A study on extraction of ear canal shape using MRI

Shunsuke Tanaka, **Shohei Yano**, **Naoki Wakui**, **Naoki Kodama**

Electrical & Mechanical Systems Engineering Advanced Course, National Institute of Technology, Nagaoka College,888 Nishikatakaimachi, Nagaoka, Niigata, 940-8532, Japan

E-mail: ac32815w@st.nagaoka-ct.ac.jp

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Introduction: In our laboratory, we have developed an ear acoustic authentication system, which is a biometric authentication system. The System achieved personal authorization by using a build-in microphone to record a sound wave reproduced from an earphone and distinguishing the personal differences in sound person by person. [1)] And this system will be indispensable in the Internet society. However, the cause of the personal differences in reflected sound is unclear. Previous study measured the shape of the ear canal using a 3D scanner and investigate d where the differences in acoustic characteristics depend on that. The results from previous study suggested that not only the shape of the ear canal, but also the shape of the airway and the lungs located behind the tympanic membrane may be related to the acoustic properties of the ear canal. The purpose of this study, therefore, is to investigate the relationship between the sh ape of the ear canal and the acoustic characteristics of the organs deeper than the tympanic membrane by measuring the shape of the ear canal and the organs located behind the tympanic membrane using high-resolution 3D magnetic resonance imaging (MRI), which is a medical too l.

Experiments: The upper body and head measurements were performed on four men in their teens to 40s using a Canon Medical Vantage Galan 3T. A three-dimensional model of the external auditory canal shape was created using several methods based on the MRI images of the head obtained from the measurements. The 3D model was created using the software InVesalius.

Results and discussion: Figure 1 is a 3D model of the shape around the external auditory canal, which was g enerated using head image data. We attempted to gene rate a model of the shape of the periphery of the ear ca nal by hand masking on each side. Although we were able to extract a rough shape around the ear canal, we were unable to reproduce organs such as the tympanic membrane that could not be determined from the meas urement data in this study. In the future, we will exami ne the shape extraction method and create not only the shape of the ear canal, but also the shape of organs loc ated deeper than the ear canal from MRI images.

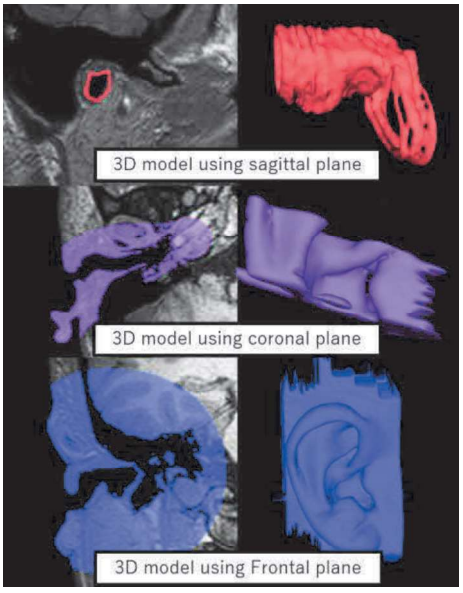

Figure 1. generative models

References:

1. Shohei Yano, et al., IEICE Transactions A, 161-168, 2017