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STUDY OF DIFFERENT NEURAL NETWORKS FOR THE IMPROVEMENT OF NONLINEAR DISTORTION IN OFDM SYSTEM

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***Abstract*—OFDM system is one of the widely used system, and also will be used in coming future. Recently it has been used in 4G communication. There is a disadvantage of OFDM system is high PAPR which leads to nonlinear distortion in OFDM system. When We use a high power amplifier, the signal gets nonlinearly distorted. Due to This it will cause degradation of BER in OFDM system. But when we use SOM and PLSOM neural network in ofdm system BER gets improved by using som and BER performance gets further improved using the PLSOM neural network in OFDM system as it is the solution to the SOM neural network. PLSOM is more sensitive in nature with external forces. This paper represents PLSOM1 algorithm, which will solve problems associated with PLSOM algorithm.**

***Keywords*— OFDM, neural networks, HPA, PAPR, SOM, PLSOM, PLSOM1**

I. INTRODUCTION

In OFDM system, to reduce nonlinearity, we use HPA, by using this we can reduce some amount of nonlinearity, but we don't get satisfied output because the BER gets degraded and constellation points are more scattered. The solution to this is to use artificial neural network. An artificial neural networks are made up of neurons. It can learn by themselves. Neurons are interconnected in network as shown in figure1

In OFDM system ,a neural network based, high power amplifier (HPA) characteristics independent adaptive method for compensation of nonlinear distortions for orthogonal frequency division multiplexing signals[1]
In OFDM system, Major elements that contribute to multipath fading effects are also considered and to account for major degradation categories, Rayleigh and Rician channel models are considered in an OFDM system. System performance tests for OFDM system with and without neural block and it is proved through spectral regrowth as well as bit error rate (BER) plots that the proposed model brings in overall improvement in OFDM system [1]

A compensating method based on Self-Organizing Map (SOM) of nonlinear distortion, which is caused by a high - power amplifier (HPA) for 16 QAM-OFDM systems. OFDM signals are sensitive to nonlinear distortions and different methods are studied to limit them [5]
The parameter less self-organizing map (PLSOM) is a new neural network algorithm based on the self-organizing map (SOM). It eliminates the need for a learning rate and annealing schemes for learning rate and neighbourhood size.

The relative performance of the PLSOM and the SOM and demonstrate some tasks in which the SOM fails but the PLSOM performs satisfactorily. Finally, this paper discusses some example applications of the PLSOM and presents a proof of ordering under certain limited conditions [4]

The original PLSOM was introduced as a solution to the problems the SOM encounters when dealing with certain types of mapping tasks. Unfortunately the PLSOM suffers from oversensitivity to outliers and over-reliance on the initial weight distribution. The PLSOM2 algorithm is introduced to address these problems with the PLSOM.PLSOM2 is able to cope well with outliers without exhibiting the problems associated with the standard PLSOM[6]. To compensate nonliearities in ofdm system ,it is expected that neural network is best for removing nonlinearities.this paper will shows how PLSOM1 is better then SOM and PLSOM neural network and also we will discuss PLSOM1 neural network.in this paper we will discuss three section in section one we will discuss how was the previous system means by using SOM and PLSOM neural network in OFDM system in section two we will see drawbacks with SOM and PLSOM network. And in section three we will see PLSOM1 how it work and improved BER performance than the previous system.

SECTION 1:

OFDM is a specialized OFDM except all the carrier signal are orthogonal to each other .the orthogonality allows high spectral efficiency,almost the whole available frequency band can be utilised .OFDM uses the spectrum more efficiently by spacing the channels closely together.the orthogonality allows foe efficient modulator and demodulator implementations using FFT algorithm on the receiver side and an inverse FFT algorithm on sender side.An OFDM system exhibit high peak to average power ratio.this is the main drawback of OFDM system which raises the noise factor and may cause interference.by using HPA we can reduce some amount of nonlinearities but the performance if BER gets degraded and the constellation points are more scattered. As shown in figure4. But we don't get satisfied output, we want to receive a signal equals to the transmitted signal. The tramsmitted 64 QAM signals are shown in figure3.As we see the BER graph constellation points are more scattered.

Solution to this ,we use neural networks first neural networl that we have used is SOM neural network which was introduced by Kohonen in 1982[7].and this neural network does not need any supervision.SOM attempting to map their weights to confirm to the given input data.received signal after SOM network shown in figure4.SOM is able to handle some amount of nonlinearities and we get improved BER compared to HPA.Secondly we use PLSOM neural network which solves the problem associated with SOM.PLSOM neural network based on the SOM and it is also made up of nodes. PLSOM completely eliminates the selection of learning rate . The annealing scheme of the learning rate and the neighbourhood size,which have been inconvenienced while using SOM and system performancr gets further improved.The received 64QAM signal after using SOM and PLSOM is shown in figure3(c) and(d), but there are some problem with PLSOM algorithm.

PLSOM is over-sensitive in nature with outliers and over-reliance with initial weight distribution.PLSOM1 algorithm is introduced to overcome such problems.PLSOM1 algorithm is able to manage the outliers,without the problems associated with PLSOM.Another problem with PLSOM is the degree of adaption is dependant on initial position of the weight nodes in input space,which leads to poor performance ,which can also degraded the BER performance,to overcome these problems an improved PLSOM algorithm is introduced called PLSOM1 algorithm.

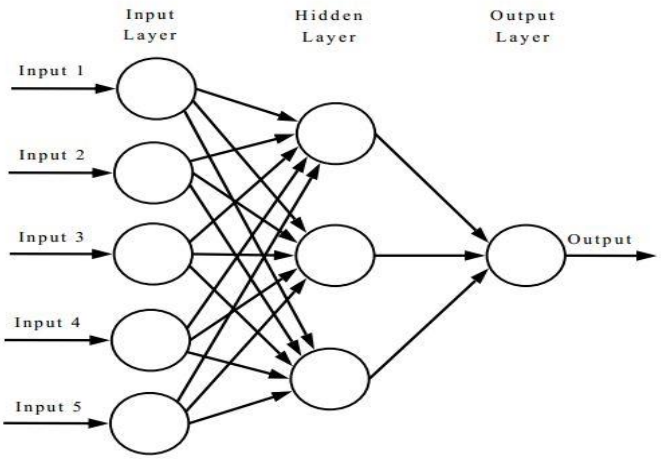

Figure1:artificial neural network

SECTION 2:

The PLSOM1is new proposed algorithm which instantaneously sets the neighbourhood size based on the distance between the weight vectorof the winning node and inputrelative to inpit distribution's diameter .the new PLSOM algorithm uses slightly different computational method than the previuos one.in this new PLSOM1 algorithm the scalind is that ratio of the last error to the diameter of the input space and that of in PLSOM was that the ratio of the last error to the largest error during training .due to this we get an efficiency by using the PLSOM1 network Due to this we can maximum nonlinearities in OFDM system which can also improve the performance of the system.

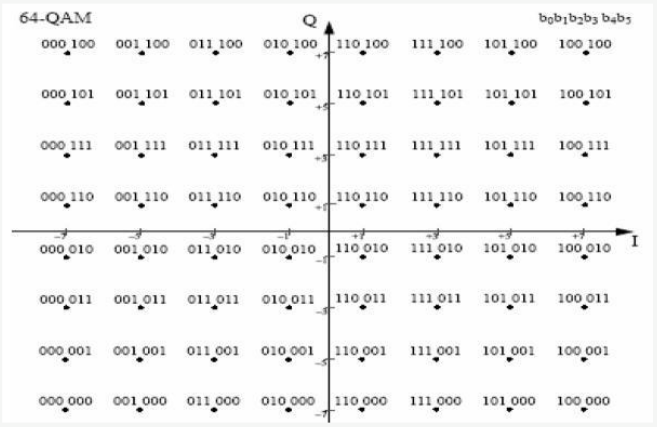

Figure 2: 64 QAM Constellations

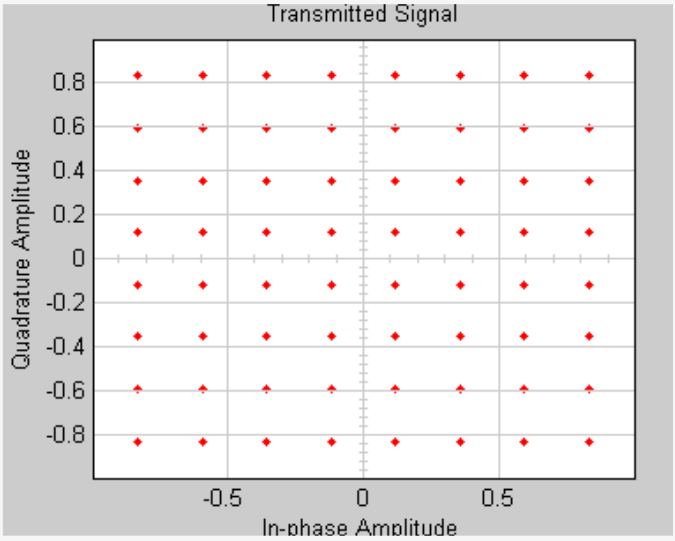

Figure 3: (a) Transmitted 64QAM signal

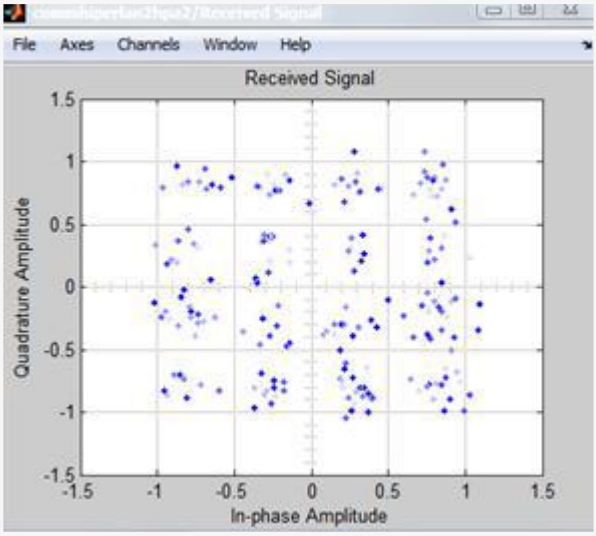

Figure 3: (b) Received 64QAM signal after Rapp

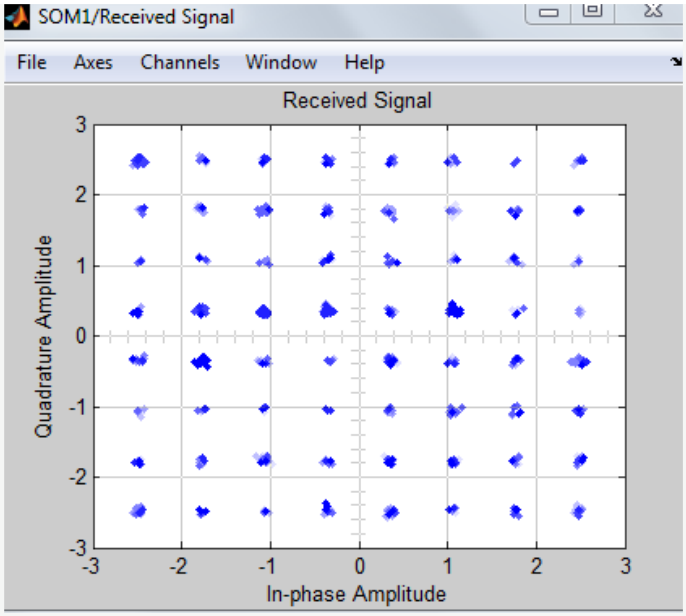

Figure 3: (c) Received 64QAM signal after SOM Network

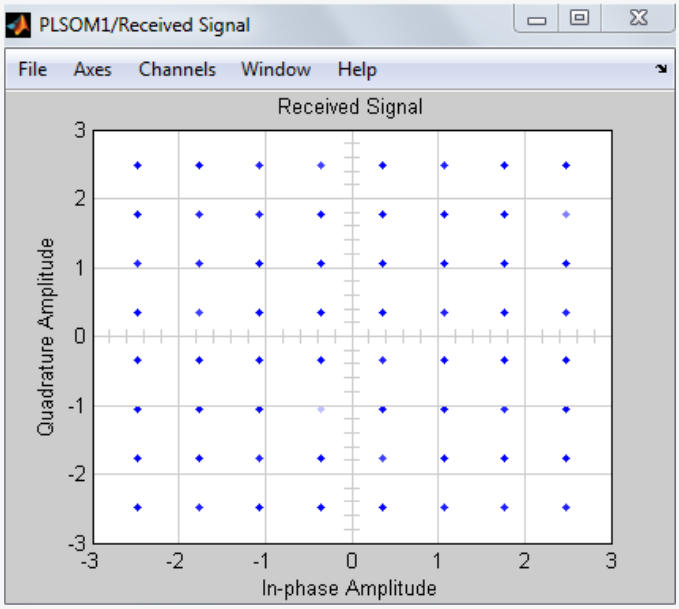

Figure 3: (d) Received 64QAM signal after PLSOM

SECTION 3:

We saw the performance of OFDM system using different neural networks first we used SOM neural network ,in which he data mapping was easily interpreted and aslo capable of organising large complex data set,so by using we get

performance better than HPA.but teir are also disadvantages with SOM like what was the input weight to use solution to this we used PLSOM neural network,PLSOM neural network is based on the SOM neural network it eliminates the need for learning rate and annealing scheme.we have to place PLSOM block after FFT block in the receiver structure here we get the improved BER .their are some disadvantages while using PLSOM ,it is sensitive to external outliers.so this paper we studied improved PLSOM algorithm called PLSOM1 algorithm.firstly we examine how the netwoks responds to the outliers second we examine BER performance and third overall system performance .PLSOM1 is better than SOM and PLSOM neural network.

REFERENCES

[1] Shubhangi Rathkanthiwar*, C.G. Dethe†, K. D. Kulat† *RTMNU, Nagpur, India "A Neural Approach for overall Improvement of OFDM System" Chennai and Dr.MGR University Second International Conference on Sustainable Energy and Intelligent System (SEISCON 2011) , Dr. M.G.R. University, Maduravoyal, Chennai, Tamil Nadu, India. July. 2022, 2011.

[2] Younes Jabrane, V´ıctor P. Gil Jim´enez, Ana Garc´ıa Armada, "Reduction of Power Envelope fluctuations in OFDM Signals by using Neural Networks" IEEE COMMUNICATIONS LETTERS, VOL. 14, NO. 7, JULY 2010, pp. 599-601.

[3] Rafi k Zayani and Ridha Bouallegue 'Crossover Neural Network Predistorter for the Compensation of Crosstalk and Nonlinearity in MIMO OFDM Systems' 2010 IEEE 21st International Symposium on Personal Indoor and Mobile Radio Communications, pp 966-970.

[4] Erik Berglund and Joaquin Sitte, 'The Parameterless Self-Organizing Map Algorithm' IEEE TRANSACTIONS ON NEURAL NETWORKS, VOL. 17, NO. 2, MARCH 2006 pp.305-316 Kimmo Raivio: Detection of nonlinearly distorted and multipath propagated signals using self-organizing maps. Licentiate's thesis, Helsinki University of Technology, Espoo, Finland, August 1993.

[5] Xiaoqiu Wang, Jianming Lu: Hiroo Sekiya and Takashi Yahagi Graduate School of Science & Technology, "A Compensating Method Based on SOM for Nonlinear Distortion in 16 QAM-OFDM System" Chiba University 1-33 Yayoi-cho, Inage=-ku, Chiba shi, 2F3-8522, Japan,2011

[6] Improved PLSOM algorithm.

[7] 3. Kohonen T (1984) Self-organization and associative memory,
vol 8. Springer, Berlin