© 2017 IJSRST | Volume 3 | Issue 2 | Print ISSN: 2395-6011 | Online ISSN: 2395-602X

National Conference on Advances in Engineering and Applied Science (NCAEAS)
16th February 2017
In association with
International Journal of Scientific Research in Science and Technology

Adaptive Smart Antenna Using Neural Network (LSMI Algorithm)

Rupali S. Pardhi, Bhagyashri B. Hedau, Megha V. Dhamgaye, Kalyani P. Mohane, Prof. Sonia V. Hokam
Electronics & Telecommunication, RTMNU/SRMCEW, Nagpur, Maharashtra, India

ABSTRACT

The adaptive algorithm used in the signal processing has profound effect on the performance of a Smart Antenna system that is known to have resolutions and interference rejection capability when array steering vector is precisely known. Adaptive beam forming is used for enhancing a desired signal while suppressing noise and interference at the output of an array of sensors. However the performance degradation As the growing demand for mobile communication is constantly increasing, the need for better coverage, improved capacity, and higher transmission quality rises. Thus, a more efficient used of the radio spectrum is required. A smart antenna system is capable of efficiently utilizing the radio spectrum and is a promise for an effective solution to the present wireless system problem while achieving reliable and robust high speed, high data rate transmission. Smart antenna technology offer significantly improved solution to reduce interference level and improved system capacity. With this technology, each user's signal is transmitted and received by the base station only in the direction of that particular user. Smart antenna technologies attempts to address this problem via advanced signal processing technology called beam forming of adaptive beam forming may become more pronounced than in an ideal case because some of underlying assumption on environment, source or sensor array can be violated and this may cause mismatch. Ther are several efficient approaches that provide and improved robustness against mismatch as like LSMI algorithm.

Keywords: SL, DOA, LOS, LSMI

I. INTRODUCTION

In recent years a substantial increases in development of broadband wireless access technologies for envolving wireless internet service and improved cellular system has been observed because of them there is traffic that demands on both manufacturer and operators to provide sufficient capacity in the network. This become major challenging problems for service provider to solve since there exists certain negative factor in the radiation environment contributing to limit the capacity. As the growing demand for mobile communication is constantly increasing, the need for better coverage , improve capacity, and higher transmission quality rises. Thus , a more efficient use of the radio spectrum is require . Smart antenna system are capable of efficiently utilizing the radio spectrums and are promise for an effective solution to the present wireless systems problems while achieving reliable and robust high-speed, high-data rates transmission. In fact, smart antenna system comprise several critical areas such as individual antenna array design, signal processing algorithms, space-time processing , wireless channel modelling and coding, and network performance.

In order to manipulate the radiation pattern of an antenna structure with software, multiple antennas are required instead of signal antenna. Unlike a signal antenna, which has fixed radiation pattern, the radiation pattern of an antenna array can be quite flexible. The flexibility varies according to the algorithm being implemented in the systems. The most straight forward approaches to generate a flexible radiation pattern is the switched lobe (SL) or the switched beam technique where the antenna array contains a numbers of highly directional antennas. Each of the antenna points are in slightly different direction. The system then analyzes the received signal from each of the antennas and select the one that has the best signal. A more intelligent approaches would be, instead of switching antennas, determine the direction of arrival (DOA) of the signals. Once the DOA is obtained, the system uses the antennas array to form highly directional beam pointing toward the user. Both methods should provide some advantages over the conventional systems; however the benefit would be minimal if the signals suffer a lot of angular spread where the signal arrives at many different directions in a multipath environment. The situation would be even worse when no line-of-sight (LOS) is present between the user and the base station.

II. METHODS AND MATERIAL

Beamforming

Beamforming is a general signal processing techniques used to control the directionality of the reception or transmission of signals on a transducer array. Beam forming creates the radiation pattern of the antenna array by adding the phase of the signal in the desired direction and by nulling the pattern in the unwanted direction. The phases and amplitudes are adjusted to optimize the received signal. A standard tools for analyzing the performance of a beam former is the response for a given N-by-1 weight vector *W (k)* as function of, known as the beam response. Thisangular response is computed for all possible angles.

Fixed Weight Beamforming

A Fixed weight beam-former as shown in fig is a smart antenna in which fixed weight is used to study the signal arriving from a specific direction. Since it optimize the signal arriving from specific direction while attenuating signals from other directions, thus it is called the spatial matched filter. In the fixed weight beamforming approach the arrival angle does not change with time, so the optimum weights would not need to be adjusted.

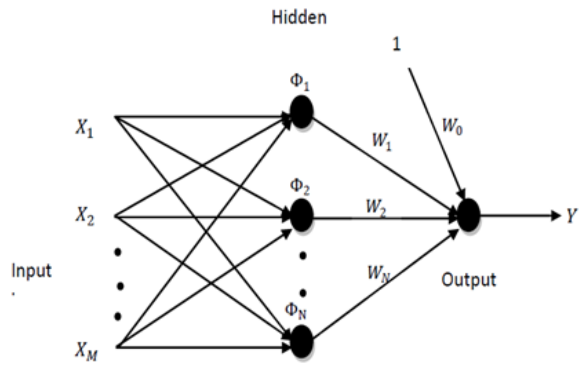

Figure 1. Loaded sample matrix inversion (LSMI) Algorithm

III. RESULTS AND DISCUSSION

One of the most popular robust approaches is the loaded SMI (LSMI) algorithm, which attempts to improve the robustness of the SMI technique against an arbitrary spatial signature mismatch by mean of diagonal loading of the sample covariance matrix. The essences of LSMI algorithm is to replace the conventional sample covariance matrix by the so-called diagonally loaded covariance matrix.

$$w_{\mathrm{SMI}} = \alpha \widehat{\boldsymbol{R}}^{-1} \boldsymbol{a}$$

where is a diagonal loading factor. So that, we can writes the LSMI weight vector in the following form

$$w_{\mathrm{LSMI}} = \widehat{\boldsymbol{R}}_{dl}^{-1} \boldsymbol{a} = \left(\widehat{\boldsymbol{R}} + \xi \boldsymbol{I}\right)^{-1} \boldsymbol{a}$$

So the LSMI algorithm can improve the performance of SMI algorithm in scenarios with an arbitrary steering vector mismatch, this improvements is not significant because LSMI algorithm exploits the presumed steering vector and, therefore, its performance degrades when the norm of the error vector is large. Furthermore, the proper choice of represents a serious problem in practical applications because depends on the unknown signal and interference parameters.

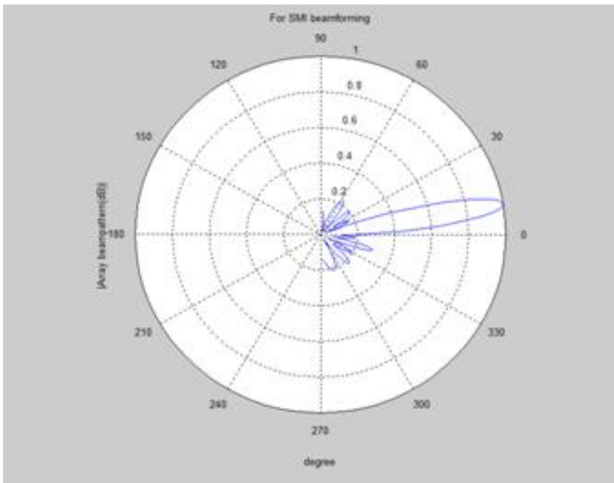

Figure 1. Polar plot of SMI

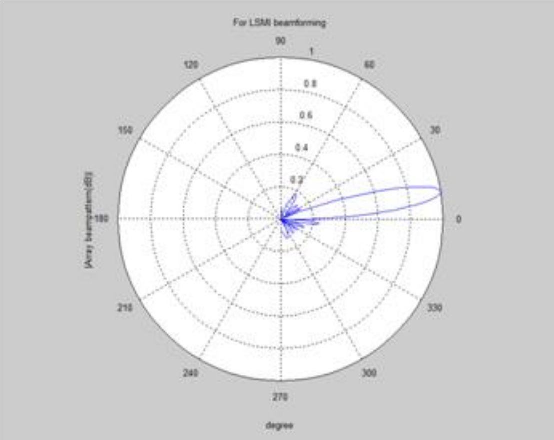

Figure 2. Polar plot of LSMI

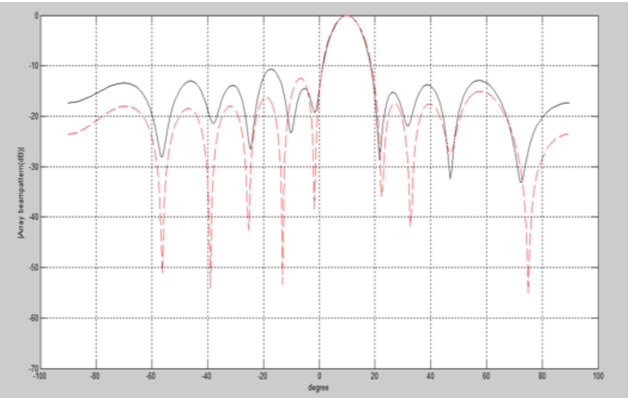

Figure 3. Output of LSMI

IV. CONCLUSION

This paper has presented an efficient method for multiple-beam adaptive beamforming in the presence of steering angle errors. We have illustrated that the performances degradation of an adaptive beam former with multiple beam constraints due to steering angle errors is significant. The proposed method constructs a cost function consisting of the squared form of the projection of the steering vector on the noise subspace and a constraint related to an exponential function of the squared form of the corresponding phase error vector. The resulting minimization problems is highly nonlinear but can be solved through the use of an iterative procedure. In conjunction with a steepest-descent algorithm, the phase angle estimate for all of the signals with specified gain constraints can be obtained simultaneously. The convergence property of the proposed method has been investigated. Several simulation examples have shown the effectiveness of the proposed method in dealings with adaptive beam forming under steering angle errors.

V. REFERENCES

[1]. Widrow B et al. Adaptive antenna systems. The Journal of the Acoustical Society of America. 1967; 42.5:1175–6.

[2]. Widrow B, Mantey P, Griffiths L, et al. Adaptive Antenna Systems. Proceedings of the IEEE. 1967 Dec; 55.

[3]. Burg JP. The Relationships between Maximum Entropy Spectra and Maximum Likelihood Spectra. Geophysics. 1972 Apr; 37:375–6.

[4]. Monzingo, R., and T. Miller,Introduction to Adaptive Arrays, Wiley Interscience, John Wiley & Sons, New York, 1980.

[5]. Jeffrey H. Reed “Software Radio” A modern approach to Radio engineering.

[6]. Winters J. Smart Antenna Techniques and their Application to Wireless Ad-hoc Networks. IEEE Wireless Communications. 2006; 13(4).