

# Blind Decomposition of Binaural Mixed Signals Using Multistage SIMO-ICA

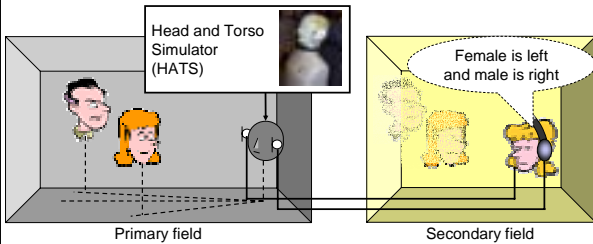
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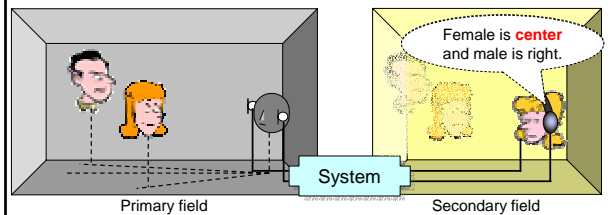
## Introduction (Binaural Sound Reproduction System)



Binaural sound reproduction system can copy the primary sound field.

However, This system can not enhance and modify the target audio signals.

## Research Goal



Realization of audio augmented reality system which can enhance and modify the target audio signals

## Application

- Telepresence (Telexistence) system using visual modality and audio modality

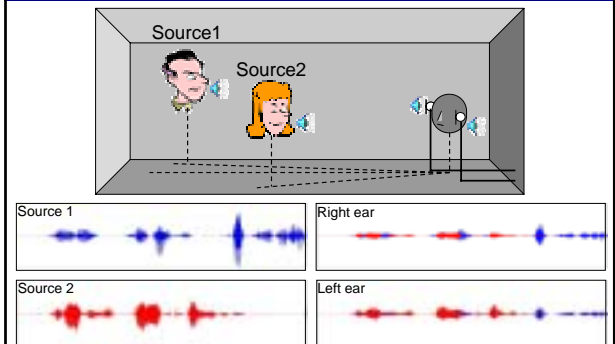


Robot

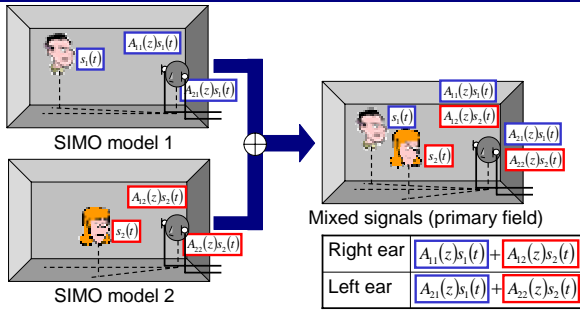


Operator (User)

## Mixing process (1/2)

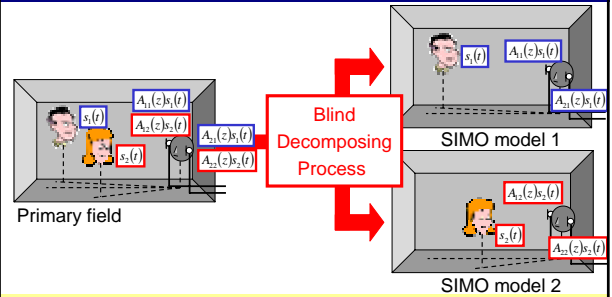


## Mixing process (2/2)



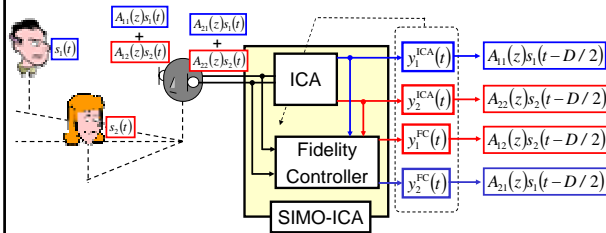
The mixed signals are sum of the SIMO-model-based signals.

## Approach



we have to decompose the mixed signals into the SIMO-model-based signals without a priori information.

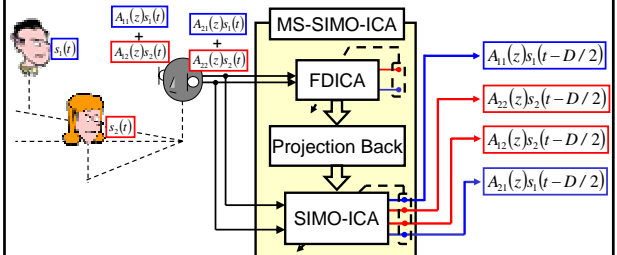
## SIMO-Model-Based ICA (SIMO-ICA) (IWAENC2003, Takatani et al.)



### • Problem of SIMO-ICA

The performance of SIMO-ICA depends on the initial value of the separation filter.

## Proposed Multistage SIMO-ICA (MS-SIMO-ICA) (ICASSP2004, Ukai, Takatani et al.)



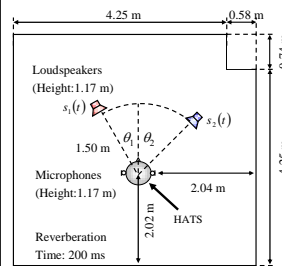
• FDICA and projection back generate the valid initial value of the separation filter of SIMO-ICA.

## Blind decomposition experiments of binaural mixed signals

In order to evaluate its effectiveness, decomposition experiments of binaural mixed signals are carried out for the different directions of sources.

- Conventional method: SIMO-ICA
- Proposed method: MS-SIMO-ICA

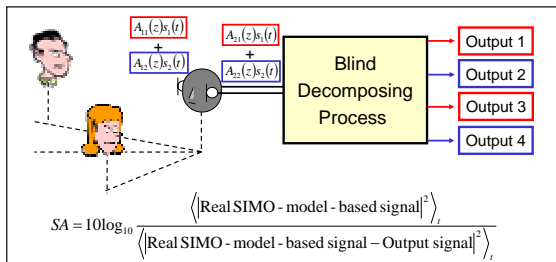
## Experimental conditions



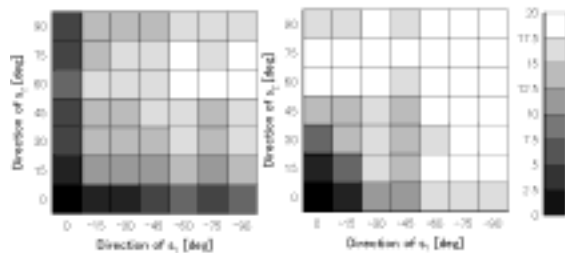
Sound source	2 male and 2 female (12 combination)
Sampling frequency	8000 Hz
Length of filter	1024 [taps]
Initial value of filter	Inverse filter of HRTF whose directions of sources are $\pm 60$ [deg]
Step size parameter	$1.0 \times 10^{-6}$ [taps]
Evaluation score	SIMO-model Accuracy [dB]

## Evaluation Score: SIMO-Model Accuracy (SA)

Similarity between the output signals of the ICA and real SIMO-model-based signals



## Experimental results



The performance of the outputs in the proposed method is superior to that in conventional method.

## Conclusion

- We propose a new blind decomposition using multistage single-input multiple-output (SIMO)-model-based ICA for audio augmented reality system.
- The proposed method can blindly generate the valid initial value of the separation filter in SIMO-ICA.
- The experimental results reveal that the performance of the outputs in the proposed method is superior to that in conventional method.