Automated Segmentation of Temporal Bone CT Imaging for Robot-Assisted Microsurgery

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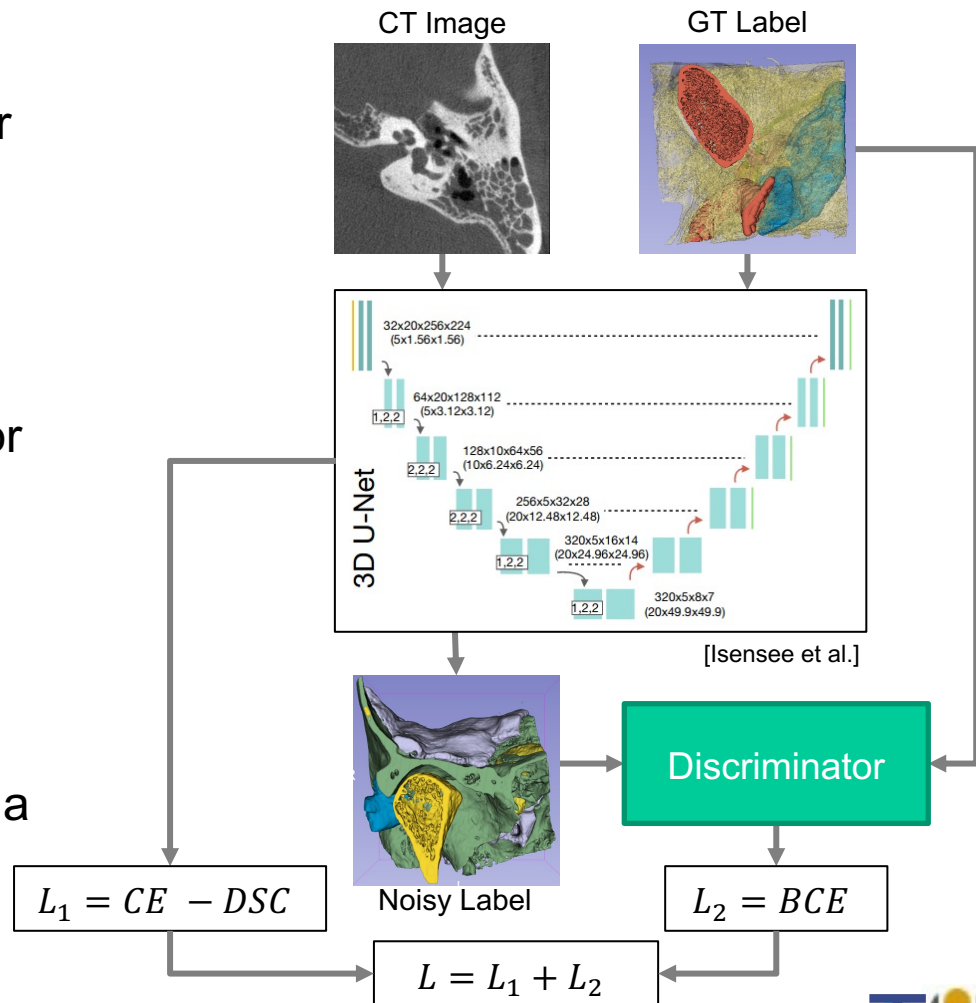Dr. Mathias Unberath, Zhaoshuo Li

Goal:

- To develop a deep learning model for segmenting critical structures in the temporal bone.
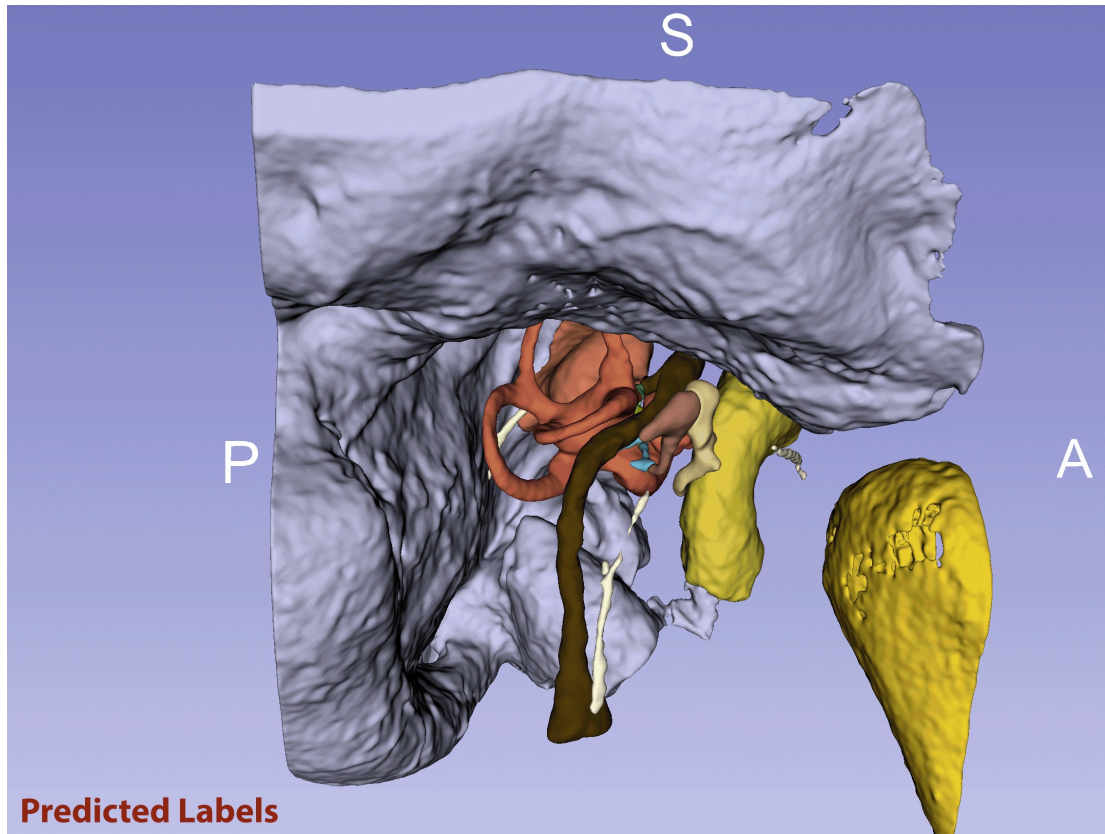
Significance:

- Accurate labeling of anatomy on CT imaging will provide the foundation for robot-enforced virtual safety barriers and prevent intraoperative injury.

Results:

- State-of-the-art segmentation results on temporal bone CTs using 3D U-Net and GAN Label Refinement with a shape model-based data augmentation method.

CT Image

GT Label

3D U-Net

[Isensee et al.]

Discriminator

Noisy Label

$$L_1 = CE - DSC$$

$$L_2 = BCE$$

$$L = L_1 + L_2$$

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nnUnet Validation Results

Class	Mean Val DSC (VANILLA)
Bone	.95
Malleus	.93
Incus	.93
Stapes	.59
Bony Labyrinth	.96
IAC	.93
Superior Vestibular Nerve	.62
Inferior Vestibular Nerve	.53
Cochlear Nerve	.79
Facial Nerve	.85
Chorda Tympani	.72
Internal Carotid Artery	.93
Sigmoid Sinus + Dura	.80
Vestibular Aqueduct	.67
Mandible	.94
External Auditory Canal	.84