

## Research highlights

### Sound interface with two microphones

In late years, the development of a human robot and the use of the portable information terminal become popular. Sound interface plays an important role in it. Sound interface is usually comprised of speaker (sound) localization, the sounds separation with the environmental sound, noise cancellation and sound recognition. Of these, our study focuses on the sound localization and sound separation.

About sound localization, in our binaural model shown in Fig.1, the sound source direction is represented by using the horizontal angle  $\alpha$  and the vertical angle  $\beta$ . Furthermore, the sound localization techniques by the binaural model using the Self-organizing map (SOM) shown in Fig.2 was proposed and correct answer 98.7% was obtained in the anechoic room.

On the other hand, for the sound separation in the true environment including the reverberations, a new method showing in Fig.3, which combining Independent Component Analysis (ICA) with the complex discrete wavelet transform, is proposed and verification of source separation in relation to the problems of permutation and scaling in the ICA are performed. Through comparison of the results according to the Signal Noise Ratio (SNR), the effectiveness of the proposed method is confirmed.

In this study, in order to achieve the sound interface with simple structure and high processing speed, two microphones were used. Furthermore, sound localization method using binaural model and the sound separation method by combining Independent Component Analysis (ICA) with the complex discrete wavelet transform were proposed, their effectiveness have been confirmed. In future, these methods will improve for true environment and achieve the sound interface.

Zhong Zhang, Kazuaki, Tetsuo Miyake, Takashi Imamura  
Three-Dimensional Sound Localization by Binaural Model Using Self Organizing Map  
International Journal of Innovative Computing, Information and Control, 6, 361–371, (2010)  
Instrumentation Systems Laboratory, Toyohashi University of Technology  
Profile of Zhong Zhang: (<http://www.tut.ac.jp/teach/main.php?mode=detail&article=67>)

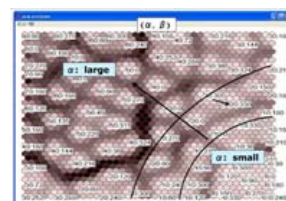


Zhong Zhang



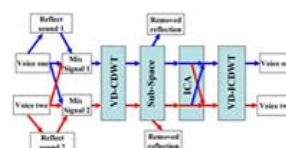
[Enlarge Image](#)

Fig. 1: Definition of sound direction in the binaural model



[Enlarge Image](#)

Fig.2: Example of SOM map of sound direction



[Enlarge Image](#)

Fig.3: Flow chart of sound separation by combining the independent component analysis (ICA) and the complex discrete wavelet transform