

Blind Audio Source Separation Based on Independent Component Analysis

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Abstract. This keynote talk describes a state-of-the-art method for the blind source separation (BSS) of convolutive mixtures of audio signals. Independent component analysis (ICA) is used as a major statistical tool for separating the mixtures. We provide examples to show how ICA criteria change as the number of audio sources increases. We then discuss a frequency-domain approach where simple instantaneous ICA is employed in each frequency bin. A directivity pattern analysis of the ICA solutions provides us with a physical interpretation of the ICA-based separation. It tells us the relationship between ICA-based BSS and adaptive beamforming. In order to obtain properly separated signals with the frequency-domain approach, the permutation and scaling ambiguity of the ICA solutions should be aligned appropriately. We describe two complementary methods for aligning the permutations, i.e., collecting separated frequency components originating from the same source. The first method exploits the signal envelope dependence of the same source across frequencies. The second method relies on the spatial diversity of the sources, and is closely related to source localization techniques. Finally, we describe methods for sparse source separation, which can be applied even to an underdetermined case.