Design Low Pass FIR Filter a Comparison in Artificial Neural Network

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Abstract
The present paper researches an approach for correlation of various sorts of simulated neural system utilized as a part of plan and examination of low pass FIR channel. The reproduced esteems for preparing and testing the neural system are acquired by planning low pass FIR channel with hamming window technique utilizing FDA tool stash in MATLAB. As hamming window is an upgraded window technique which can limit the most extreme (closest) side flap of a flag henceforth hamming window strategy is favored in this work. In this paper three distinctive calculation of fake neural system in particular summed up relapse technique, sustain forward back spread and outspread premise work are utilized. The outcome got utilizing manufactured neural system are contrasted and spiral premise work establishes with give very acceptable outcome at that point summed up relapse technique and nourish forward back spread strategy.

Keywords**:** *FIR filter, ANN, GRNN, BPNN, RBF*

I. INTRODUCTION

A channel is a system that specifically changes stage recurrence or potentially adequacy recurrence of a flag in coveted way. The target of sifting is to enhance nature of a flag to extricate data from signals or to isolate at least two signs. A computerized channel is calculation actualized in both equipment and programming that works on advanced information flag to create advanced yield flag. Advanced channel are of two sorts relying on reaction Finite Impulse Response (FIR) channel and Infinite Impulse Response (IIR) channel. IIR channels are advanced partner to simple channel such a channel has inner input and may keep on responding uncertainly. FIR channel referred to as non-recursive advanced channel as they don't have input even recursive calculation can be utilized to acknowledge FIR channel. Yield succession y[n] is given by

$$y[n]=b0x(n)+b1x(n\text{-}1)+\text{----------}+bnx(n\text{-}N) \quad (1)$$

The outline of advanced channel has gotten awesome enthusiasm over the previous decades FIR customary technique plans a computerized FIR channel are: - Fourier arrangement strategy, Frequency inspecting strategy, window technique. As indicated by Ref. [1] Window strategy is a standout amongst the most productive strategies in planning of FIR channel before manufactured neural system (MNS), as it gives ideal outline superior to different techniques.

Fig. 1 demonstrates a straightforward low pass FIR channel

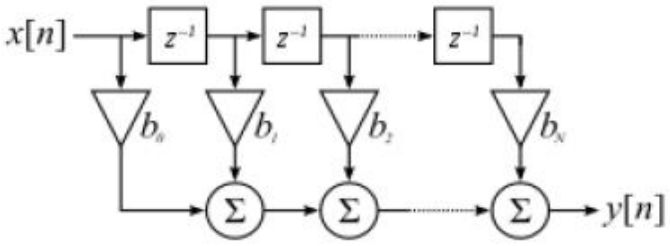

Figure 1. Simple low pass FIR filter

Window technique is a strategy use to changes over as "perfect" unending span drive reaction, for example, sin capacity to a limited term motivation reaction channel plan.

Presently a days there are different other plan strategy to configuration channel, for example, Neural system (NS), Genetic calculation Ref. [2], molecule swarm enhancement Ref. [3], spiral premise work Ref. [4], Ref. [5] and so forth. In exhibit paper summed up relapse neural system, bolster forward back spread and outspread premise work are utilized. Hamming window strategy is utilized to figure the channel coefficient to plan informational index. The benefit of hamming window is that the window is advanced to limited the greatest (closest) side flap, giving it a tallness of around one fifth that of other window. Its window work is communicated beneath

$$w(n) = \alpha - \beta \cos\left(\frac{2\pi n}{N-1}\right) \quad (2)$$

$$\alpha = 0.54, \qquad \beta = 1 - \alpha = 0.45 \quad (3)$$

II. ARTIFICIAL NEURAL NETWORK (ANN)

A manufactured neural system (MNS) is computational models of neurons in view of the exceptionally thick entomb associated parallel structure of human mind. The quantity of hubs, their association and synaptic weights of these associations of any neural system decide the yield of ANN. Fake neural system is a versatile framework that progressions its structure or weights in view of given arrangement of info and target yields amid the preparation stage on produces last yield. It is especially successful for foreseeing occasions when the system have a vast database of earlier illustrations. Normal execution of ANN

has products input, weights of each info, a limit that decide whether neurons should fire or not, an enactment work that decide yield and method of operation [6][8].

Fig. 2 indicate general structure of neural system as portray above.

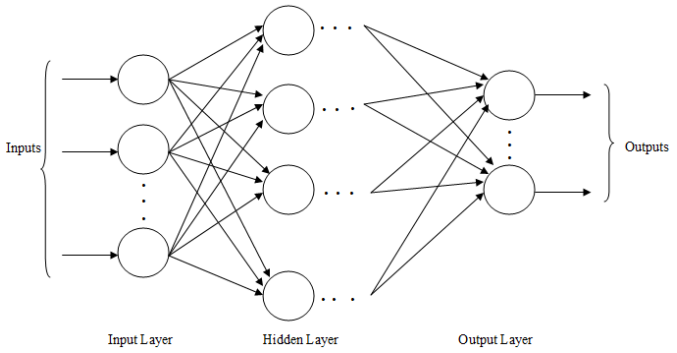

Figure 2. General structure of neural network

There are some algorithms that can be used to train artificial neural network such as feed forward back propagation, radial basis function and general regression neural network etc.

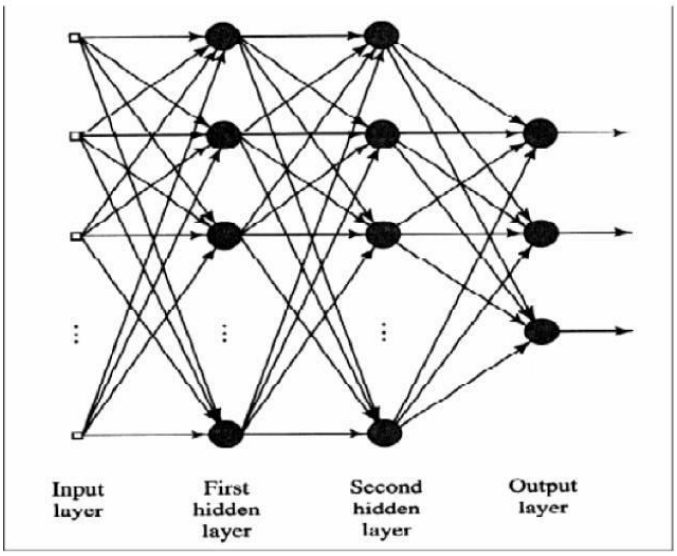

Figure 3. Feed forward back propagation neural network

According to Ref. [9] in radial basis function (RBF) network hidden neurons compute radial basis function of inputs, which are similar to that of kernel functions in kernel regression. Wasserman in 1993 gives the concept of radial basis function on network as show in Fig. 4.

The back propagation is the simplest of all other algorithm. Back propagation means that the neurons are organized in layer send signals in "forward" direction and have errors propagating in backward direction as shown in Fig. 3.

The main aim of back propagation algorithm is to reduce error, until ANN learns the training data. Training started with random weights and aimed to adjust weights so the minimal error is obtained.

General regression neural network (GRNN) is a variation of radial basis function (RBF) based on the Nadaraya-Watson on kernel regression. By Ref. [10] the main features of GRNN are fat training time and can also model non-linear function.

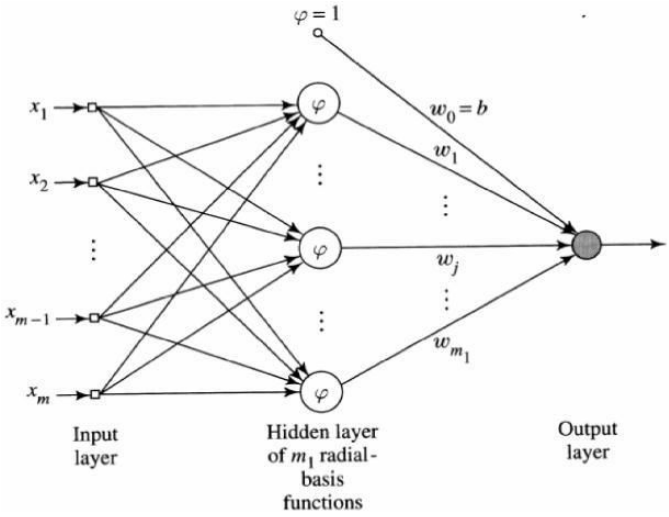

Figure 4. Radial basis function

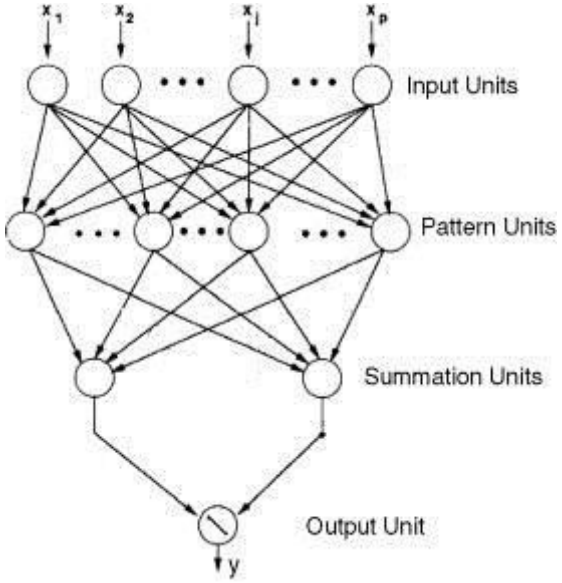

Figure 5. Generalized regression neural network

GRNN (Fig. 5) being firstly proposed by Sprecht in 1991 is a feed forward neural network model base on non liner regression theory; it approximates the function through activating neurons Ref. [11]. In GRNN transfer function of hidden layer is radial basis function.

$$y'i = \frac{\sum_{i=1}^{n} yi * exp - D(x - xi)}{\sum_{i=1}^{n} exp - D(x - xi)} \quad \textbf{(4)}$$

$$D(x - xi) = \sum_{k=1}^{m} \left(\frac{xi - xik}{\sigma}\right)^2 \quad \textbf{(5)}$$

III. PROPOSED NEURAL NETWORK MODEL

ssaadcd In proposed neural network model of low pass FIR filter inputs are normalized cut off frequency that varies between 0 to 1Hz and scale value a constant value equal to 10. By help of these input output in form of filter transfer function coefficients is obtain.

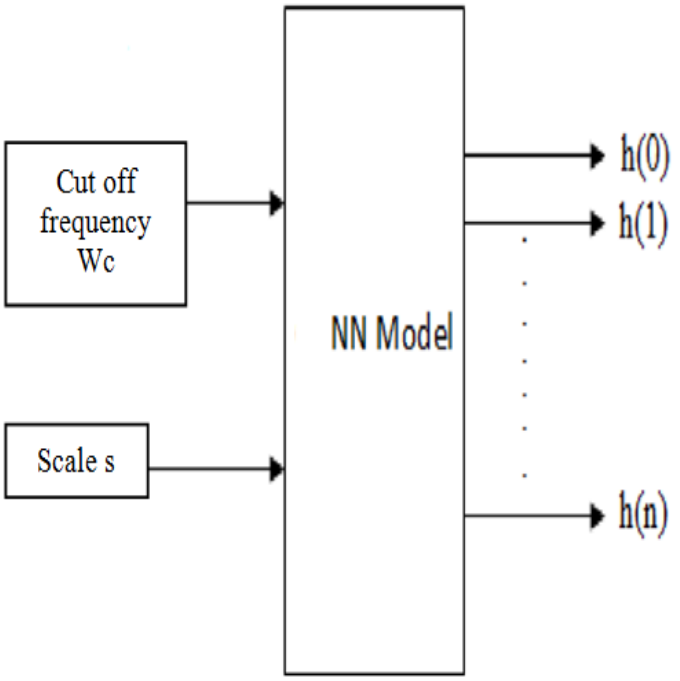

Figure 6. Neural model of low pass FIR filter with Wc and S as constant

Proposed model using above mention filter specification as input and filter coefficient as output is showing in Fig. 6.
In above model all of three artificial neural networks are used to find out results/output of network namely network 1 by GRNN, network 2 by feed forward back propagation and network 3 by RBF.

IV. RESULT

The trained network has been tested using ten value filter coefficient out of 40 values of filter coefficient obtain by FDA tool of MATLAB using Hamming window. Fig. 7 shows training of neural network done by tool of MATLAB.

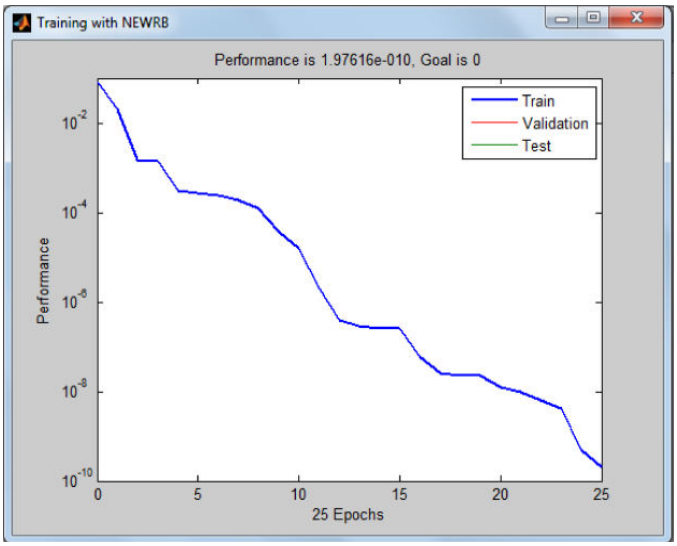

Figure 7. Training of neural network

Error in calculating the filter coefficients of these input set using GRNN, feed forward back propagation.

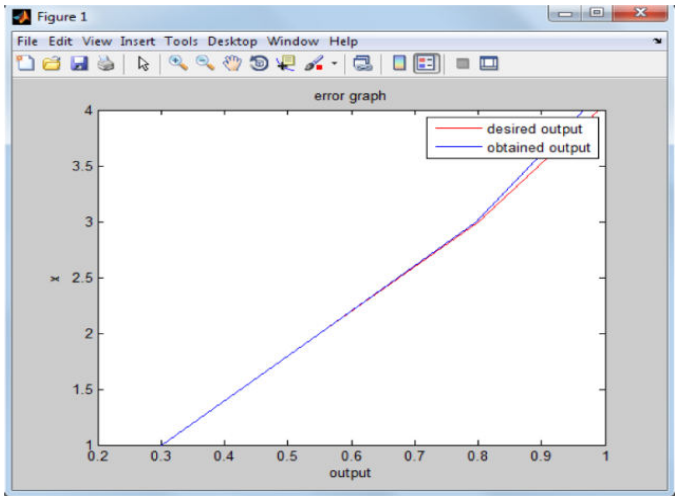

Fig. 8 shows error graph between hamming window output and generalized regression neural network output.

Fig. 9 shows error graph between hamming window output and Feed forward back propagation algorithm output.

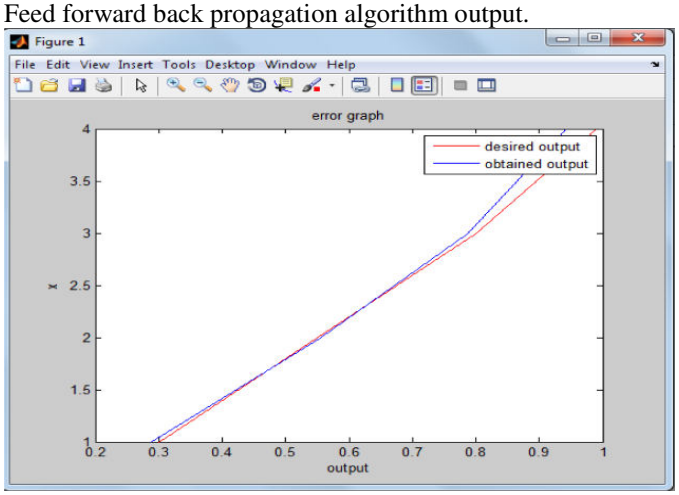

Figure 9. Error graph between hamming window o/p and FFBP o/p

Fig. 10 shows error graph between hamming window output and Radial basis function output.

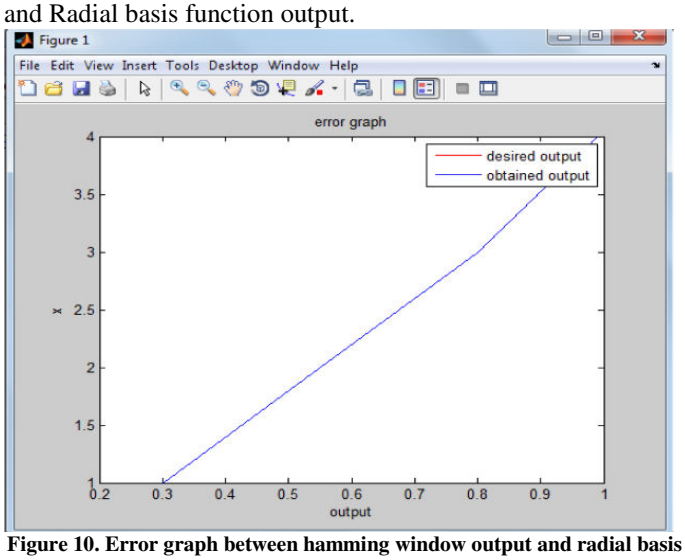

Figure 10. Error graph between hamming window output and radial basis function output

By above figures (Fig. 8, Fig. 9, Fig. 10.) and table no 1 it is clear that RBF gives results 99.9% and back propagation results almost 98.37% and GRNN gives 99.45% result accuracy. So on comparison of these three types of artificial

neural network RBF, back propagation, GRNN results shows that designing of low pass FIR filter using radial basis function network gives most accurate, efficient, less complex and easy implemented design.

Fig. 11 shows the result window of RBF method.

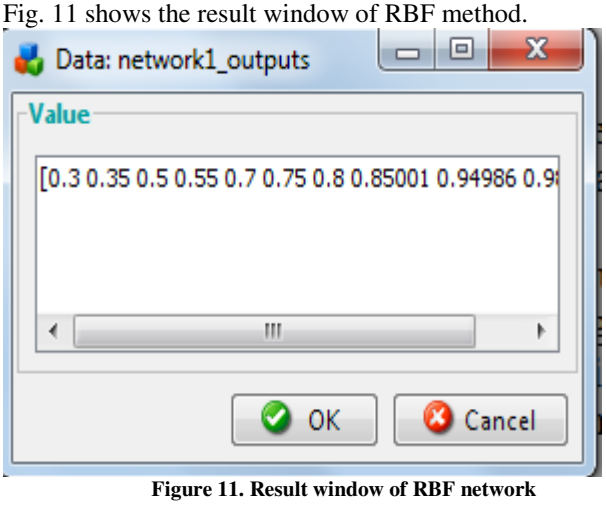

Figure 11. Result window of RBF network

V. CONCLUSION

The present paper has proposed the examination of three sorts of counterfeit neural system to be specific RBF, Back engendering and GRNN utilized as a part of plan of low pass FIR channel. RBF is observed to be simple, quick and most precise technique to outline a low pass FIR channel one prepared appropriately. The channel reaction blunder charts are practically comparative for both hamming window and RBF neural system which approve the proposed model and examinations.

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His main research interests include Electrical Engineering and MATLAB. He is currently doing his project in Neural Network.