A Hypothesis on Synthesis Techniques and Amalgam Trends in Image Compression Techniques

* G. Thippanna,
* Research Scholar Dept.of Computer Science & Technology,
S.K. University, INDIA

Abstract: --- Trend means that expose a new mechanism/plane/processor to implement the existence. Such types of assorted hybrid trends were implemented in image compression techniques concepts. The abstract of this dissertation will explained briefly such type of assortment compression techniques in image compression concepts. This is awesome thing many library compression techniques captured by image processing System. The programmer's privilege from those techniques, and implements many hybrid compression techniques but then applied hybrid compression to images, we must apply library (Huffman) compression technique to get bright compression rate. The author hope on This paper will be very helpful to known the many new hybrid techniques in compression techniques and how use them to make a new think in the concept, now a days this is very important thought to store large amount of fixed/motioned images/data to store in a less size of storage devices and helpful to easily transformation.

Key Words: - Images, compression, compression techniques.

I. INTRODUCTION

This is awesome to express that in present days images are impartment thing to capture a lot of information, one more compression techniques also to compress and store large amount of data in less memory, helpful to transmit such typed data/images within less time so for. When we discuss about compression techniques in image processing Systems may author explained in detail assorted compression techniques which are very helpful to compress the data/image/audio/video. All the compression techniques will explain with mathematical equations. But my dissertation will express some different typed compression technique (simple hybrid compression techniques) those were not depend on mathematical equations, those functioning on spatial mechanism so that my dissertation explaining about that hybrid compression based on spatial mechanism. The authors hope that these techniques will give best results along with Library compression. Most compression schemes take advantage of the fact that data contains a lot of repetition. Trend means that expose a new mechanism/plane/processor to implement the existence. Such types of assorted hybrid trends were implemented in image compression techniques concepts. The abstract of this dissertation will explained briefly such type of assortment compression techniques in image compression concepts. This is awesome thing many library compression techniques captured by image processing System. The programmer's privilege from those techniques, and implements many hybrid compression techniques but then applied hybrid compression to images, we must apply library (Huffman) compression technique to get bright compression rate. The author hope on This paper will be very helpful to known the many new hybrid techniques in compression techniques and how use them to make a new think in the concept, now a days this is very important thought to store large amount of fixed/motioned images/data to store in a less size of storage devices and helpful to easily transformation.

II. COMPRESSION TECHNIQUES[1]

Compression is a mechanism to reduce existence data/image size than its original. It is also very comfortable to transformation. Uncompressed data also possible to transformation but its takes much time and few times that lot of data is not existed in the network. But compressed data/image takes less time for quickly transformation. So that consequence of compression saves disk space and reduce time needed to file transformation. For compression, programmers were developed few techniques are called Compression Techniques.
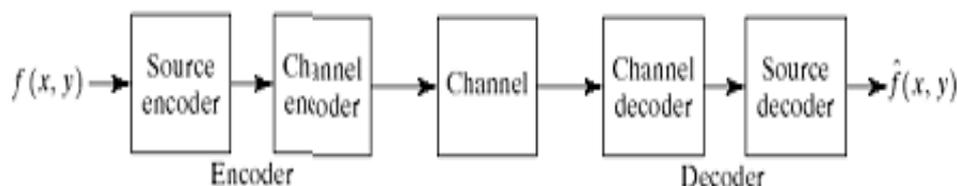

$$f(x, y) \rightarrow \boxed{\text{Source encoder}} \rightarrow \boxed{\text{Channel encoder}} \rightarrow \boxed{\text{Channel}} \rightarrow \boxed{\text{Channel decoder}} \rightarrow \boxed{\text{Source decoder}} \rightarrow \hat{f}(x, y)$$

Encoder   Decoder

Figure 2.1. The above diagram will explain the compression mechanism.

```
f(x, y) → [ Mapper ] → [ Quantizer ] → [ Symbol encoder ] → Channel
```

(a)

```
Channel → [ Symbol decoder ] → [ Inverse mapper ] → f̂(x, y)
```

(b)
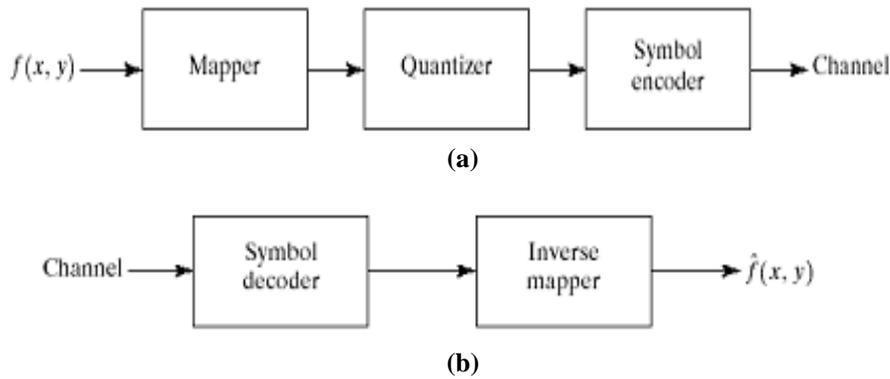
Figure 2.2(a) Source Encoder   (b) Source Decoder

```
[ COMPRESSION ] → Spatial Mechanism
                → Mathematical
```
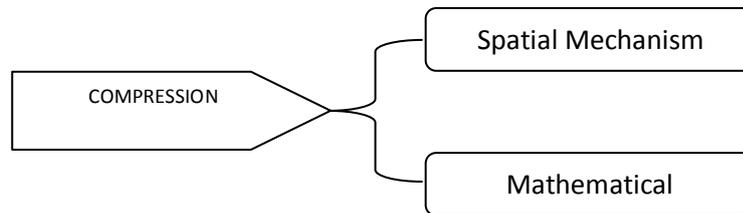
Figure 2.3.The following equations shows that how the way of compression classifications.

1. Spatial Mechanism [2]: - It is mechanism using that compress of an image on the base of its pixels i.e. here no mathematical equations are used. Spatial compression is where unnecessary information from an image is discarded, resulting in smaller files and faster load times. It does not affect image quality in any way, and from a users perspective will only mean faster load times.

This sort of compression is only really useful when dealing with images captured from computer screens.

When spatial compression is activated, Knowledge Presenter searches for images that are candidates for spatial compression. In order to be eligible, a series of images must:
- be of the same size and position
- Subsequent images must appear on the timeline where old ones disappear.
        - Must be in PNG or GIF format
        - must not use any display filters.
        - must use dynamic moving or resizing.

2. Mathematical Equations [3]:- In this compression mechanism we use some mathematical equations, after an image compressed into pixels, all pixel substitute into what require mathematical equation we used to compress an image. Generally the available compression techniques called library compression techniques must follows the mathematical mechanism compression like run length coding, Huffman coding, arithmetic coding, symbol based coding techniques, . . . etc.

A. Types of Compression Techniques [4] :- There are two categories of compression techniques used with digital graphics, lossy and lossless. Whilst each uses different techniques to compress files, both have the same aim. To look for duplicate data in the graphic and use a much more compact data representation.

Lossy and Lossless each have various methods which are used by different file formats and achieve different results. Therefore not all lossy or lossless formats will use the same methods. It is beyond the scope of this Unit to look at these methods in detail so you will not be assessed on them. The Unit entitled Digital Imaging: Bitmaps covers compression methods in more detail. If you are a bit unclear about this, the following may help:

Two important compression concepts are Lossy and Lossless compression:

➢Lossy compression [6]   with lossy compression, it is assumed that some loss of information is acceptable. The best example is a videoconference where there is an acceptable amount of frame loss in order to deliver the image in real time. People may appear jerky in their movements, but you still have a grasp for what is happening on the other end of the conference. In the case of graphics files, some resolution may be lost in order to create a smaller file. The loss may be in the form of color depth or graphic detail. For example, high-resolution details can be lost if a picture is going to be displayed on a low-resolution device. Loss is also acceptable in voice and audio compression, depending on the desired quality.

  • Lossy compression methods include DCT[5] (Discreet Cosine Transform), Vector Quantization and Huffman coding.

> Lossless compression [7]   with lossless compression, data is compressed without any loss of data. It assumes you want to get everything back that you put in. Critical financial data files are examples where lossless compression is required.

- Lossless compression methods include RLE [4] (Run Length Encoding), string-table compression, LZW[4] (Lempel Ziff Welch) and zlib.

B. Principles of Compression [1] :-A common characteristic of most of the images is that the neighboring pixels are correlated and therefore contain redundant information. Two fundamental components of compression are redundancy and irrelevancy reduction [3]. In general, three types of redundancy can be identified:

- Spatial Redundancy or correlation between neighboring pixel values.
- Spectral Redundancy or correlation between different colour planes or spectra bands.
- Temporal Redundancy or correlation between adjacent frames in sequence of image (in video application).

Since, we focus only on still images, for image compression there are three types of redundancies, they are.

1. Coding redundancy
2. Inter pixel redundancy
3. Psycho visual Redundancy

III.   Assorted Hybrid Compression Techniques.[8]

Hybrid Compression Techniques are Compression Techniques which were inherited form existence compression mechanisms, i.e. spatial compression functioning. The main aim of this dissertation gives information about compression techniques follows spatial mechanism. Here according author knowing hybrid compression based on spatial mechanism, classified into...

a. Lossless BPTMI[9] (Binary Plane Technique for Medical Images)
b. Lossless BPTCI[10] (Binary Plane Technique for Colour Images)
c. OBPT[11] (Optimization Binary Plane Technique)
d. Lossy BPT[12] (Difference Technique)
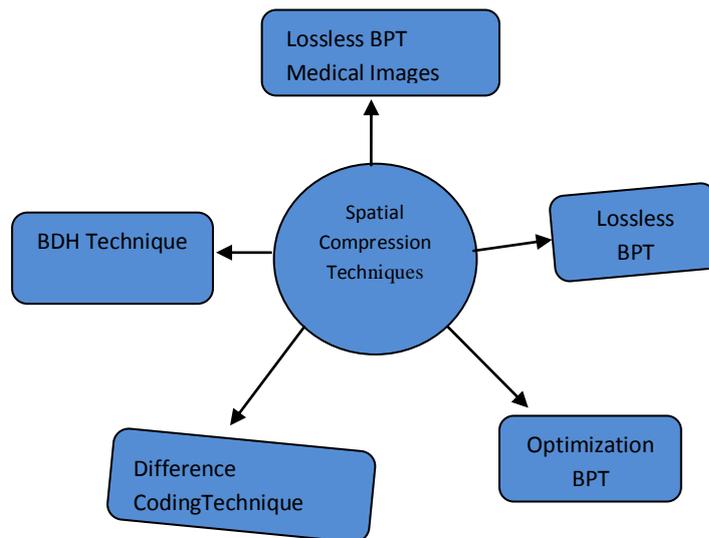e. Raster Line Compression Technique[12] (BDH Compression Technique)

Figure 3.1. Classifications of Hybrid Compression Techniques

a. Binary Plane Technique (BPT) for Medical Images:

This BPT is based on spatial domain of the image and is suitable for compression of Medical images(monochrome images). The main objective of this technique is to take advantage of repeat values in consecutive pixels positions. For a set of repeated consecutive values only one value is retained.

Method Approach: - in this techniques two codes are used to build the Bit plane, the codes are as given bellow.

Code 1's:- is used to indicate that current pixel is different from previous pixel. In this case the current pixel is moved to the data table.

Code 0's:- is used to indicate that the current pixel is exactly same as previous pixel. This elements the storage of current pixel.

After generating and merging the Bit plane & Data table, then apply Huffman coding and finally compressed form file is generated.
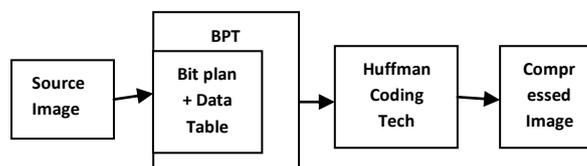

Figure 3.2. The following Diagram represents the mechanism of BPT for Medical Images

Reconstruct for Medical Images: - In the Reconstruction of the image, first the intermediate file is generated from the compressed file. The Bit plane and Data tables are extracted from the intermediate file by checking each bit of Bit plane either a fresh byte from the binary plane is read and written the reconstructed image file or earlier byte itself is written based on the current bit checked.
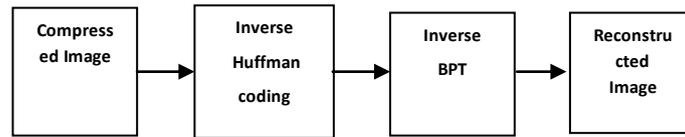
Compressed Image → Inverse Huffman coding → Inverse BPT → Reconstructed Image

Figure 3.3. The following diagram will show that how reconstruct the Original Image.

b. *BPT for Colour Images:-*
Method Approach for Colour Images:- for colour images, the image is first separated into three planes like RED, GREEN, BLUE, for each colour treated as monochrome color images, we applied Binary Plane Technique. The processing of the pixel of the three planes is done together.

RED Bit plan

GREEN Bit plan

BLUE Bit plan

RED Data table
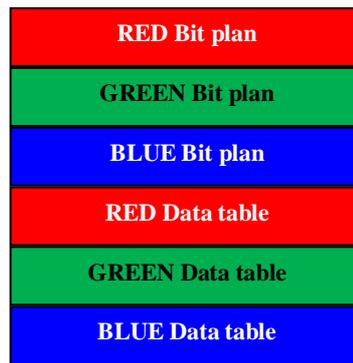
GREEN Data table

BLUE Data table

Figure 3. 4. The following figure represents the format of Intermediate file for colour images.

The Bit plan & Data table are maintained separately for each plane. Finally the Bit planes and Data tables of each plane are merged in that order to generate file as shown in above figure.

Reconstruct for Color Images:- In the reconstruction of the image, first the intermediate file is generated from the compressed file. The Bit plane and Data table for RED, GREEN, and BLUE planes are extracted from the intermediate file by checking each bit of Bit plane for every colour plane separately the images are reconstructed.

c. *Optimization BPT:-* Like the BPT, the optimization BPT is also based on spatial domain of the image and suitable for compression of medical images. In this technique additionally to checking for the similar adjacent pixels is also checked a pair of successive pixels with difference in the range of -8 to +7 with respect previous pixel values. The range -8 to +7 is selected because the difference can be stored with half a byte. So that the par can be stored in single byte.

Method approach for OBPT: - the OBPT the coding in the Bit plane is different from BPT. Here three different codes are used in the plane of two codes used in BPT.

Code 1:- is used to indicate that current pixel is different from previous pixel. In this case the current pixel is moved to Data table.

Code 00:- is used to indicate that the current pixel is exactly same as previous pixel. This eliminates the storage of current pixel.

Code 01:- is used to indicate that two successive pixels are in the range -8 to +7 with respect to current pixel. The difference between the previous pixel and each of the successive pixels are merged into on byte and the merged byte is moved into Data table.

Like in BPT apply Huffman coding Technique after merging the Bit plane and Data table and finally a compressed file form is generated
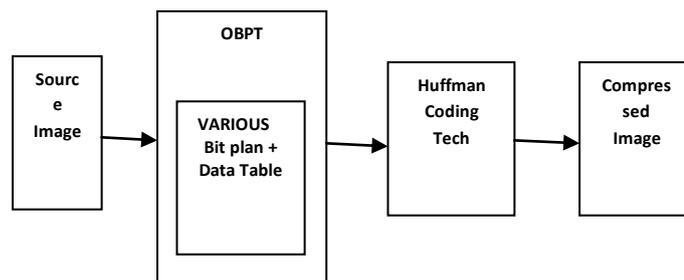
OBPT

Source Image → VARIOUS Bit plan + Data Table → Huffman Coding Tech → Compressed Image

Figure 3.5. The following diagram shows the OBPT

Reconstruct Image in OBPT:- Here reconstruction of image the bit plane and Data table are built from compressed file using inverse Huffman coding technique. The bits of the binary plane are checked for the following bit pattern and the corresponding action is performed.

For pattern 1 (one) – a fresh byte/ pixel is read from Data table and written of the image file to be reconstructed.
For pattern 00 – The earlier pixel itself is written to the image file to be reconstructed.
For pattern 01 – a fresh byte is read and adding the previous pixel to higher& lower nibble of the fresh byte, two pixel are generated and are written to the image file to be reconstructed.
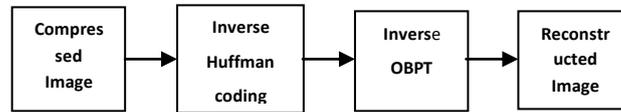

Figure 3.6. The following diagram will show that how reconstruct the Original Image.

d. Lossy BPT (Difference coding Technique):-

This technique is also like BPT but quantization is applied to reduce no. of possible values of pixels, thereby reducing the no. Of bits needed to represents it quantization refers to the process of approximating the continuous set of values into the data with a finite set of values. There are two categories of quantization,

i. Scalar Quantization: In this concept each input symbol is treated separately in producing the output.
ii. Vector Quantization:- The input symbols are clubbed together in groups called vectors and processed to give the output. This clubbing data treating than as a single unit.

Figure 3.7.
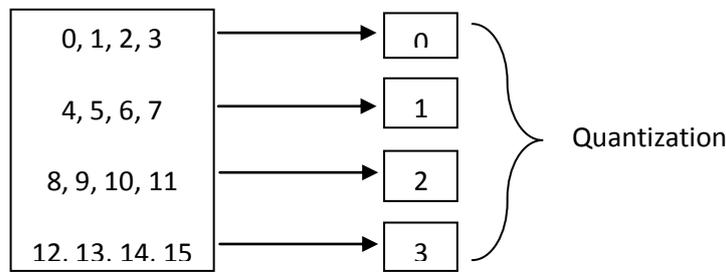
The quantization used in the Lossy BPT takes a threshold value (TV) which is varied between 4 and 32 to control the degree of quantization. The current pixel is mode based on the TV. The current pixel is approximated to previous pixel if current pixel with the range as given bellow.

Figure 3. 8.

$(PP – TV/2) >= CP <= (PP + TV/2 -1)$

PP – Previous Pixel.
CP - Current Pixel
TV – Threshold Value.
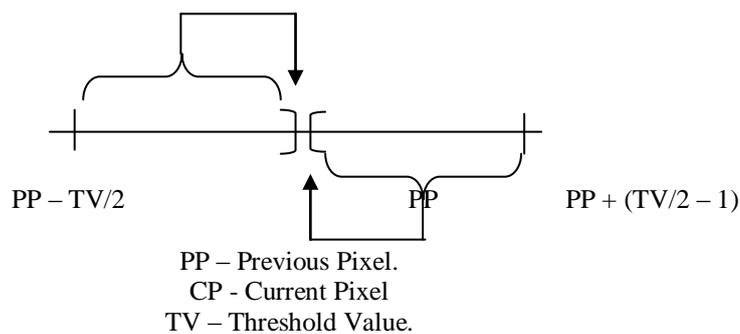
Method Approach:- In this technique like BPT two codes are used to build the Bit plane. The codes are given as bellow.

Code 1:- Is used to indicate the current pixel is different from previous pixel. In this case the current pixel is moved to Data

table.

Code 0: - Is used to indicate that the current pixel is exactly same as previous pixel or within the threshold limit used.This eliminates the storage of current pixel. Here also after generating and merging Bit plane and Data Table Huffman coding is applied, finally a compressed file form is generated.
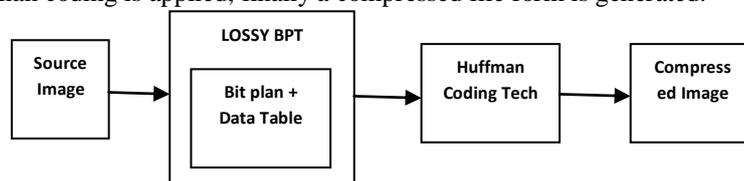

Figure 3. 9.The following diagram show that the mechanism of LOSSY BPT function.

Reconstruct Image:- In this we get Image, the bit plane and Data table are built from compressed file using inverse Huffman Coding Technique. The each byte from bit plane file is read and each bit is checked. If bit is 1 (one) then a fresh byte from Data table is read and written to reconstructed image file. Otherwise instead of reading fresh byte, the previous byte read it is written to the reconstructed image file.
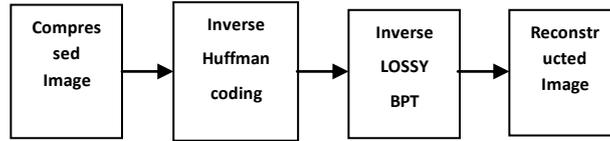

Figure 3.10.The following diagram will show that how reconstruct the Original Image.

e. BDH Technique (Raster Line)
The BDH encoding is involved with three stages they are binary plane, Difference coding, and Huffman coding in that order as followed figures.
Here two things are important
i. BDH Encoding
The BDH encoding is involved with three stages they are binary plane, Difference coding, and Huffman coding in that order as followed figures. The Difference coding and Huffman coding are popular and very widely used
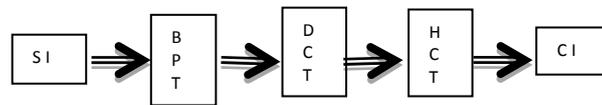

Figure 3.11: BDH Technique

SI- Source Image
BPT- Binary plane Technique
HCT- Huffman coding Technique
DCT- Difference coding Technique
CI- Compressed Image

ii. BDH Decoding
In the reconstruction of the image the Inverse Difference Coding Technique, Inverse Huffman Technique and Inverse BPT are applied on compressed file respectively as in the figure 2.
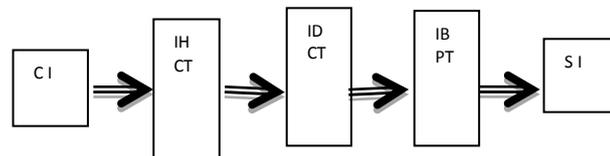

Figure 3.12: Reconstruction BDH Technique

CI- Compressed Image
IBPT- Inverse Binary plane Technique
IHCT- Inverse Huffman coding Technique
IDCT- Inverse Difference coding Technique
SI- Compressed Image

ACKNOWLEDGMENT AND CONCLUSION
In this dissertation the author endeavor to explain the assorted hybrid compression techniques based on image spatial. When the image is converts into the form of matrix pixels then we apply what we required compression need to compress the image. But here Huffman coding only applied for existed spatial compression to get bright compression. In the same scenario applicable for Arithmetic coding, run length coding, Symbol based coding for videos', Bit-plane coding for Text.
Limitations:
   a. It can be applied to the images with different colour models such as CMYK & HSI.
   b. In region specific compression, only one region of importance can be selected. But this can be extended to more than one region.
   c. The rate of compression is based on the suitability of the redundancy in the region or image. Of course these limitations are applicable to all images.
   d. The speed of compression can be taken as one parameter for comparing the performance of different compression techniques.

Future Enhancements
a. The image can be divided into blocks of suitable sizes (e.g. 8X8). For each block some important parameter such as average, standard deviation or any other suitable parameter is calculated. Based on this parameter the blocks are arranged in ascending order and then the Block Based Binary Plane technique is applied to achieve a better compression rate.
b. The Block Based Binary Plane Technique can also be applied to Fractal images.
c. The Block Based Binary Plane Techniques can be extended to gnomes of cells to achieve better compression in storage and transmission of these gnomes.
d. The effect of using the modified Run Length Coding in place of Huffman/Canonical Huffman Coding can be studied.

References
1. MajidRabbani, Paul W. JonesDigital image compression techniques, SPIE Publications (February 1, 1991) ISBN-10: 819406481, ISBN-13: 978-0819406484.
2. Daniel G. Aliaga, Ingrid Carlbom An Image Compression Method for Spatial SearchDepartment of Computer Science at Purdue University, Lucent Technologies Bell Labs
3. Gleb V. Tcheslavski Basic Image compression methods gleb@ee.lamar.eduSpring 2008.
4. G. Thippanna, Dr. T. Bhaskara Reddy http://www.ijarcs.info/?wicket:interface=:2:::: ISSN No. 0976-5697, Volume 3, No. 7, Nov-Dec 2012, www.ijarcs.info.
5. Andrew B. Watson, NASA Ames Image Compression Using the Discrete Cosine Transform Research Centre.
6. W.S.lee "Edge adaptive predication for loss less image coding "in proc. IEE data Compression Conference, Snowbird Utah march 199,pp 483-490
7. Jeffrey M. Gilber, Robert W. Brodersen; "A Lossless 2d image compression technique for synthetic discrete tone image" University of California at Bekeley, Electrical Engineering & Computer Science Bekeley, CA 94720-1770, Unpublished.
8. S.-W. Hong 1 ; P. Bao, "Hybrid image compression model based on subband coding and edge-preserving regularization."
9. Wuhan, Hubei, China, "Medical Image Compression Based on Ordered Binary Decision Diagrams", ISBN: 978-0-7695-3557-9, March 07-March 08.
10. G. Thippanna, Dr. T. Bhaskara Reddy, http:// iosrjournals.org/iosr-jac/papers/vol2-issue1/G0213438. pdf , ISSN: 2278-0661 Volume 2, Issue 1 (Sep-Oct. 2012), PP 34-38 ww.iosrjournals.org
11. Combinational Optimization by M. GROTSCHEL and L. LOVAZ, https://www.zib.de/groetschel/pubnew/paper/groetschellovasz1995.pdf.
12. N. Subhash Chandra, , M.Balraju Loss less compressionof images using binary plane, difference and Huffman coding., Journal of Theoretical and Applied Information Technology, pp 1199 – 1203.

Short Bio Data for the Author
This is Mr. G. Thippanna, Research Scholar. He has completed his Post Graduation in 2008 from S.V. University, Tirupati, he has till now four (4) international in various subjects, he attend and presented several papers in assorted seminars., and attended many workshops. He had four years of teaching experience. His interested areas are Image Processing and Computer Networks.
E-mail:- gt.pana2012@gmail.com.