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SIGNAL ANALYSIS USING ICA

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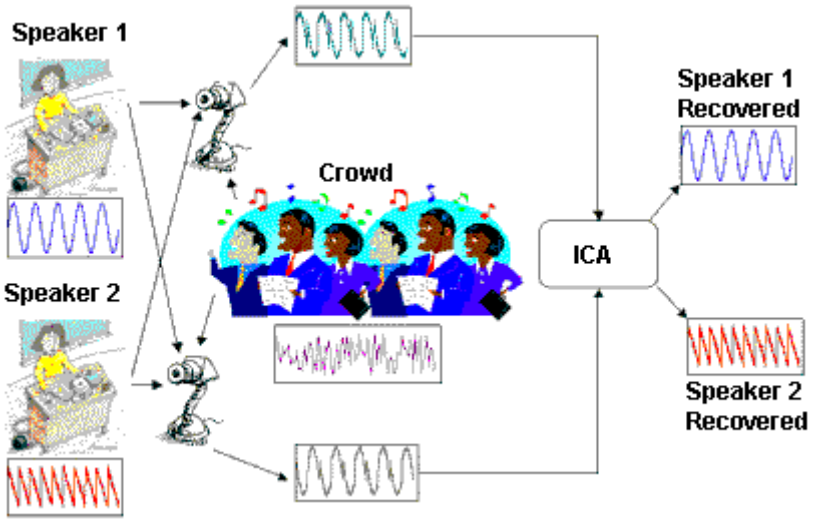
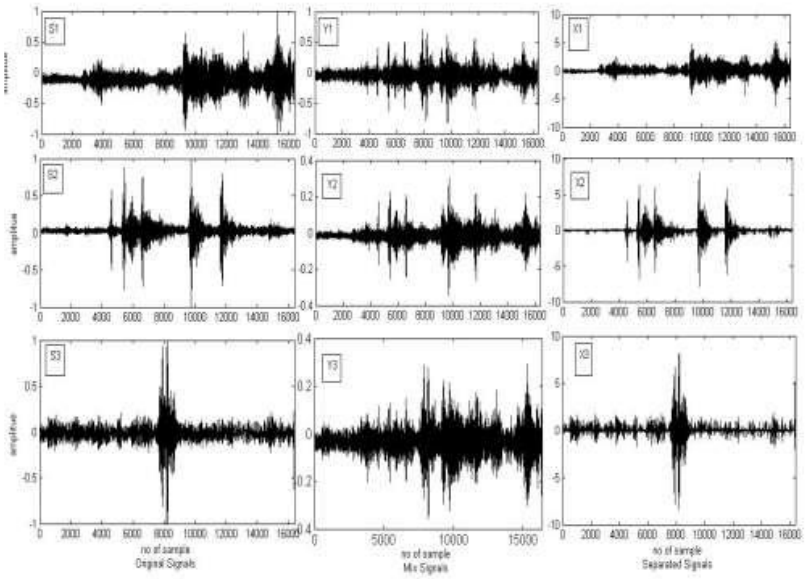
ABSTRACT:
Independent component investigation attempt to decompose a multivariate signal into independent non-Gaussian signals. As an example, sound is frequently a signal that is composed of the numerical addition, at each time t, of signals from several sources. The question then is whether it is potential to divide these contributing sources from the observed total signal. When the statistical Independent component analysis attempts to decompose a multivariate signal into independent non-Gaussian signals. As an example, sound is usually a signal that is composed of the numerical addition, at each time t, of signals from several sources. The question then is whether it is possible to separate these contributing sources from the observed total signal. When the statistical independence assumption is correct, blind ICA separation of a mixed signal gives very good results.A simple application of ICA is the "cocktail party problem", where the underlying speech signals separated from a sample data consisting of people talking simultaneously in a room. Usually the problem is cut down by assuming no time delays or echoes. Note that a filtered and delayed signal is a reproduction of a dependent component, and thus the statistical independence statement is not violated.



This figure represents how ICA works.

Implementation of ICA in our tool:
As of nowin our audio files we are identifying the different sounds in the audio with a near approximate also to get the correct words from a mixture of speakers takes lots of time and more reference and support to get the exact word. This type of resource spending can be minimized by using this new technology and helps us to save lot of time.

How is separation done in ICA: (mixture separation)

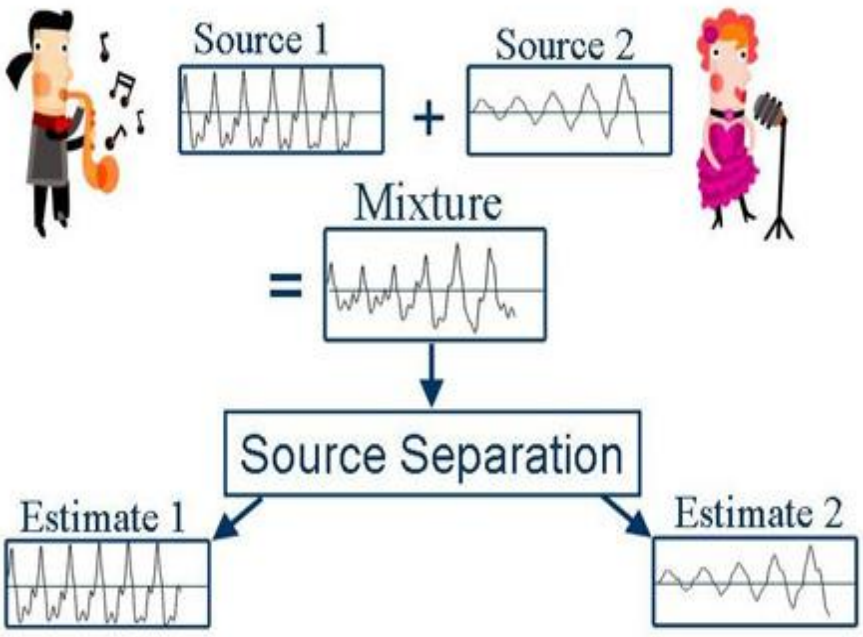


The original signals, their mixture and separation results by ICA

The basic model of ICA requirements several mixtures of independent components (ICs) as input signals. If number of sensors/channels is more than one their signals are adopted as immediate mixtures like ECG signals, fMRI signals and EEG signals. In the case of single sensor an interchange way is to consider as input matrix in the mixture of many signals which are reproduced by same process. This has been done by many scientists. These signals are mixed by 3x3 random matrixes whose elements are chosen from uniformly distributed random numbers within 0 to 1.Simulated signals are shown in figure in which the unique source signals are correspond to by S1,S2,S3 and mixture of these signals are denoted by Y1,Y2,Y3

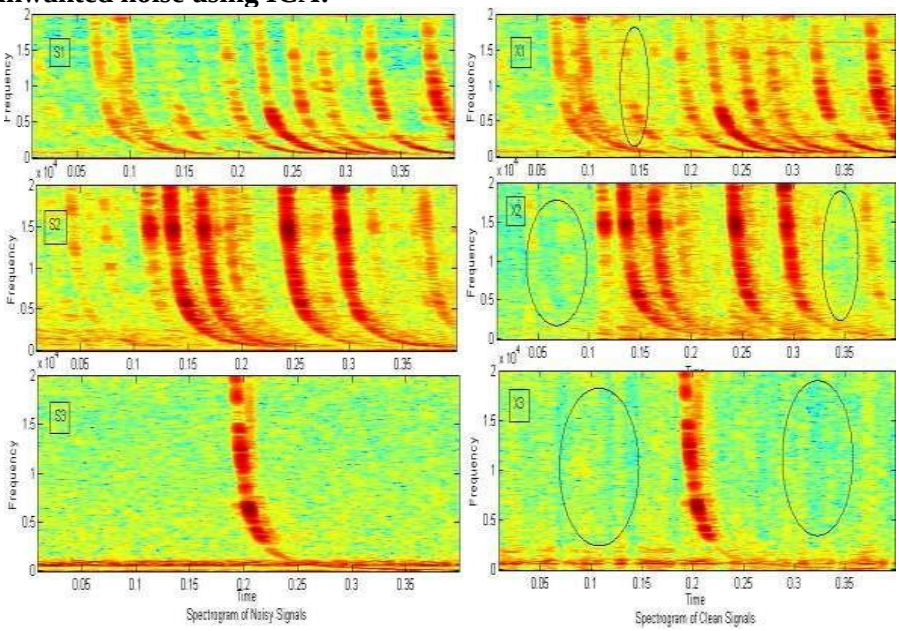
Separation of media noise in a mixture:
The separation of sound called media or any sound not from human can be separated using ICA, it works as a filter that we can separate the sound differentiating the sound with average human frequency and pitch as means and separate them, so that we get a filtered human voice without any disturbance .

Speech separation using ICA:



This is an example taken where two speakers named alice and bob are talking simultaneously when they are arranged into an audio file using the ica method they can be separated into two different module.

Elimination of unwanted noise using ICA:



The Spectrogram without ICA (right side) and with ICA (left side) of VLF signals (encircle area represents the enhancement and denoising).frequency in kHz and time in second.

In proposed method the mixture VLF signals have been preprocessed by FastICA and whitening signals were calculated. These white signals are feed as input in MFICA for denosing. The output of MFICA is the clean ICs. In this way we are getting noise free Independent components from the simulated mixture of VLF signals. Above diagram shows alienated and reconstructed signals(X1, X2, X3) estimated by the proposed method. It is clear from figure with the intention of used ICA algorithms retained the full shape of the VLF signals and remove superfluous noise as well as increase the amplitude of reconstructed signal. It is more apparent by the power spectrum density curve (PSD) shown in figure. that the shape of both PSD curve (with and without ICA) are similar only the amplitude of all frequencies greater than before .Not only that after the ICA treatment we found some sharp variation in the PSD curve that cannot be observed in the original signals PSD curves.

Uses of ICA:

- Separation of human voice from media voice
- Extraction of original audio signal of individual speakers from the mixture of speakers and reduce the noise to hear the voice clearly.
- Gender categorization by using ICA.
- Finding whether it is a native speaker or not.

CONCLUSION

In this paper, we have discussed the importance of signal separation and the challenges arising in this area. This paper reviews the essential researches carried out in the field of face recognition. It reviews the independent component analysis algorithms used for signal recognition.

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