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THREE-DIMENSION SOUND LOCALIZATION BY BINAURAL MODEL USING SELF ORGANIZING MAP

Zhong Zhang, Kazuaki I, Tetsuo Miyake, Takashi Imamura

Instrumentation Systems Laboratory
Toyohashi University of Technology
Toyohashi, 441-8580, Japan
{ zhang; miyake; ima }@is.pse.tut.ac.jp

Satoshi Horihata

Laboratory of Physics, School of Dentistry at Matsudo
Nihon University
Chiba 271-8587, Japan
horihata.satoshi@nihon-u.ac.jp

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Abstract. *It is well known that there are many advantages in using two microphones in sound localization systems when applied to assist the hearing impaired and in humanoid robots. In this paper, we propose a novel sound localization method based on the binaural model, in which the feature differences of observed signals obtained from two microphones are used. In our method, first the feature vectors corresponding to the ratio of the observed signature power spectrum between both ears and the difference between the arrival times of the sound in both ears are learned based on the algorithm of Self Organizing Maps (SOM) and then the SOM of the 3-D sound source direction is created. The characteristic vector of the sound source is input into the SOM and the node that is the nearest reference vector to the input characteristic vector is estimated by searching for the winning node in the map's reference vector space, and the sound source direction corresponding to the winning node is output as the estimated sound source direction. Sounds from five kinds of objects from many directions were used to experimentally confirm the effectiveness of the method and a correct answer rate of 98.7% was obtained.*
Keywords: Sound localization, Self organizing map, Binaural model, Human interface, Humanoid robots

1. **Introduction.** Sound localization can be estimated in humans by using the time difference between both ears and also in how a sound is heard, when the sound is generated [1]. However, it is very difficult to create an estimation system by using a computer and two microphones. Research that uses three or more microphone arrays [2, 3, 4], research based on using the sound pressure information obtained from many microphones [5] and research that used the binaural model with two microphones [6] have been performed to estimate the sound source direction. In the case of a lot of microphones, the volume of information obtained from the microphones is greater than when using one or two microphones and a more accurate sound source direction estimation is possible. On the other hand, the structure of a system with two microphones is simpler, miniaturization is easier and signal processing is faster due to only having to process two channels. Therefore, two-microphone research has been quite active in recent years. So there are a lot of advantages in using two microphones in any sound source direction estimation system when applied to assist the hearing impaired and in humanoid robots.