# STUDY AND IMPLEMENTATION OF SPIHT AND MODIFIED SPIHT ALGORITHM FOR IMAGE COMPRESSION

**[1]TANUJA DAVE, [2]POOJA JAIN**

[1,2]Computer science Engineering, Department computer science,
Shri Vaishanav Institute of Technology and Science, Indore, India
E-mail: [1]Tanuja66dave@gmail.com, [2]poojacs35@gmail.com

**Abstract**— In this paper, we study the existing compression technique. That is, Set Partitioning in Hierarchical Trees (SPIHT). This compression algorithm is based on the wavelet transform. A wavelet is a small wave which has its energy concentrated in time. It gives a tool for the inspection of non-stationary signal. Wavelet transform which decompose a signal into a set of elementary function.This elementary function is called the Wavelet. Here we present experimental result comparing the SPHIT and modified SPIHT algorithm. We found modified SPIHT algorithm gives better compression ratio and bit per pixel value than the existing SPIHT algorithm. Compression of image is carried on MATLAB.

**Keywords—** Wavelet Transform, Image Compression, SPIHT and Modified SPIHT.

## I. INTRODUCTION

In the recent years, there is a large amount of information present in the form of Digital image data. At present, there is a huge demand for the low image size and high resolution. However, the digital images require more storage space or bandwidth, there is always a proficient algorithm is needed for the effective system performance. In the literature, as number of algorithms were introduced. As we know Image compression, is minimizing the size of a graphic file without degrading the image quality of image. The reduction in file size allow more image to be stored in a given amount of memory space. Nowadays wavelet transform is used in the image compression. The wavelet transform based image compression technique are Embedded Zero tree wavelet [1] and Set Partitioning into hierarchical trees [2].

## II. WAVELET

A wavelet is a "wave" which has its energy concentrated in time. It gives a tool for the analysis of mandatory non stationary. It is also known as wave like oscillations with an amplitude which increase from zero and decrease up to zero. This is also known as one complete cycle. It is an oscillating wave like character. Wavelet is mainly designed for a specific purpose that makes them useful for signal processing and image processing. Convolution is the techniques that can combine using revert, shift, multiply and sum.

### *A. Wavelet Transform*

By and large, we used to wavelet transform (WT) to examine active signals i.e. signal whose frequency response varies in time. The wavelet transform is comparable to the Fourier transform with a different merit function. The main difference is that wavelets transform are localized in both time and frequency whereas the standard Fourier transform is only localized in frequency. Generally, the wavelet transform is expressed by the following equation.

$$F(a,b) = \int_{-\infty}^{\infty} f(x)\, \psi^*_{(a,b)}(x)\, \mathrm{d}x$$

Where the * symbol is the complex conjugate and ψ is some function.

### *B. Discrete Wavelet Transform*

In Lossy image compression, Discrete Cosine Transform (OCT) is the core of JPEG international Standards and is one of the most grown-up developed compression algorithms. For 10: 1 less than compression ratio, the DCT based JPEG image compression will not have a notable effect on geometry by using, “Blocking artifacts" and it result edge effects under the large compression ratio. A good solution to this problem is the use of "wavelet". So this is the reason that from the last two decades for "image Analysis and coding", DWT has become an important tool [3],[4]. The DWT transform is not successful to provide a proficient representation of the directional image feature like edge and lines because the WT lifting mechanism is applied on horizontal and vertical direction.

## III. NEED OF IMAGE COMPRESSION

Image Compression decreases the amount of data mandatory to symbolize an image by removing the unnecessary information. We can remove the unnecessary information by three ways. Unnecessary coding that arises from symbolization of the image gray levels unnecessary inter pixel that exists due to the high association between the side by side pixels, & unnecessary psycho image that is obtained based on Human awareness of the image information [5]. The Image Compression symbolizes an image data in a compressed way that there should be encoder that

utilizes one or more of the above redundancies and a decoder reconstruct the age from compressed data.

### *A) Various Techniques in Image Compression*

Image Compression done on image may be lossless or lossy. In the lossless type, Images can be recreated exactly without any change in the power values. Lossless compression is important in satellite image processing, medical field and document imaging, which do not bear any losses in their data and are often compressed using this type. On the other hand, lossytype, images cannot be recreated exactly after changes in the power values. lossy encoding can be obtained with LZW, JPEG etc. and EZW,WDR,ASWDR,SPIHT etc. are the examples of lossless image compression technique.

## IV. SET PARTITIONED INTO HIERARCHICAL TREES (SPIHT)

The SPIHT algorithm was devised by said and Pearlman [6] [7]. It is a controlling, well organized and yet computationally easy image compression algorithm. With the help of this algorithm, we can get the highest PSNR values for a different gray-scale images. It provides good differentiation standards for all ensuring algorithms. . It was developed for best developed transmission as well as for compression. During the decoding of an image, the quality of a displayed image is the greater that can be reaching for the number of bits input by the decoder up to that time. In The progressive transmission method, decoder starts by setting the reconstructed image to zero. Then transformed co-efficient is inputted, decodes them, & uses them to generate an improved rebuilt images to transmit most important information. SPIHT uses the Mean squared error (MSE) twist measure [8].

EZW algorithm is the base version for SPIHT algorithm [8] [9] and it is a powerful image compression algorithm that generates an embedded bit stream.it gives the best highest PSNR values and compression ratios for a different types of gray scale images have been gained [10] but through this algorithm, we can't compress the images dynamically.

### *A. SPIHT Algorithm*

SPIHT use the following sets of coordinates:
*O (i, j)*: set of coordinates of all offspring of node *(i, j).*
*D (i, j)*: set of coordinates of all descendants of node *(i, j).*
*H*: set of coordinates of all spatial orientation tree roots (nodes in the highest pyramid level).
LIS: list of the insignificant sets.
LIP: list of the insignificant pixels.
LSP: list of the significant pixels.
*L (i, j) = D (i, j) −O (i, j).*

A LIS entry is of type A if it represents *D (i, j),*
Type B if it represents *L (i, j).*
The steps of the algorithm are as follows:
(1) *Initialization*:
Output *n* = _log 2(max *(i, j)* {|*Ci, j* |}) _;
Set the LSP as an empty list;
Add the coordinates *(i, j)* ∈*H* to the list LIP, and only those with descendants also to the LIS, as type an entries.
(2) *Sorting pass*:
(2.1) for each entry *(i, j)* in the LIP do:
(2.1.1) transmit *Sn (i, j)*;
(2.1.2) if *Sn (i, j)* = 1 then move *(i, j)* to the LSP and transmit the sign of *Ci, j;*
(2.2) for each entry *(i, j)* in the LIS do:
(2.2.1) if the entry is of type a then
• transmit *Sn (D (i, j))*;
• If *Sn (D (i, j))* = 1 then
_ for each *(к, _)* ∈*O (i, j)* do:
• transmit *Sn (к, _)*;
• If *Sn (к, _)* = 1 then add *(к, _)* to the LSP and output the sign of *Cк,_*;
• If *Sn (к, _)* = 0 then add *(к, _)* to the end of the LIP;
_ If *L (i, j)* _= ∅then move *(i, j)* to the end of the LIS, as an entry of type B, and go to step (2.2.2);
Otherwise, remove entry *(i, j)* from the LIS;
(2.2.2) if the entry is of type B then
• transmit *Sn (L (i, j))*;
• If *Sn (L (i, j))* = 1 then
_ add each *(к, _)* ∈*O (i, j)* to the end of the LIS as an entry of type A;
_ Remove *(i, j)* from the LIS.
(3) *Refinement pass*:
For each entry *(i, j)* in the LSP, except those included in the last sorting pass, output the *n*th most significant bit
Of |*Ci, j* |;
(4) *Quantization-step update*:
Decrement *n* by 1 and go to step (2).

### *B. modified SPIHTalgorithm*

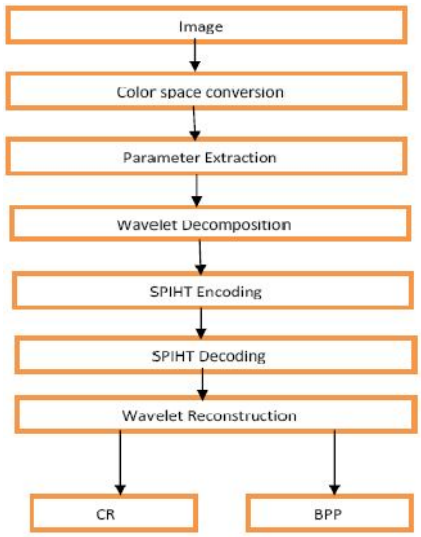

**Figure 1 Block based Modified SPIHT**

When we used SPIHT image compression technique then this compresses less number of image. Now this represent a very active area of research, the modification have been done alone in SPIHT algorithm e.g. block based image coding. In the Figure 1, we see the modified SPIHT algorithm, on the basis of block based encoding. First we take the image and then we are performing the color space conversion on that image by performing this conversion we are converting our color image into the gray scale image. then in the next step this gray scale image is the input to the parameter exaction in that we are converting 2-0 parameter to 1-0 parameter then we perform the wavelet decomposition in that we are using the 9/7 filter we perform the 7-level decomposition And then SPIHT encoding and decoding is performed on that image, in encoding we provide the actual code. At the last, wavelet reconstruction starts and we are able to calculate the compression ratio (cr) and bit per pixel (bpp), modified SPIHT to be employed.

RESULT-

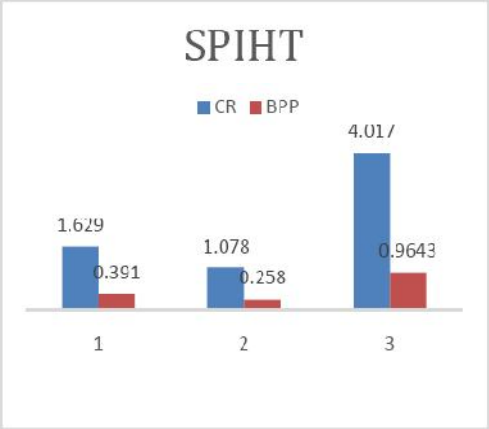


**Figure 2 Result of SPHIT algorithm**

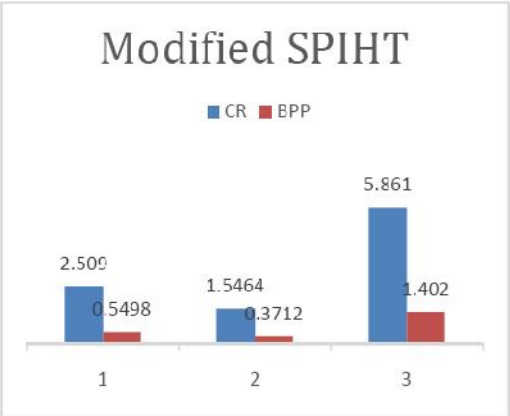


**Figure 3 Result of modified SPHIT algorithm**

Above experimental result is performed on the different type of images that are having different size it may vary from 30kb to 5 MB. Here we compare our SPIHT and modified SPIHT algorithm on the basis of compression ratio (cr) and bit per pixel (bpp). Its diagrammatic representation is given on figure 2 and figure 3. Figure 4 is the original image and figure 5 is the good visual quality of input image.

**Figure 4 original image**

**Figure 5 decoded image**

## V. PERFORMANCE ANALYSIS

The above conversed algorithm has been executed in MATLAB R2012a In this image, compression algorithm we take lena image. Firstly, we compressed with existing SPIHT algorithm and after all compressed with proposed algorithm and then following outcome are coming. Although MSIPHT is Simple, aggressive with SPIRT in compression ratio and bit per pixel value and often provides better perceptual results in Table. We show the number of significant Values encoded by both for 3 different images in almost every case MSIPHT was able to encode more values then SPIHT.

## CONCLUSION

Most of the image compression techniques carried out up till now all is having some sort of redundancy. The modified SPIHT algorithm is beneficial in order to achieve the better compression ratio and bit per pixel. Using image compressing techniques, we can sharpen the images, contrast to make a graphic display more useful for display, reduce amount of memory requirement for storing image information.

## REFERENCES

[1] Shapiro, J. M,"Embedded Image Coding using Zero trees of Wavelet Coefficients," IEEE Transactions of Signal processing vo1.41, No.12, pp34 45_3462, 1993.

[2] Said and W. A Pearlman, "A new, Fast and Efficient image Codec Based on set Partitioned in hierarchical

trees, "IEEE Transaction circuits & systems for video Technology, Vo.6,PP.243 250june 1996.

[3] M.Antonimi, M. Borland, p. Mathieu and l.Daubechies,"lmage coding using the wavelet trasform," IEEE transaction Image processes, Vo1.l, no.2, PP.205 220, April .1992.

[4] D.Taubman and M.W.Marcelin,"JPEG 2000 Image Compression Fundamentals Standards and practice", Dordrecht the Netherlands: Kluwer, 2002.

[5] R.A.Devore, B. Jawerth, and B. J Lucier, transform coding,"IEEE transactions Information Theory, Vo1.38, PP.719_746, Mar-1992.

[6] A. said, W. A Pearlman, "Image compression using The Spatial Orientation tree", IEEE international symp on circuits &systems Chicago, IL,PP 279-282 1993.

[7] A. said ,W.A. pearlman,"Anew,Fast and etlicient image co dec based on set partitioned in hierarchical trees IEEE Trans on circuits and systems for video technology,Yo1. 6,No.3 PP-243- 250,1996

[8] S.P.Raja, Dr.A. suruliandi,"Analysis Of efficient wavelet based Image Compression Techniques, "Second International Conference on Compression Using Communication networking Technology, 20 I O.

[9] A. said Islam, Pearlman, "An Embedded and etlicientlowcomplexity hierarchical Image Processing", 99 Proceeding of SPIE, Vol 3653, PP294-305.Jan, 1999.

[10] Strang and Nguyun, T. "Wavelets and Filter. Banks", wellesleycam-bridge press. wellesley, MA, 1996.

★★★