

SOURCE SEPARATION TECHNIQUE

MAYANK SHARMA

ELECTRONICS AND COMMUNICATION,

¹MTECH (JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY), SOLAN(Wakhnaghat), INDIA

Abstract— in this paper signal separation with independent component analysis and principal component analysis. speech separation with independent component analysis .Independent Component Analysis (ICA) and principal component analysis , a computationally efficient blind source separation technique, has been an area of interest for researchers for many practical applications in various fields of science and engineering. This paper attempts to cover the fundamental concepts involved in ICA and pca techniques..

Index Terms— PCA, ICA, Blind source separation

I. INTRODUCTION

signal and speech signal separation based on Blind source separation.Signal separation with ica and pca and speech separation with independent component analysis. Source separation is a very typical problem of signal processing system. It is based on source separation technique. ICA provides a foundational mathematical approach for When presented with a set of observation from sensor such as microphone the process of extracting the underlying source is called source separation.

Many Application of signal separation.Signal are Denoising ,Defence ,Medical signal processing –(fMRI, ECG, EEG) , ,Compression, redundancy reduction Watermarking Remote Sensing (radar detection) [Aapo].

There are many approached for signal separation namely1) scatter technique 2)ICA technique 3) PCA Blind source separation (BSS) is a fundamental problem that is encountered in many sensible applications like telecommunications image/speech process, and medical signal analysis. where multiple sensors square measure concerned. In its simplest type, the dimensional observation vector is assumed to be generated, Many algorithm have been proposed for Blind source separation. Many algorithm have been used for source separation such as scatter based geometrical method(SCA), Independent component analysis (ICA), ,watershed transfoarm, AMMCA process, wavelet transform, Water Marking, Principal component analysis(PCA).scatter technique is a efficient technique for signal separation. Ica technique is a Second efficient technique for signal separation .PCA is not use for image separation .it is applicable of signal separation.it is not apply fourth order Moment. Principal component analysis (PCA) is a linear Transformation that is derived from the second order signal Statically (covariance structure),.Pca have been used first and second order moment's of the measure Data, It is fail for fourth order moment and depend on orthogonal data. Than we can prefer ICA for image separation.

–separation can be done from the combined different –images by using the proposed method with an acceptable residual error.

We observe some their merged signal then our aim is to recover the original signal From the merged signal with help of two algorithm (1) PCA method (2) Ica method(Independent component analysis).

II BLIND SIGNAL SEPARATION

Suppose many of the people speaking simunteniously .Each of the microphone located different places. Each of the microphone recorded weighted sum of the speech signal, separation of signal with help PCA .This is called a blind source separation Blind source separation (BSS) is a fundamental problem that is encountered in many sensible application like telecommunication image/speech process, and medical

Typical blind source separation way's request separation once the mixing process is unknown .

Blind source separation (BSS) is that methodology of separating different source signal from a gaggle of ascertained Signal –mixture with very little or no information on the character of those source signal (ICA) is used for locating Part from variable statically information and is one-amongst The various solution to the BSS

$$x_1(t) = a_{11}s_1 + a_{12}s_2 \quad (1)$$

$$x_2(t) = a_{21}s_1 + a_{22}s_2 \quad (2)$$

$x_1(t)$ and $x_2(t)$ are observed data

$$A = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \quad (3)$$

A =Mixing matrix

S=source signal

III PRINCIPAL COMPONENT ANALYSIS

Principal Component Analysis (PCA) is that general name for a way. That uses refined underlying mathematical principles to transforms variety of probable related to variables into a smaller number of variables referred to as principal components. The origins of PCA lie variable data analysis, however, it is a large vary of alternative applications, as we will show in due course. PCA has been referred to as , 'one of the most important results from applied linear algebra' and perhaps its most common use is as the first step in trying to analyses large data sets. Some of the other common applications include; de-noising signals, blind source separation, and data compression. The aim of this essay is to explain the theatrical side of Pca. Pca lie in multivariate data analysis .it has a wide range of other application. general terms Pca uses a vector spaces. Transfoarm to reduce the dimensionality of large data set using mathematically projection.

IV MATHEMATICAL ANALYSIS

Mean value for image matrix

Step1: A set of M images (I1, I2, I3...IM) with size N*N can be represented by column or row vector of size N2

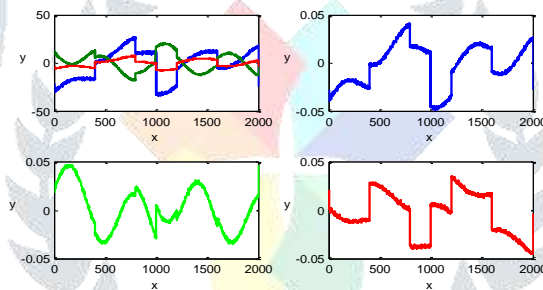
Step2: The average (μ) of the training set image is defined by

$$\mu = \frac{1}{M} \sum_{i=1}^M I_n \tag{4}$$

Step3: Each trainee image differs from the average image by vector (Φ) $\varphi_i = I_i - \mu$ (5)

Step4: Total Scatter Matrix or Covariance Matrix is calculated from Φ as follows: $c = \frac{1}{M} \sum_{i=1}^M \varphi$

SIMULATION



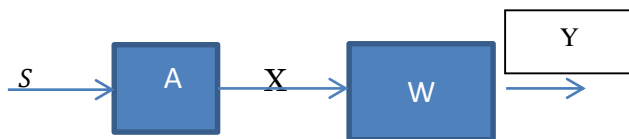
Fig(1) Signal separation with pca

V Independent component analysis

Independent component's are the maximally nonGaussian component .Another, very intuitive and important principal of ica estimation is maximum.non gaussianity.Independent component analysis based on blind source separation .The idea is that according to the central limit theoram sum's of non gaussianity random variable are closer to gaussian that the original one Assume that we tend to observe n linear mixture

$x_1 \dots x_2 \dots \dots x_n$ of n independent parts

$$x = a_1s_1 + a_2s_2 + a_3s_3 \dots \dots \dots a_ns_n \tag{6}$$



$$X = AS \tag{7}$$

X =Observable data
A= Mixing matrix

S= source signal

$$y = wx \quad (8)$$

The varied ICA algorithm separate source signal supported the principal of information maximization .mutual information step down ,maximum probability estimation and increasing non gaussianity.

Simulation result

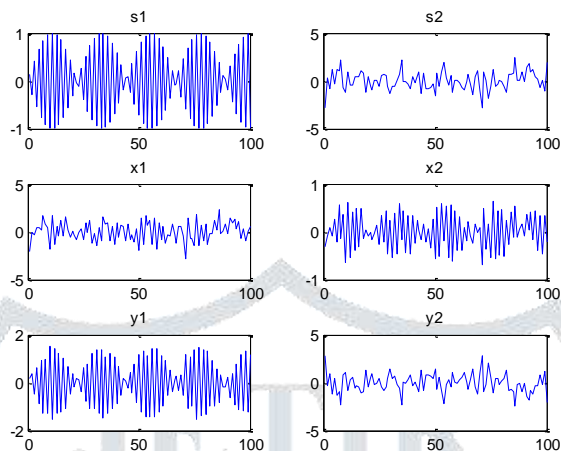
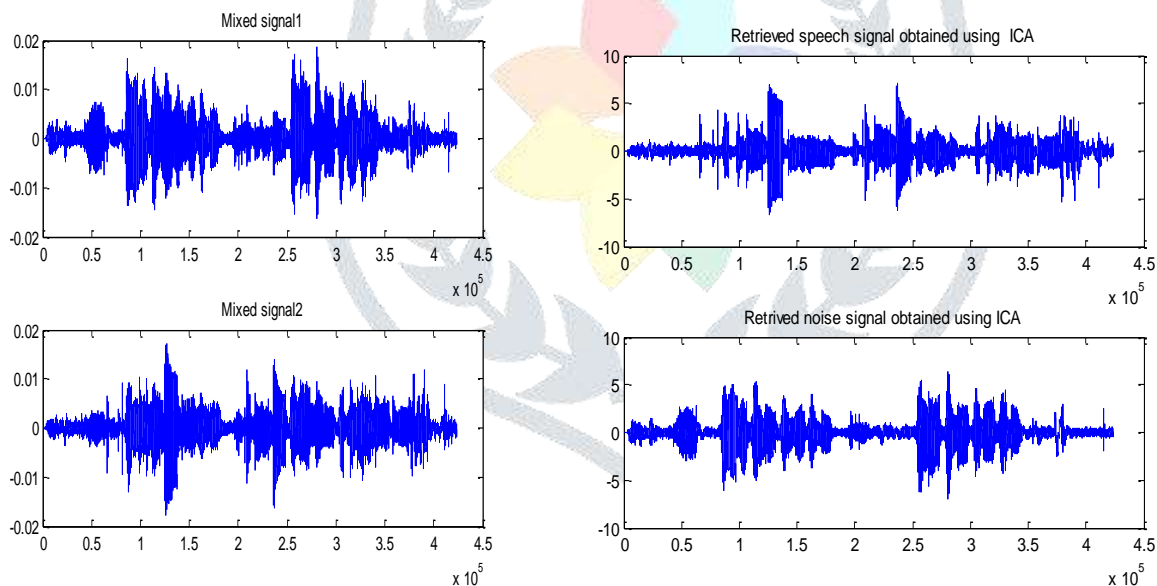
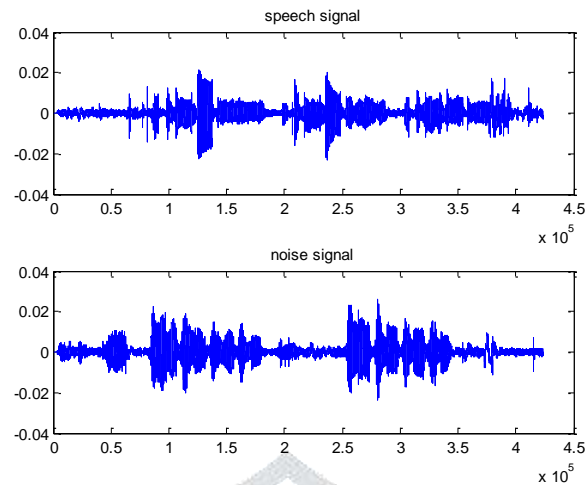


Fig Signal separation with ica

Speech separation with ica (cocktail party problem)





VI CONCLUSION

This paper has introduced the fundamentals of BS and ICA and PCA. The mathematical framework of the source mixing problem that BSS/ICA /PCA addresses was examined in some detail, as was the general approach to solving BSS/ICA./PCA As part of this discussion, some inherent ambiguities of the BSS/ICA framework were examined as well as the two important preprocessing steps of centering and whitening .ICA algorithm is good algorithm compare to PCA algorithm.

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