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SEPERATION OF SIGNALS SOUND BASED ON INTERFERENCE POWER CAUSED BY MIXING PROCESS

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ABSTRACT

A new extension signals source separation (SSS) method based on time-frequency T-F information to extract two sound signals from two linear instantaneous mixtures of these sources. In the present paper, we give the extension of the latter method LI-TIFROM , give experimental results concerning mixtures of induction motor signals, thus showing that this approach yields variation in the interference performance caused by recording and special mixing process.

Keywords- *signals sound separation. Single-Source TF Zones, polar of transition matrix and source to interference ratio.*

I. INTRODUCTION

The TIFROM method is a new member in the Blind source separation (BSS) method, is a technique for estimating individual source components from their mixtures at single or multiple sensors we don't use any other or little information besides the mixtures. As stated in [1] , its ability of practical application is more important, beside an objective in a basic BSS problem is to extract unknown source signals that are mutually independent from the observed signals obtained from the sensors ,the TIFROM method discusses how can estimate the elements of the mixing matrix , by measures contribution of other sources and estimate one source, when operated with the different parameter values specially in mixing matrix or mixture parameters.

II. BSS BASED ON SINGLE-SOURCE TF ZONES

An approach achieves complete or partial BSS method among the linear instantaneous on time-frequency ratios of mixed signals, it automatically determines the single-source TF areas to detects and identifies the corresponding parts of the mixing matrix, depending on the numbers of sources, observations N and P number of visible sources .Instantaneous mixtures that reported in the literature corresponds to the model from the previous works,

see([1],[2]):

$$Y = A X \qquad (1)$$

Where:

Y: is a matrix with the recorded microphone , A is mixing matrix. and X is a matrix with the independent source signals.

The model define microphone records is a linear combination of the same source signals and the noise free Linear instantaneous possibly undetermined mixtures case ,in condition of mixing coefficients aij �, 0, as reported in[1]. By modify the model in eq(1) in the TF domain using short time Fourier transform (STFT) ,were expressed fully or clearly in previous work [2] process of detection and identify parameters and information of mixture source show in fig(1), it contains three stages ,where the efficiency of the algorithm has been improved by FFT expression as

Decompose the wav.files to mat. file (array)

$$s(t) \xrightarrow{STFT} x_i(t,\omega), \qquad (2)$$

Mixing process of Decomposition

$$\sum_{j=1}^{N} A x_i(\omega.t) = S_i(t,.\omega), \qquad (3)$$

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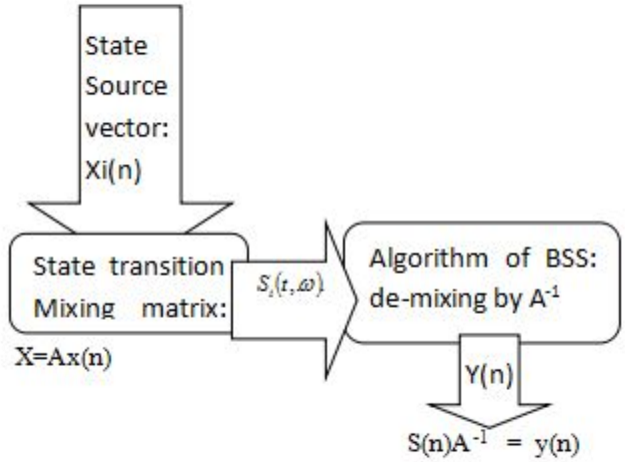
De-mixing Algorithm

$$S_i(t,.\omega).A^{-1} = y(t,\omega) = y(n) \qquad (4)$$

Investigation using above equations and previous theory of BSS can be presents an approach in diagram in figure 1



Theorem of LI-TIFROM is based on a time-frequency (TF) analysis .that it performed by source vectors state detection with mixing process using state transition matrix (A). Figure (1) shown stages which identify TF zone and estimating a column of the mixing matrix for each of the above TF zones and according to investigation in [6] ,the source $S_i(t,.\omega)$. is isolated in a single-source analysis zone $(t,.\omega)$. if all the sources except $S_i(t,.\omega)$. are null in $(t,.\omega)$. and the source is visible if there exists at least one TF zone where it is isolated. Due to the investigation [3] the TIFROM algorithm uses a series of minimum variances of the ratios of the mixed signals in the TF domain taken over the selected windows for the estimation of the column vectors of the mixing matrix.

The problem is however solvable to estimating columns of the mixing matrix in these zones which based on the complex ratio of the mixtures in the TF domain. It is important to assume or concerns mixing matrix A in specific mixing matrices, to performing variance analyses. Factorization and parameterization of the mixing matrix refer to polar of transition matrix and beformed by $T : R^n \rightarrow R^n$ is symetric linear transform in two dimentionn, see([4],[7])

$$A = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \qquad (5)$$

Where the vectors of matrix A in right –handed in condition of $a_{11} / a_{21} \neq a_{12} / a_{22}$, which it equivalent to coordinate rotated ,similar to the Cabibbo angle represents the rotation by angle in range of $0 \leq \theta \leq 2\pi$ [4,7] as

$$A = \begin{bmatrix} r\cos\theta & -r\sin\theta \\ r\sin\theta & r\cos\theta \end{bmatrix} \qquad (6)$$

Where $,a_{11} = a_{22}.,,,\_and,a_{21},a_{12} \leq a_{11}$

Since: $\|A\| = r \leq 1$

Consider a TF window $(t,.\omega)$. where only source S_i occurs the complex ratio from previous theorem reported in [5]:

$$\text{Since} \quad \alpha(t,\omega) = \frac{a_{11}}{a_{21}} \tag{7}$$

When the number of measurements is two, the columns of the mixing matrix can be given as:

$$\mathbf{a}j = [\cos(\theta j), \sin(\theta j)]^T \tag{8}$$

In previous work [10] investigated that the columns are of unit norm, that was consistent with the indeterminacy on the scale factors of the sources in the SSS and BSS problem, to find **A** is enough to estimate the angles θj , $j = 1, . . ., m$.

And the angles θj could have any value in the range $[0, 2\pi]$.

III. RESULTS & DISCUSSION

The experiment results were performed with signal sources of two induction motors ,Transfer Water Pump ¼ in and Electric Drill Motor. Formatted in wav- type , in equals of Bit rate 176.4 Kbps and sampling rate of , 11.025 KHz -Bit depth 16 bits . The LITIFORM software that it available at [9], was performed in MATLAB 7.5 and oriented to achieve a time-frequency analysis and it performed by the followings stages of :

Mixing stage of two sources process (N=2) with the sample frequency rate (fs=20000), the mixing matrix according to equation (6) , parameters are chosen in a different values of θ (rotating angle of coefficient mixer vectors),that it involve strong and weak mixture parameters . Separation stage by computation number of samples which overlap in STFTs using size N_{STFT} (128) , number of windows (4) and smoothing with 75% overlap.These stage briefly using to detect TF single-source zones and identify the columns of B.

In previous works reported in [1,6.8] the performance of separation stage by computation of the true contributions between the mixing matrix A and observer sources S, the computation of the contributions achieved by signal to interference ratio SIRs , (SIR^{out}) computing for separation quality. The procedure of experiment achieved by selecting more parameters in mixing stage provided by LITIFORM as extended approach work. We considered sources and observations in equal (N= P=2) for determined mixtures. Configuration with two mixtures of two sources with different inputs in mixing stage provided in LITIFORM functions according to previous stages. The separation process quality performance achieved by the SIR_{out} and SIR_{in} mixture rate and we shown variation due different entry values of θ .as shown as table (1) .

Tables(1)

Test-N o.	Angle Θ	r=0.4		r=0.9	
		SIR_{in} dB	**SIR_{out}** dB	**SIR_{in}** dB	**SIR_{out}** dB
1.	0	Inf	NaN	Inf	NaN
2.	2.5	27.1	28.7	27.1	28.7
3.	12.5	13.1	35.8	13.1	35.8
4.	22.5	7.6	38.6	7.6	37.0
5.	32.5	3.9	40.6	3.9	40.6
6.	42.5	0.7	42.3	0.8	42.3
7.	52.5	-2.3	42.7	-2.3	42.7
8.	62.5	-5.7	44.2	-5.7	44.2
9.	72.5	-10.1	45.9	-10.1	45.9
10.	82.5	-17.6	46.6	-17.6	46.6

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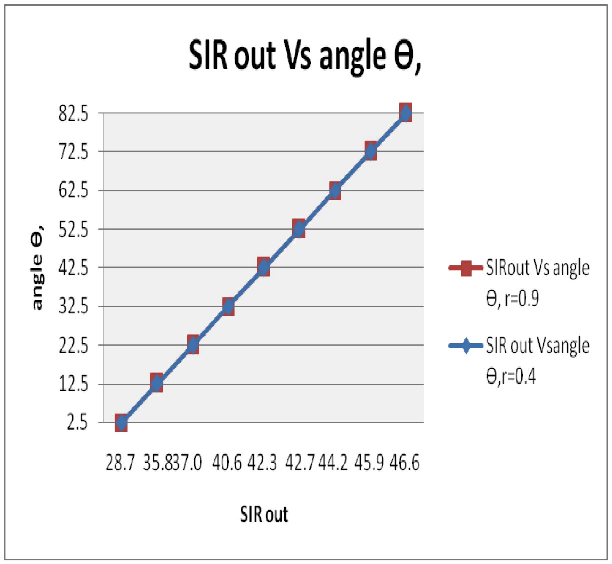

Fig(2) quality of seperation by SIRout Vs angles Θ of mixer matrixes.

The results of (SIR) in first row appear in table (1) are not real or complex numbers with a special value (NaN) and these result from operation of (SIR_{in}) which have undefined numerical results(inf). infinity results from operation of (SIR_{out}) ,which were caused by Θ=0 or 90 and these results matching to assumption in [2] that defined the mixing matrix A in condition of $a_{ij} \neq 0, \forall i, j$ and the power of each source is non negligible at least some times t. The results with Θ =82.5^0, optioned high value of SIR (46.6 dB).

Investigation of this an extension work based on the relation of SIR s virus angle between each mixing vector and it's axis as actual mixing vector were presented in Fig(2) , the separation performance through computing the source to interference ratio (SIR) vs mixing matrix entering with rotating vector shwon SIRs are in linear proportional to Θ for each SIR_{out} refer to separation quality and SIR_{in} for parameters of mixture rate . Where interference may include other signals or noise caused by recording or mixing process.

IV. CONCLUSION

In this paper, we proposed a simple method to detect more parameter in sound signals separation from two linear instantaneous mixtures , as extension of the time–frequency of ratios of mixtures of source signals . We formulated the problem based of linear instantaneous BSS in determine case by assumed that mixing matrix or transition matrix in polar, we showed the rotation of mixing matrix vectors how could been effected on signal to interferance ratio and in contrbiotion of estimated mixng matrix . It is clear from the experiments that Θ affected the performance of SIRs, these effects are in conformity with theoretical relations.

Our future investigations will be concern to study the angle between orignal sources and estimated source by increasing the sound sources, may be will obtaining good values or high quality in BSS results.

REFERENCES

1. *Frederic Abrard &Yannick Deville ,Extension of the "TIme-Frequency Ratio Of Mixtures" blind source separation method to more than 2 channels ,University of Paul Sabatier.*
2. *Yannick DEVILLE1 and Matthieu PUIGT, Temporal and time-frequency correlation-based blind source separation methods.*

3. *Evangelos Roussos Wolfson, Bayesian (201)2Methods for Sparse Data Decomposition and Blind Source Separation ,College University of Oxford A thesis submitted for the degree of Doctor of Philosophy Trinity Term.*
4. *Sanjit K.Mitra,Digital signal Processing-A computer Based approach, University of California*
5. *M.Zibulevsky, B.A. Pearlmutter, Blind source separation by sparse decomposition in a signal dictionary. Cambridge University Press, Cambridge, 2000.*
6. *Frederic Abrard &Yannick Deville A time–frequency blind signal separation method applicable to Underdetermined mixtures of dependent sources.*
7. *Graybill, F. A. 1983. Matrixes with applications in statistics. Belmont, Calif.: Wadsworth. .*
8. *Thon, K. 2007. A comparative study of algorithms for blind source separation in the instantaneous linear mixture model. Universitetet i Troms\o.*
9. *http://www.ast.obs-mip.fr/bss-softwares.*
10. *A. Hyv¨arinen, J. Karhunen, and E. Oja2001., Independent Component Analysis. John Wiley & Sons.*