RESEARCH ARTICLE OPEN ACCESS

Co-Prime Sampliers and Arrays Research Assignment

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Abstract
There is a new technology to estimate the line spectra of multiple different processes as the sum of sinusoids buried in noise and DOA of narrow band signals to the array of antenna. In some technique we can construct a positive semi definite matrix.
This paper will discuss the three journals done by Vaidyanathan, P.P. All the work is related to the digital signal processing. The three articles which have been evaluated in this paper are "Co prime sampling and the music algorithm,", "Sparse Sensing With Co-Prime Samplers and Arrays," and "Theory of Sparse Co prime Sensing in Multiple Dimensions,".
Overview of these articles have been provided along with the problem which has been addressed in the three articles as well as the solution which has been provided in the above given three journals.

I. INTRODUCTION

In recent years, a lot of new technology has been applied in the real life. Finding or estimating the source of multi-signals is became an important field to search and build new techniques to fit with huge demanding to this issue.

From multiple sources that I have looked at I found very good techniques and researches that can help and solve problems in this matter.

In my research, I didn't find many things regarding the coherent case, so this case did not get enough attention from the scientists or researchers.

In this research assignment, I will try to present more complete picture of the analyses and techniques that we need in this issue.

II. OVERVIEW

Below is a very brief overview of what the three journals are about and what they provide means which topic has been discussed.

Journal 1: *"Co prime sampling and the music algorithm"*

By: Pal, P.; Vaidyanathan

Journal "Co prime sampling and the music algorithm," focuses on the line spectrum and provides a completely new approach to the line spectrum.

Journal 2: *"Sparse Sensing With Co-Prime Samplers and Arrays"*

By: Pal, P.; Vaidyanathan

Journal "Sparse Sensing with Co-Prime Samplers and Arrays" focuses on the concept of co-prime sensor arrays and co-prime sampling which are introduced recently for the one dimensional (1-D) array.

Journal 3: *"Theory of Sparse Co prime Sensing in Multiple Dimensions,"*

By: Pal, P.; Vaidyanathan

Journal 3 "Theory of Sparse Coprime Sensing in Multiple Dimensions," focuses on the sampling of temporal or spatial wide sense stationary (WSS) signals. This has been done using the co-prime pair of spare samplers.

III. PROBLEM STATEMENT

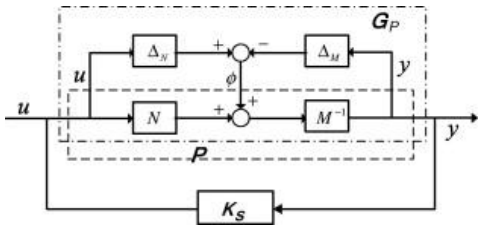
Consider a uniform linear array composed of p identical sensors. Let q ($q < p$) narrow-band plane waves, centered at frequency, impinge on the array from directions.

It has been seen that the generation of co-prime integers known as the pairs of integer matrices is a major and focal mathematical problem and has been addressed by many of the researchers in a different way and provides different ways to solve this problem.

Below is the figure for a similar problem but it deals with the issue of robustness in the co-prime integer matrices.

The later section would evaluate the methods which have been used by the three journals "Coprime sampling and the music algorithm,", "Sparse Sensing With Co-Prime Samplers and Arrays," and "Theory of Sparse Co prime Sensing in Multiple Dimensions," by Pal, P.; Vaidyanathan

Figure 1
Co-prime Robustness Issue



IV. EVALUATION AND ANALYSIS

This section would evaluate the three journals one by one and would see that what issues have been addressed and what are the solutions provided for the problems.

Journal 1: *"Co prime sampling and the music algorithm"*

By: Pal, P.; Vaidyanathan

Journal "Co prime sampling and the music algorithm," proposes a new approach which is been done using the co-prime samplers. It provides a super line spectrum which has been estimated using two techniques and measure.

One is the temporal domain and second is the spatial domain.

The sample spacing for the two samplers used is NT and MT and they are equal and uniform in nature. In this N and M is used as the co-prime value while T corresponds to the dimension of time or you can say space.

By taking into account the different sample spacing pair of co-prime (in second order moments this sample spacing difference arise naturally) as well as the different sample locations which are calculated to be O(MN) of the consecutive multiples of T.

These can be generated and obtained through the use of O (M+N) physical samples. Based over the idea of spatial smoothing, a new novel algorithm has been proposed.

This new algorithm is aimed at using the O (MN) virtual samples effectively using the co-prime.

According to the article *" This technique allows us to construct a suitable positive semi definite matrix on which subspace based algorithms like MUSIC can be applied to detect O(MN) spectral lines using only O(M + N) physical samples."*

Journal 2: *"Sparse Sensing With Co-Prime Samplers and Arrays"*

By: Pal, P.; Vaidyanathan

Journal "Sparse Sensing with Co-Prime Samplers and Arrays" highlights that the co-prime sensor arrays as well as the co-prime sampling have been introduced for the one dimensional (1-D) case.

It has been observed that sampling of a wide range sense stationary signal can be done sparely through the use of co-prime arrays pair. Latterly at the significantly denser set of points, correlation can be reconstructed.

It has been seen that all the applications which uses this property of correlation always benefit from this property and take the best out of this technique.

According to the article *"...First several properties of co arrays of lattices are derived. It is shown how one can get dense co arrays from sparse arrays on non rectangular lattices…"*

Journal 3: *"Theory of Sparse Co prime Sensing in Multiple Dimensions,"*

By: Pal, P.; Vaidyanathan

Journal 3 "Theory of Sparse Co prime Sensing in Multiple Dimensions," uses the co-prime pair of sparse samplers in order to produce the sampling of temporal or spatial wide sense stationary (WSS) signals.

It has been seen that a number of applications as well as properties for the co prime samplers have been developed. In the journal there is firstly taken a simple uniform spatial samples which have M and N sensors.

It has been seen that M and N are the co-prime which have some sort of appropriate inter-element spacing.

The freedom which has been observed between the co-arrays is O (MN). It has been seen that this freedom can be exploited with the help of the beam forming and also in the direction of the arrival estimation.

According to the journal *"...co-array based method for estimating sinusoids in noise offers many advantages over methods based on the use of Chinese remainder theorem and its extensions…"*

This paper relates to the digital image processing because it highlights all the important techniques which has been implied by the three most important and prominent journals done by Vaidyanathan, P.P.

The three articles which have been evaluated in this paper are "Co prime sampling and the music algorithm,", "Sparse Sensing with Co-Prime Samplers and Arrays," and "Theory of Sparse Co prime Sensing in Multiple Dimensions,".

This research paper analysis that in digital image processing how the algorithms works and how these techniques help in understanding the usage of the digital image processing algorithms. The digital image processing which has been analysed is the music algorithm.

Music algorithm basically analysis's the frequency in the signal. It performs an eigen

decomposition. It is also observed that digital image processing has a number of advantages over the analogy image processing.

This paper thus revolves around the techniques of algorithm used in the image processing techniques particularly for the digital systems.

The paper discusses the new idea which has been proposed by Vaidyanathan, P.P. as he also proposes a new approach which is been done using the co-prime samplers. It provides a super line spectrum which has been estimated using two techniques and measure.

V. CONCLUSION

It has been observed that the MUSIC algorithm defined in the journal *"Co prime sampling and the music algorithm"* can be applied to construct some sort of suitable positive semi definite matrix.

This will then help to detect the O (MN) spectral lines using only O (M + N) physical samples.

Secondly it has been observed that the beam forming applications are suitable for the Multidimensional DFT filter banks.

These can be used in commuting the co-prime lattice array. In the journal *"Sparse Sensing with Co-Prime Samplers and Arrays"* commuting co prime matrices called adjugate pairs are the part of the family. These are explained in much detail in the article.

In the third journal "Theory of Sparse Co prime sensing in Multiple Dimensions," make use of the filter bank. It considers two filter banks M-point DFT as well as the N-point DFT.

They are used at the output of the two sensor points and arrays.

REFERENCES

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