

ESHNR conference 2021

Oral presentation abstract (max 350 words)

Fully Automated 3D Vestibular Schwannoma Segmentation: a multicentre multi-vendor study

Neve O.M., Tao Q., Romeijn S.R., Chen Y., de Boer N.P., Grootjans W., Kruit M.C., Lelieveldt B.P.F., Jansen J.C., Hensen E.F., Staring M., Verbist B.M.

Keywords: vestibular schwannoma, segmentation, MRI, convolutional neural network

Short summary:

For the evaluation of vestibular schwannoma (VS) progression and treatment planning, accurate measurement from MRI is important. In clinical practice, manual linear measurements are performed from MRI. Manual 3D measurement is time-consuming and 2D measurement is subjective and reflects highly variable tumour volume poorly. We developed an AI model to detect and segment VS from MRI automatically.

Purpose/Objectives:

We present a model for the detection and segmentation of VS, based on deep learning and suited to process multi-centre, multi-vendor MR images. The model's performance is evaluated and compared to humans in an observer study.

Methods & materials:

In total 214 cases (134 VS positive and 80 negative) with gadolinium-enhanced T1 and native T2 weighted MR images were acquired from 37 centres and 12 different MRI scanners. The intra- and extra meatal parts of the tumour were manually delineated by two observers under supervision of an experienced head and neck radiologist. Cases were divided into three non-overlapping sets (training, validation, and testing). A model was trained using 3D no-new-Unet deep learning segmentation method. In addition, an observer study was performed, in which the radiologist blinded to case information and delineation method compared model and human delineations.

Results:

The model correctly detected VS in all positive cases and excluded the negative. Evaluation of the T1 model compared to the human delineation resulted in a Dice index 90.4 ± 13.0 , Hausdorff distance 2.12 ± 9.32 mm, and mean surface-to-surface distance 0.49 ± 1.52 mm. Intra and extra meatal tumour parts had Dice indices of 77.5 ± 21.3 and 82.2 ± 28.0 , respectively. The observer study showed that in 103 out of 111 cases (93%) the model was comparable to or better than human delineation.

Conclusion: The proposed model can accurately detect and delineate VS from MRI in a multi-centre, multi-vendor setting. As such, it is a robust tool well suited to the reality of clinical practise. The model performed comparably to human delineations in the observer study.

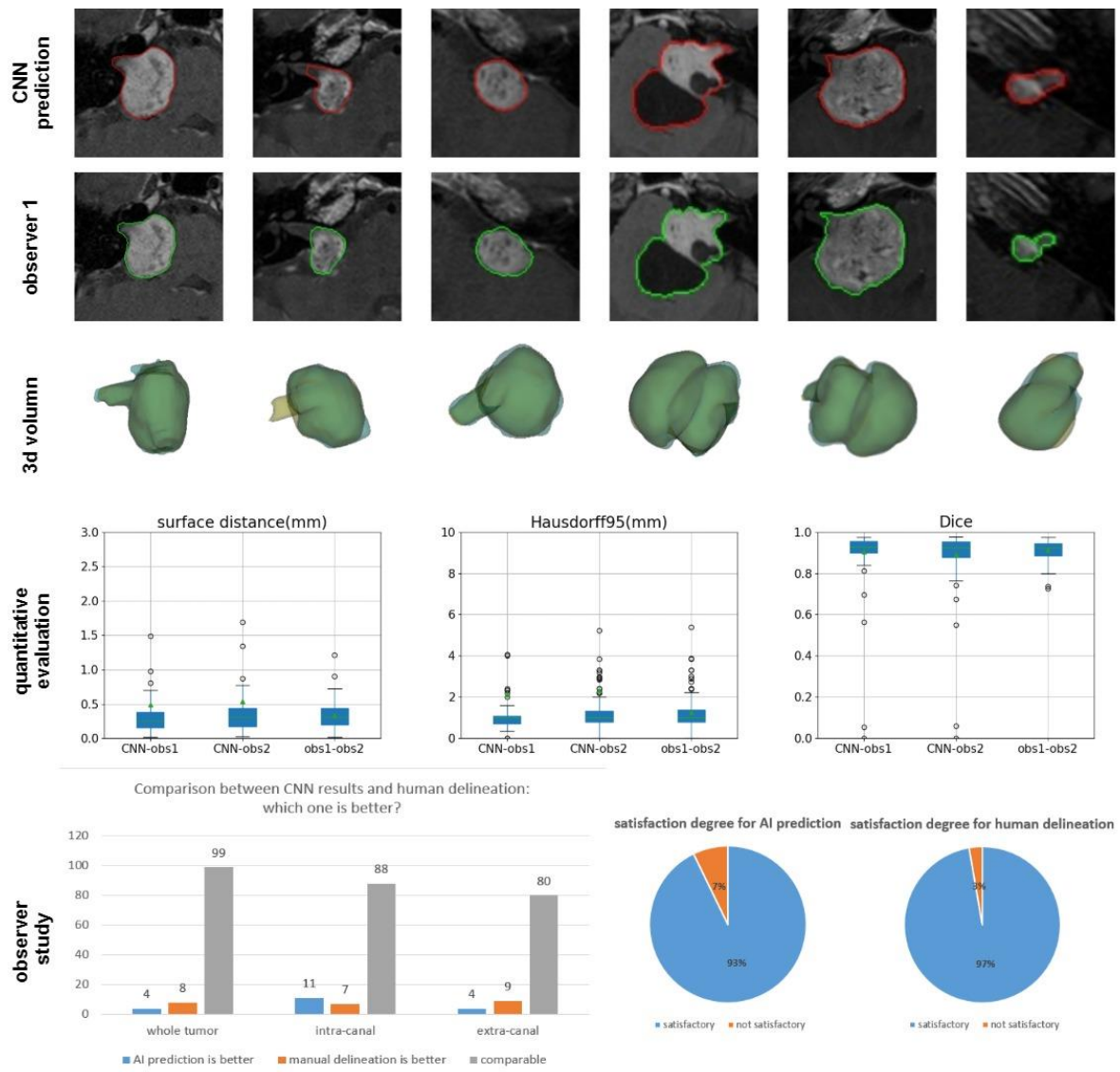


Figure 1. Six examples of VS segmentation by our AI model and the human delineation, together with the quantitative measures.