International Journal of Technical Research and Applications e-ISSN: 2320-8163,
www.ijtra.com Volume 4, Issue 2 (March-April, 2016), PP. 270-273

BER USING NEURAL NETWOK IN OFDM SYSTEM

Swati Dabre*, G. Kankath,M.M.Kadam
Department Of Electronics and Telecommunication
Terna College of Engineering, Nerul
Navi Mumbai, India
* swati.dabre61@gmail.com

***Abstract*— an improved bit error rate is obtained by using neural networks in OFDM system, and there is also a comparison between self-organizing map (SOM) and parameterless Self-organizing map (PLSOM), neural network. Orthogonal frequency division multiplexing (OFDM) system is widely used for audio/video broadcasting, WiMAX, Wi-Fi, and provides high data rates. OFDM contributes to multipath fading, which leads to major degradation, different channel modes are considered in OFDM system. In this paper, we discuss improved bit error rate by using neural networks and comparison of SOM and PLSOM.**

***Index Terms*—OFDM, neural networks, HPA, PAPR, SOM, PLSOM.**

I. INTRODUCTION

From the recent years, OFDM system has got a major attention in the standardization of broadband wireless system. OFDM is a modulation technique with a rather simple implementation performed using FFT/IFFT algorithms. The OFDM system provides high-speed data transmission, but there is a major drawback of OFDM system is its high peak to average power ratio (PAPR), particularly high PAPR causes an OFDM system to be sensitive to nonlinear distortion introduced by the high power amplifier.

OFDM is easy to scheme is to reduce the autocorrelation at the input implement due to efficient FFT (fast Fourier transforms) algorithm.

This paper shows, improved bit error rate (BER) of the system using a neural network. In this we discuss three sections. In section one we discuss the performance of BER using HPA in OFDM system. In the second section, we discuss the performance of BER using SOM neural network In the third section we discuss the performance of BER using the PLSOM neural network.

SOM is a type of neural network that is trained using unsupervised learning to produce a low-dimensional discretized representation of the input space of the training samples, called a map. SOM is a type of neural network it is called self-organizing because no supervision is required. The map is required, they were attempting to map their weights to confirm with the given input data. It retains principle features of the input data, therefore, it is called as feature map which is fundamentally of the principal of SOM.

SOM is a powerful tool for visualization of high dimensional data. PLSOM is the new neural network based on the SOM. It eliminates the need for a learning rate and annealing scheme. We have to place SOM and PLSOM block after FFT blocking the receiver structure, here we get the improved bit error rate. SOM is able to handle nonlinearity, interference effect and Doppler spread. System performance further gets improved when the SOM block is replaced by PLSOM.

When dealing with the certain distribution of the input space, it is not easy to attain SOM with careful selection of network size and network parameter, therefore, sometimes it requires externally applied annealing scheme. Externally applied learning scheme is undesirable because it deviate from the biological (real model) model of neural network. PLSOM solves this problem; PLSOM completely eliminates the selection of learning rate, the annealing rate, and annealing scheme of the learning rate and neighborhood size which have been an inconvenience while applying SOM. It also decreases the number of iterations required to get stable and ordered map. PLSOM also covers a greater area of the input space with a smaller gap.

II. INTRODUCTION TO HYPERLAN/2

Because of their ability wireless local area network (WLAN), have attended a lot of attention. It can access anywhere, anytime with high data rate up to 54Mbps. HIPERLAN/2 provides high transmission rate. In this connection-oriented nature of HIPERLAN/2 makes it straightforward to implement support for quality of services. In HIPERLAN/2, there is no need for manual planning as cellular network like GSM. HIPERLAN/2 protocol has a flexible architecture for ease of integration. The HIPERLAN/2 has support for both authentication and encryption.

III. OVERVIEW OF HIPERLAN/2

The OFDM system used in HIPERLAN/2 provides a WLAN with data payload communication capabilities of 6, 9, 12, 18, 24, 36, 48, and 54 Mbps [5]. The block diagram of

HIPERLAN/2 system is shown in figure1. The system uses 52 sub-carriers that are modulated using binary or quadrature phase shift keying (BPSK/QPSK), 16-quadrature amplitude modulation (QAM), or 64-QAM. Forward error correction coding (Convolutional coding) is used with a coding rate of 1/2, 2/3, or 3/4. At the transmitter, binary input data is encoded by the industry standard rate 1/2, constraint length 7, and code with generator polynomials (133,171) Optional puncturing omits some of the encoded bits in the transmitter, increasing the bit rate to 2/3 or 3/4. . Interleaving, with a block size corresponding to the number of bits in an OFDM symbol, reduces the effect of frequency selective fading in the radio channels. It also prevents error bursts from being input to the convolutional decoding process on the receiver. After interleaving, bits are mapped into complex numbers according to the modulation scheme which are normalized to achieve the same average power for all mappings. In order to facilitate coherent reception, four pilot values are added to each of the 48 data values, such that a total of 52 modulation values are reached per OFDM symbol. 52 values are then modulated onto 52 sub carriers by applying an Inverse Fast Fourier Transform (IFFT). The IFFT converts all the mapped symbols in the frequency domain into a time domain signal for transmission. A guard interval (cyclic prefix) is added to make the system robust to multipath propagation and is used for both timing and frequency synchronization. Next, windowing is applied to attain a narrower output spectrum. The modulated and windowed digital output signals are converted to analog signals, which are then up converted to the proper channel in the 5 GHz Band, amplified, and transmitted through an antenna.

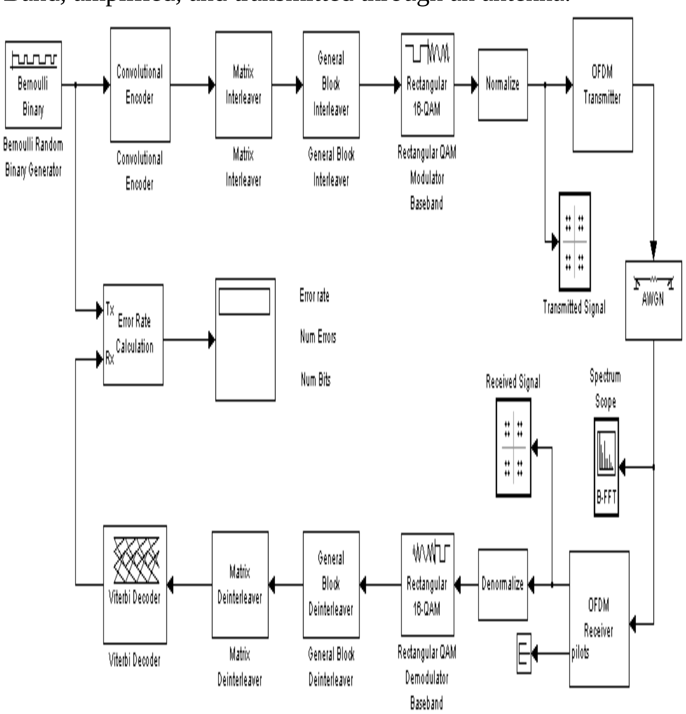

Figure 1 Block Diagram of Hiperlan/2

IV.SECTION:1

High PAPR is the major drawback of the transmitted signal in OFDM system. Most of the recent work has focused on minimizing the PAPR of OFDM signal to enhance the performance. However, after relating this issue to the specific characteristics of a high power amplifier (HPA). HPA overcomes the loss between the transmitter and receiver. However, they also introduce a problem. The amplifier can consume a major fraction of the power. The HPA can also distort the transmitted power, introducing additional noise within the signal frequency band and generated unwanted frequencies in adjacent channels. Here, I studied in-band distortion by connecting HPA.Using BER vs. SNR plot we observe that due to nonlinear distortion due to HPA bit error rate gets degraded and constellation points are more scattered.

V. SECTION:2

SELF ORGANIZING MAPS (SOM)

SOM was developed in 1982 by Teuvo Kohonen of the academy in Finland and they provided a way of representing multidimensional data in much lower dimensional space usually one or two dimensions. One of the important things about the SOM is that, they learn to classify data without any supervision. Map is because they were attempting to map their weights to confirm with the given input data. It compresses the information. It retains principle features of input data therefore it is called as feature map, which is fundamentally of principal of SOM.SOM is a type of artificial neural network and it is different than other neural network as they apply competitive learning as opposed to error-correction learning and sense that they use a neighborhood function to present the topological properties of the input space.the SOM neural network consists of two layers of neurons first only receives the input data and transfer it to the second layer, neuron of the second layer are combined into two dimentional structure.the no. of neurons in the second layers canbe chosen arbitrarily. SOM is also called as topology preserving map because there is topological map is simply a mapping that presents neighborhood relations. The neighborhood can be rectangular or hexagonal in shape. The relation is given by a function called a topological neighborhood as shown in figure2.And the architecture of SOM is shown in figure3.

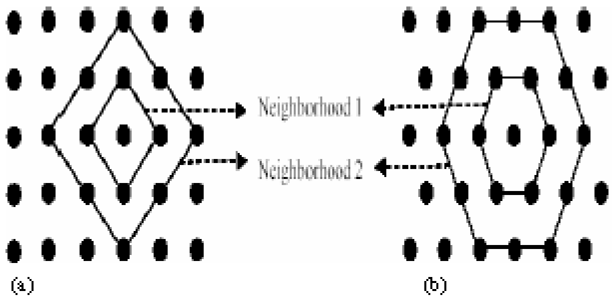

Figure 2 : SOM's grid structures (a) rectangular (b) Hexagonal

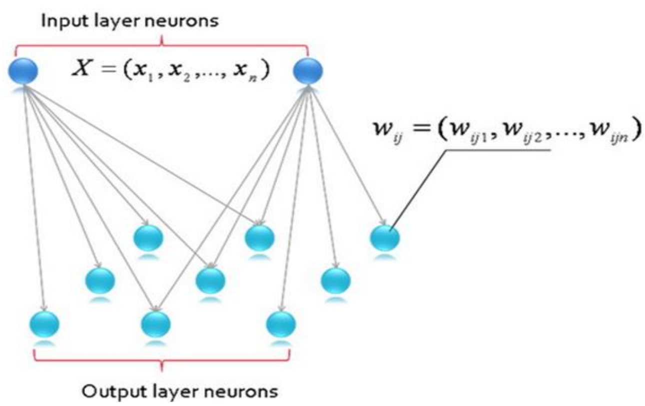

Figure 3 :Architecture of SOM neural network

VI.SECTION:3

PARAMETERLESS SELF-ORGANISING MAP

PLSOM is a new neural network based on the SOM. It eliminates the need for a learning rate and annealing scheme. PLSOM is made up of the network of nodes usually two or three dimensions. Each node is associated with the weight vector. The training of the map consists of two steps which are repeated until the desired output is obtained. In step one an input is selected at random is presented to the node with the weight vector matching closely with the input, it designated the winning node. In step two the weight vectors of the nodes are moved closer to the last given input vector how much they are moved depends on the distance from the winning on the map node and the learning rate from the effect of the distance. Winning node on the map is given by the function called the neighbourhood function. the leaning rate and neighbourhood size decreases over time following the scheme called annealing scheme. In step three, if the end connection has been satisfied then terminate or go to the step one.

VII.CONCLUSION

When high power amplifier is connected to the transmitter section of HIPERLAN/2, the high amplitude component of OFDM signal enters in the non-linear region of an amplifier which causes non-linear distortion. Due to large dynamic range of modulated signal, the nonlinear distortion at the power amplifier in transmitter causes interference both inside (intermediation between subcarriers) and outside (spectral–spreading of OFDM signal) the signal bandwidth. Here, I studied the in-band distortion by connecting Rapp's model of Solid State Power Amplifier (SSPA). Using Bit Error Rate (BER) vs Signal to Noise ratio (SNR) plot we observed that due to non-linear distortion in high power amplifier bit error rate is degraded. Also, we studied the effect of nonlinearity in terms of constellation points. We observed from this that after passing through the HPA the constellation points are the more scattered i.e. wrapping of the signal constellation in each sub-channel occurs. We also observed that spectral re-growth occurs as the signal passes through the HPA.

To compensate the above nonlinearity, here we have proposed a non-linear compensator for HIPERLAN/2 signals based on a Self-Organizing Map neural network. The SOM network is placed in the receiver and corrects the non-linearity introduced by the transmitter's high-power amplifier. The SOM algorithm showed good results in simulations and can improve the performance of OFDM systems, or keep the same performance with low power consumption. The adaptation of the proposed scheme is based on the topology-preserving characteristic of the mapping algorithm. But when we use PLSOM, system performance gets further improved. And here we get improved BER.

REFERENCES

[1] 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.

[2] 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.

[3] 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.

[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