Mean±Std DSC	0.979±0.006	0.952±0.010	0.963±0.008
Median ASD	0.803	2.118	1.312
Mean±Std ASD	0.987±0.458	2.322±0.976	1.441±0.318

* the unit for ASD related measurements is millimeter (mm).

Summary

- Massive network
 - Five sub-networks
 - Five loss functions
- Significance
 - No ground truth is required for the target images for training CNN
 - Splenomegaly: Segmentation performance is no significant difference with those trained with ground truth
 - Brain: not as good as direct supervision