# BLIND SOURCE SEPARATION BY COMBINING INDEPENDENT COMPONENT ANALYSIS WITH THE COMPLEX DISCRETE WAVELET TRANSFORM

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ABSTRACT. *It is well known that Independent Component Analysis (ICA) is a useful method for blind source separation although it does have some drawbacks, such as performing poorly on unsteady sounds. In this study, in order to improve this deficiency, a new method combining ICA with the complex discrete wavelet transform is proposed and its performance at source separation in relation to the problems of permutation and scaling in the ICA are investigated experimentally. Through comparison of the results according to the Signal Noise Ratio (SNR), the effectiveness of the proposed method is confirmed.*
**Keywords:** Independent component analysis, Wavelet transform, Sound source, Time–frequency analysis

1. **Introduction.** Recently, the demand for speech signals as a user interface for robotic applications, home electric appliances, and cellular phones has increased. Accordingly, the techniques of sound recognition, a noise reduction and other signal processing applied in a real environment are necessary. However, the performance of conventional sound recognition methods decreases profoundly when other sound sources exist in the real environment besides the object sound source. Therefore, it now becomes one of the problems that how to improve the sound recognition performance.

Generally, in a real environment, the prerequisites of sound recognition are that there are two or more sound sources, the location information is unknown and the observed signals are a mixture of the object sound source and other sound sources. For signals in which the object sound source is a voice and the other sound sources are noise, such as white noise, some de-noising methods have been proposed. As some examples of these methods, a wavelet thresholding method [1], adaptive digital filters [2] and adaptive line enhancers [3] have been proposed. However, when both the object sound source and other sound sources are voices, these example methods cannot separate the object sound source from other sound sources well. In this case, a sound source separation method called blind source separation based on Independent Component Analysis (ICA) has been used [4, 5]. The ICA is a statistical method which guesses the original signal from the mixture signal, even if the original signal and the transfer function are unknown, by assuming statistical independence of the object sound and other sound.