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Enhanced the Performance of Digital Image Compression Using Wavelet Transform Function and BP Neural Network Model

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***Abstract*—** The compression technique play vital role in digital multimedia data. The size of digital multi-media is very high due to this reason used more memory space for storage and need more bandwidth for transmission of data. the data compression techniques used various approaches like pixel based methods and some are transform based method. In the research work introduced better approach for picture pixel size reduction. The approach is addition of WT and BPN model. The BPNN model is very efficient model in terms of processing of data of WT function. The proposed algorithm implemented in MATLAB and used reputed image for compression. Our empirical result shows better PSNR and C.R instead of Wavelet transform method.

***Keywords*—** Digital Image, Wavelet, BP Neural Network.

I. INTRODUCTION

The increasing rate of smart and digital device creates high resolution image and digital data acquired more space for storage and transmission. The memory space and transmission bandwidth is important parts of smart devices. The uses of memory and more bandwidth degraded the performance of smart devices. Now need for image compression technique. Now a day's various authors used various methods for image compression [1,2]. The transform function plays an important role in digital image compression. Some authors used wavelet transform function for the image compression. The wavelet transform function gets better PSNR value but still suffered the problem of compression ratio. For the fast compression of image used quantisation technique for image compression, but the quantization technique loss the data during the process of image compression. The frequency based image compression technique used various transform function such as FFT, DCT and many more transform function [3,4]. All these transform function gives better image compression technique in consideration of image quality value. But the factor of quality compromised with compression rate and compression ratio. For the improvement of compression ratio and compression rate used neural network model and wavelet transform technique. Some late commitments have proposed the use of neural system models to information pressure in picture coding frameworks. Toward enhancing the pressure rate and the nature of recreated picture, two unique varieties to the essential approach have been conceived and tested: the main, change the structure of the neural systems, be that as it may, the surface structure of picture and the human visual components were viewed as few in their commitments, and the nature of remade picture is enhanced with give up of pressure rate. In this paper, we depict a technique for picture pressure in light of grouped pieces, utilizing adjusted BP neural system show [5,6]. The info pieces are ordered by making full utilization of the surface components in the picture and the human visual elements, and afterward sent to a relating set of neural systems.

The rest of paper discuss as in section II. BP neural network model and wavelet transform function. In section III. Discuss proposed algorithm. in section IV discuss the practical result analysis.

II. WAVELET TRANSFORM AND BP NEURAL NETWORK

The working of WT function is shown in figure1. The Discrete WT coefficient buffer at right in the diagram stores wavelet Thresh-holds computed by the Discrete WT stage. The program flow in the diagram produces Discrete WT Thresh-holds for a one slot[8]. Once the thresh-hold corresponding to a slot have been computed and placed in the buffer, the BPE stage can begin encoding that slot. The BPE stage relies on all of the Thresh-holds in a slot being available simultaneously. The calculation of a DISCRETE WT coefficient depends on image pixels in a limited neighborhood. Consequently, when images are encoded

using more than one slot, it is often possible to implement the DISCRETE WT stage so that DISCRETE WT Thresh-holds for a slot are produced without requiring input of a complete image frame. For example, in a push-broom imaging application, DISCRETE WT Thresh-holds may be produced in a pipeline fashion as new image scan lines are generated by the picturiser.

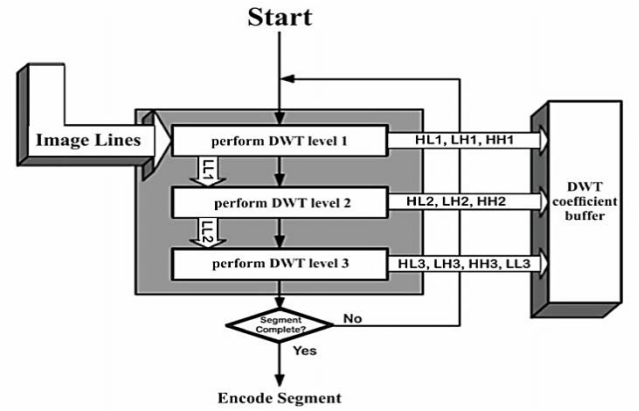

Figure 1: Program and Data Flow of DISCRETE WT Module.

Back Propagation Neural Network Model

.Back propagation is a training method used for a multi-layer neural network. It is also called the generalized delta rule. It is a gradient descent method which minimizes the total squared error of the output computed by the net. All NN is supposed to return accurately to the input patterns that are used for training which is termed as memorization and it should respond reasonably to input that is similar to but not the same as the samples used for training which is called generalization. The training of a neural network by back propagation takes place in three stages [9].

1. Feed forward of the initial mechanism
2. Computation and Back propagation of the associated bugs
3. Adjustments of the weights after the neural network is trained, the neural network has to compute the feed forward phase only.

Even if the training is slow, the trained net can produce its output immediately.

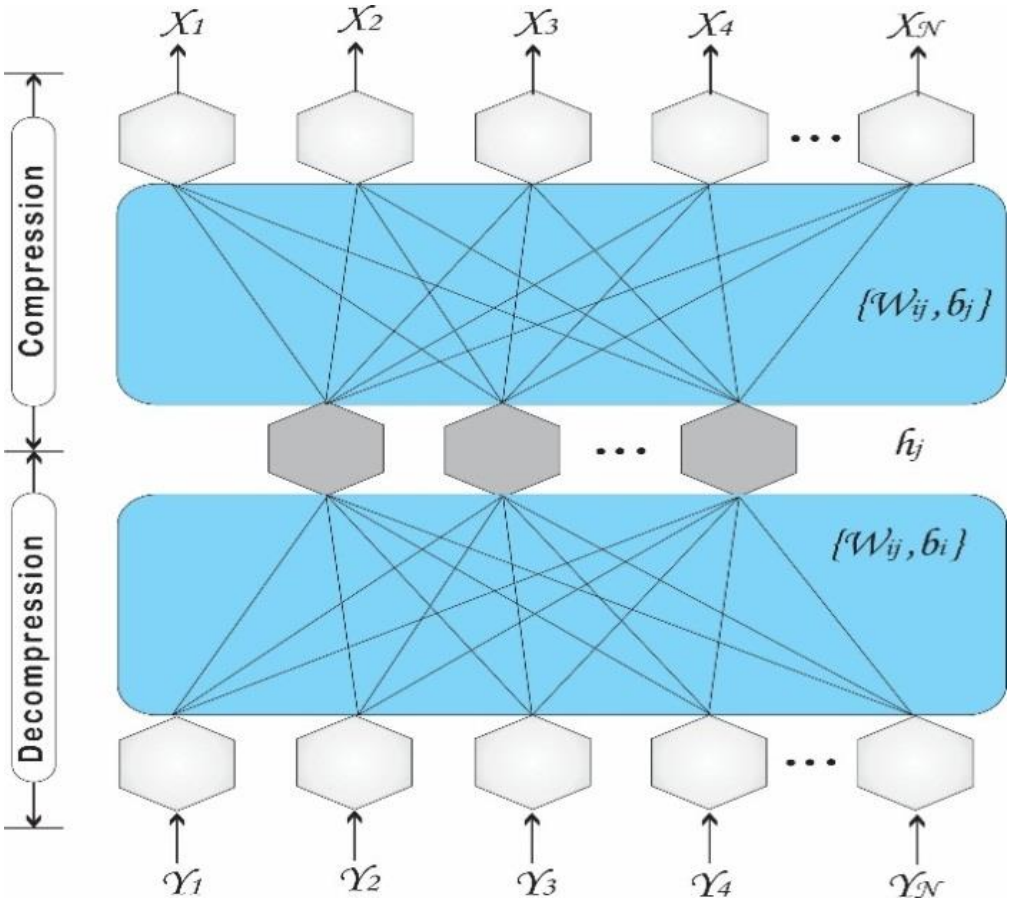

Figure 2: BPNN model for suppression and expansion

III. METHODOLOGY

The proposed algorithm is combination of wavelet transform function and BP neural network. The wavelet transform function decomposed the data in different layers such as layer 1, layer 2 and layer n. the layer data of transform function is input of BP neural network. In this algorithm used multi-layer back propagation neural network model. The processing of compression algorithm describes in steps.

Step 1-
The wavelet transform function data is mapped according to their number of neurons for layer processing of data describe in equation (1).

$$E \sim \sum_{i=1}^{N}[\sum_{i=1}^{\infty}\frac{H^{(n)}(\mathrm{p}_i)}{n!}(\varepsilon_i)^n] \ as \ \varepsilon_i \to 0 \qquad (1)$$

Step 2-
For the estimation of training error of BP neural network model used equation (2).

$$E = \sum_{i=1}^{N}[\sum_{i=1}^{\infty}\frac{H^{(n)}(\mathrm{p}_i)}{n!}\varepsilon_i{}^n + 0(\varepsilon_i{}^n)] \qquad (2)$$

Step 3-
The output of BP neural network mapped in image as compressed in equation (3).

$$E = \sum_{i=1}^{N}\left[-\varepsilon_i\left(\frac{1}{ln2} + log_2\mathrm{p}_i\right) - \frac{1}{2ln2}\frac{\varepsilon_i{}^2}{\mathrm{p}_i} + 0(\varepsilon_i{}^2)\right] \ as \ \varepsilon_i \to 0 \qquad (3)$$

Step 4-
Measure the block of compressed image.
$\{x(i,j)\mathrm{I}j = 1,2 \ldots\ldots, p\}$ is block point for the same $a = [a(1), a(2), \ldots\ldots, a(p)]$ as:
$z(i) = \sum_{j=1}^{p} a(j)x(i,j), \quad i = 1,2, \ldots\ldots n \qquad (3)$

Step 5-
Estimate the dissimilar block for the estimation of MSE value for PSNR
(1) Defining as the absolute distance between two blocks of image.

$$d\big(z(k), z(h)\big) = \sqrt{\big(z(k) - z(h)\big)\big(z(k) - z(h)\big)} = \sqrt{\big(z(k) - z(h)\big)^2}$$

$$k = 1,2, \ldots\ldots\ldots\ldots, N; h = 1,2, \ldots\ldots\ldots\ldots, N$$

Step 6 -
image is compressed and measure PSNR value and compression ratio.

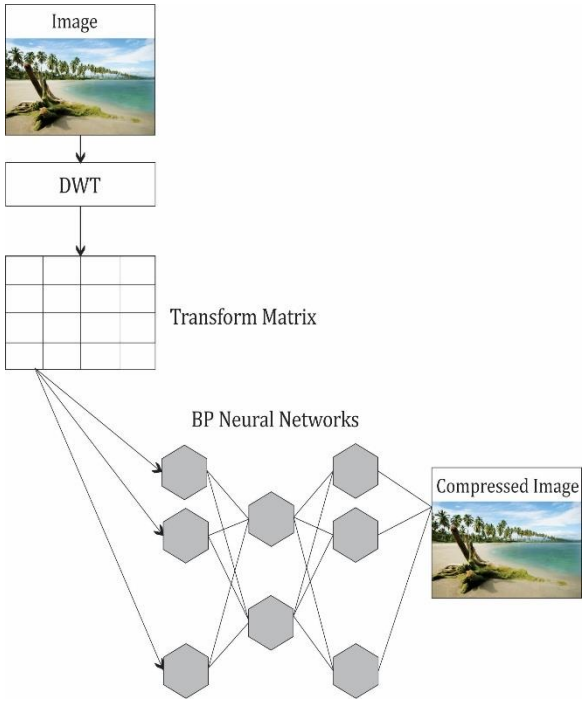

Figure 3 proposed model processing of image compression.

IV. RESULTS AND DISCUSSION

In this section discuss the simulation and result analysis of image compression method. Here discuss two image compression algorithms one DISCRETE WT and proposed algorithm. all two-algorithm implemented in MATLAB software [12]. The MATLAB software is well known recognition tools for image processing. It gives the basic and fundamental image processing tools. For the validation of proposed algorithm of image compression used some standard image such as Lena, Barbara, cameraman and some other image. This image resolution size is 512* 512. These entire images obtained from Google image database.

Figure 4: Shows that the result window for Cameraman Original and Compressed Image using DISCRETE WT Methods.

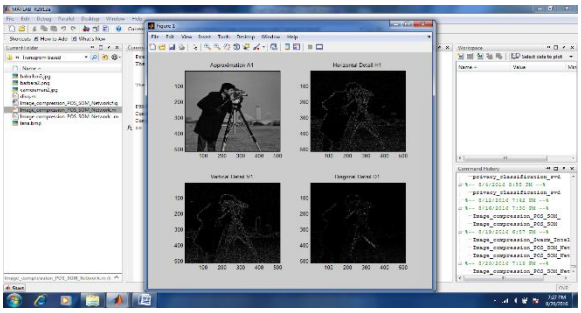

Figure 5: Shows that the Transformation window for Cameraman Image using DISCRETE WT Methods.

COMPARATIVE RESULT ANALYSIS

Table 1: Shows that the PSNR, Compression Rate and Compression Ratio using DISCRETE WT and HYBRID method for Cameraman.jpeg image.

FOR CAMERAMAN IMAGE			
Method	PSNR	Compression Rate	Compression Ratio
DISCRETE WT	26	0.48	12
HYBRID	29	0.51	16

Table 2: Shows that the PSNR, Compression Rate and Compression Ratio using DISCRETE WT and HYBRID method for Baballon2.jpeg image.

FOR BABALLON2 IMAGE			
Method	PSNR	Compression Rate	Compression Ratio
DISCRETE WT	19	0.59	9.79
HYBRID	24	0.63	14.29

COMPARATIVE RESULT GRAPHS

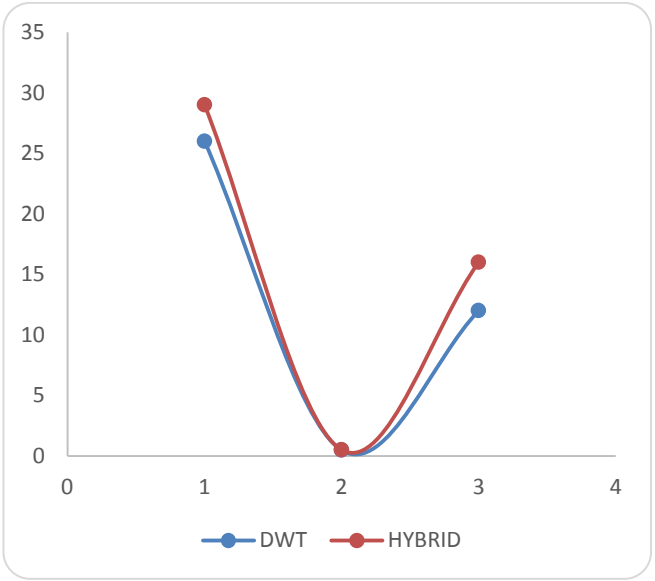

Figure. 6

Figure 6: The above figure Show the result analysis on the basis of comparative result analysis study of using Cameraman image with include the performance parameter is PSNR, Compression Rate and Compression Ratio value with applied the method such as DISCRETE WT and HYBRID Method. And here our HYBRID method result shows the better result than existing methods.

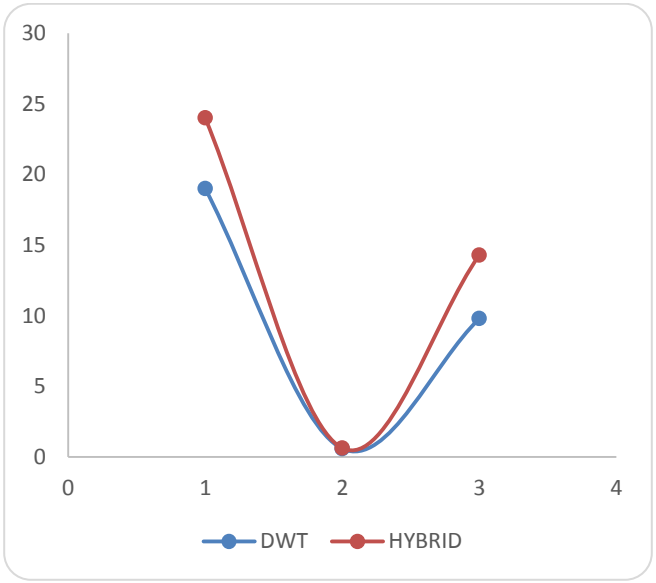

Figure.7

Figure 7: The above figure Show the result analysis on the basis of comparative result analysis study of using Baballon2 image with include the performance parameter is PSNR, Compression Rate and Compression Ratio value with applied the method such as DISCRETE WT and HYBRID Method. And here our HYBRID method result shows the better result than existing methods.

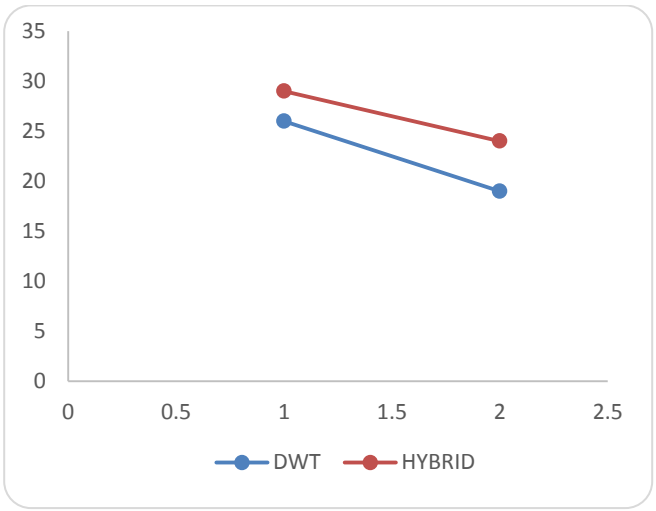

Figure.8

Figure 8: The above figure Show the result analysis on the basis of comparative result analysis study of using Cameraman image, Baballon2 image, Leena image and Barbara2 image with include the performance parameter is PSNR value with applied the method such as DISCRETE WT and HYBRID Method. And here our HYBRID method result shows the better result than existing methods.

V. CONCLUSION AND FUTURE SCOPE

In this paper proposed the hybrid method of image compression. The proposed algorithm is combination of wavelet transform function and BP neural network model. The BP neural network model enhances the performance of image compression technique. The proposed algorithm used wavelet transform function for the layer decomposition of image. The decomposed image is input of BP neural network. The BP neural network model trained the block of digital image and measure the dissimilar block of image for the estimation of MSR value. The BP neural network model decreases the value of MSR and increase the value of PSNR. Our empirical result shows that the proposed algorithm is better than other transform function such as DCT and DISCRETE WT. In future used another training algorithm for minimization of time.

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