IMPINGING SIGNAL ESTIMATION OF MINIMUM VARIANCE METHOD USING UPDATING WEIGHT

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Abstract— This paper study on estimation signals of the wireless channels. We propose new algorithm in order to esitmation desired singal correctly to remove noise signal and interference supression. Proposed algorithm is to combine minimum variance method with updating weight value. Minimum varinace method, form constrained 1, is direction-of-arrival estimation algorithm. We obtain updating weight of minimizing error signal using lagarge multiplier. We search the signal direction taht we want to estimate substituting updating weight in minimum variance method. Through simulation, we compare proposed algorithm using both minimum varinace method and updating weight with the traditional MUSIC algorithm. Numerical results demonstrate the superior performacne of the proposed algorithm relative to the gerneral MUSIC algorithm.

Index Terms— Minimum variance, Updating weight, DoA, Array antenna.

I. INTRODUCTION

In this paper, our goal are to extract the signal of interest in the presence of interferers and noise signals. Estimating of signal position has been widely researching to apply in radar, sonar and wireless communication. Desired signal can be estimation from spatial spectrum of radiation field. Direction-of-arrival(DOA) estimation methods are parametric and nonparametric. Parametric methods are classical method and linear prediction [1]. Nonparametric methods are minimum variance, MUSIC, and ESPRIT. Received signals on array antenna are consisting of a desired signal, noise signal and interference signal because of multipath in wireless communication. If received signal on array antenna have interference and noise signal, it is difficult for desired signal to estimate correctly. This paper studied to estimate desired signal using both DOA algorithm and array antenna. DOA estimation of MUSIC and ESPRIT algorithm are superior to resolution. Algorithm such as MUSIC and ESPRIT increase processing time and computational complexity because of using eigen decomposition. We discuss DOA estimation algorithm to estimate desired signals correctly. Proposed algorithm is to combine minimum variance method and updating weight algorithm. Minimum variance method can decrease signal processing time because of not doing eigen decomposition. This algorithm is not good at performance of angle resolution because it is difficult for optimum weight to find while gain constraint is one. In this paper, we study about proposed algorithm which combine minimum variance method with updating weight algorithm.

II. PROCEDURE FOR PAPER SUBMISSION

Minimum Variance is called Maximum-Like-Hood (MLH), and the method is proposed by Capon. This method is to find minimizing weight value of total output spectrum by maintaining gain of incident direction. This is achieved by removal about noise and interference signal from other direction. We have uniform linear array with M array elements, separated by a distance$d$, and K narrow band sources signal on array antenna. Array output can be written as follow[2]

$$\mathrm{y(t)} = \mathrm{W}^H X(t) \quad (1)$$

Here $\mathrm{X(t)}$ and W^H denote receive signal and weigh vector, respectively. Out power is as follow

$$\mathrm{P} = \mathrm{E}[|y(t)|^2] = W^H R W \quad (2)$$

When incident direction of gain is 1, constrained can be as follow

$$W^H a(\theta) = 1 \quad (3)$$

Output spectrum using Lagrange multiplier is as follow

$$\mathrm{P}_{MV} = \frac{1}{|a^H(\theta)R^{-1}a(\theta)|} \quad (4)$$

Array antenna of output covariance matrix can be written as follow

$$\mathrm{R} = \mathrm{W}^H E[x(t)x^H(t)] = W^H R_{ss} W \quad (5)$$

Where $\mathrm{R}_{ss} = E[s(t)s^H(t)]$ denotes signal correlation matrix. Linear constrained minimum variance method is to find optimum weight to minimize output power with taking gain(G) and phase(θ) about desired signal. The signal direction error that we want to estimate is as follow[3-4]

$$\mathrm{e(m)} = \mathrm{d}(m) - \mathrm{y(m)} = \sum_{q=0}^{M} w^*(q)\, e^{-j\,2\pi q d cos\theta/\lambda} \quad (6)$$

Where $\mathrm{d(m)}$ is denotes reference signal. The error is can be written as follow

$$\mathrm{Z} = \sum_{m=i_1}^{i_2} |e(m)|^2 \quad (7)$$

This is achieved by maintaining the gain of the array antenna along the DOA. Constrained is as follow

$$\sum_{q=0}^{M} w^*(q)\, e^{-j\,2\pi q d cos\theta/\lambda} = 1 \quad (8)$$

The objective of the weights is to minimize the cost function, Z, formed through the Lagrange multiplier.

$$\mathrm{Z} = \sum_{m=N+1}^{I} |e(m)|^2 + \eta\left(\sum_{q=0}^{N} w^*(q) e^{-j2\pi q d cos\theta/\lambda)} - 1\right) \quad (9)$$

Where I and η note the number of time samples and complex constant, respectively.

$$Z = \sum_{m=N+1}^{I} \left| \sum_{q=0}^{M} w^*(q)\, e^{-j\,2\pi q d cos\theta/\lambda} \right|^2 + \eta\left(\sum_{q=0}^{N} w^*(q) e^{-j2\pi q d cos\theta/\lambda)} - 1 \right) \quad (10)$$

By minimizing the cost function of the weight, it is as follow

$$\frac{\partial Z}{\partial w^*(q)} = 2\sum_{m=N+1}^{I} e^{-j\,2\pi q d cos\theta/\lambda} \left\{ \sum_{p=0}^{N} w(p) x^*(m-p) \right\} + \eta\, e^{-j2\pi q d cos\theta/\lambda)} \quad (11)$$

The optimum weight vectors are given by

$$W = -\frac{1}{2}\,\eta\, R^{-1}\, a(\theta) \quad (12)$$

Substituting equation (3) in equation (12) results in

$$\eta = \frac{-2}{a(\theta)^H R^{-1}\, a(\theta)} \quad (15)$$

III. SIMULATON

We analyze on the performance to compare traditional MUSIC and proposed algorithm. Simulation condition is an array elements 9, elements separated by half wavelength, signal to noise ratio 20dB, snapshots 150. We estimate desired signal at the direction [-5°, 5°]. Fig.1(a) showed about estimated signal by traditional MUSIC algorithm. Fig. 1(a) didn`t estimate for desired signal of the direction [5°].Fig.1(b) showed about estimated signal by proposed algorithm. Fig. 1(b) correctly estimate for desired signal of the direction [-5°, 5°].

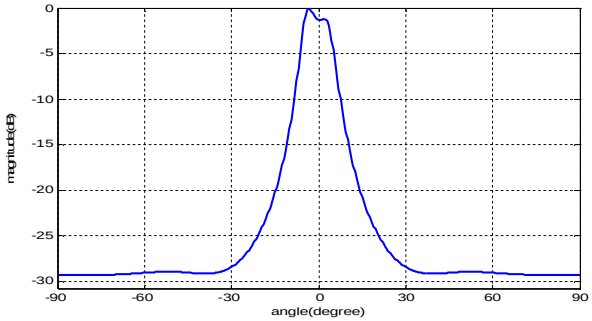


Fig.1 DoA of traditional MUSIC algorithm

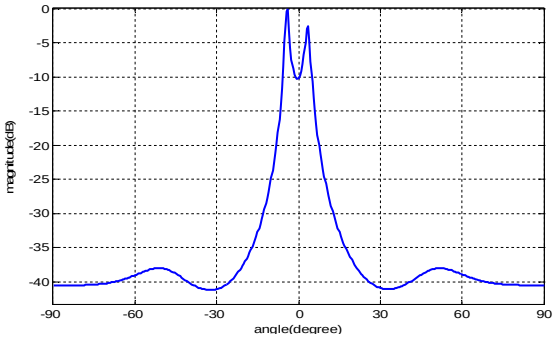


Fig.2DoA of Proposed algorithm

CONCLUSION

We studied DOA estimation algorithm to estimate desired signal correctly. The proposed algorithm is to combine minimum variance method and updating weight. We have analyzed comparative performance both proposed algorithm and traditional MUSIC algorithm. Traditional MUSIC algorithm is not estimationtoward two source direction, but proposed algorithm estimate correctly for two source direction. The proposed algorithm, from angle resolution, is superior to traditional MUSIC algorithm.

We proposed efficient estimation for desired signals using combination MUSIC algorithm. Proposed algorithm of this paper is good at angle resolution relative to traditional MUSIC algorithm.

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