

IMAGE COMPRESSION USING SPECK TECHNIQUE

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ABSTRACT: Image compression is a process that allow the reduction of data without reducing the quality of image. The storage and transfer of compressed data is faster as compared to uncompressed data. The main objective of compression is to minimize the number of bits required to represent an image or video sequence. In the wavelet domain, for compression the embedded coder technique such as SPITH (set partitioning in hierarchical tree) and SPECK (set partitioning embedded block coder) is very simple and efficient algorithm. For this purpose MATLAB. To achieve high compression ratio and PSNR, a set partitioning in embedded block coder technique is used. SPECK uses zero block of image instead of zero trees used in SPITH. This technique is best suited for large size data as compared to the EZW (embedded zero tree wavelet) and SPITH. It is faster in encoding because of its encoding simplicity. With the use of this algorithm we find out different parameter such as PSNR (peak signal to noise ratio), CR (compression ratio), MSE (mean square error), and BPP(bit per pixel). By calculating these performance parameter, can be analyze by the comparison among these technique. This algorithm achieve the same visual quality and less encoding and decoding time at lower bit rate than that of SPITH.

KEYWORDS: EZW, SPITH, SPECK, PSNR, MSE, CR, MATLAB

INTRODUCTION: It is because of the enhancing requirement for interchange of image in computer and environment of the mobile that the scope of research in the field of image compression has enhanced

importantly. A crucial role is played by digital image processing in Image compression. It is direly required for the purpose of efficient transmission and image storing. The meaning of the term data compression is the process of decreasing the amount of required data to show the provided quantity of information. Information and the data cannot be referred as the same thing. The data are the means through which transmission of information is done. As different amount of data may be utilized to show the same amount of information, it may have irrelevant or repeated information which is said the redundant data. Image compression may be categories as: Lossless or lossy. The use of lossless compression is for artificial image like technical drawing, icons and comics. It should be given preference for high value content like medical imagery or scan of image made for archival purpose. In lossless technique the image can be reconstructed after compression without any loss of data in the entire process. Example of lossless compression are entropy coding, Huffman coding and Lempel-Ziv Welch coding. The most suitable method for natural image is Lossy method. This is applicable in such as photos where little fidelity loss is allowed to get a reduction in bit rate. The lossy compression is producing difference. It is known visually lossy. Examples of lossy technique are fractal coding and Fourier transform. These compression methods are used to obtain good quality image. An effective compression method is the one which extract characteristics feature of an image and neglect redundant & irrelevant information. Compression can be achieved by receiving one or more of the three basic data redundancies.

- a. Spatial redundancy or correlation between neighboring pixels.
- b. The reason of presence of spectral redundancy is the correlation between various color planes or spectral bands.
- c. Because of the qualities of the human visual system, there is presence of psycho-visual redundancy.

The spatial and spectral redundancies can be found in case of some fixed spatial and spectral patterns present between the pixel and color component. These are common to each other. The psycho-visual redundancy develops the fact that the human eye is insensitive to certain spatial frequency.

WAVELET: Wavelet is an important tool in image processing and computer vision such as compression, detection and recognition. Wavelet has main feature of multi resolution analysis and space-frequency localization. It is an improved version of furrier transform. Fourier transform is an powerful tool for analyzing stationary signal, whereas wavelet transform is helpful for analyzing non-stationary signal. It does not divide the image into block but analyze the whole image. When it is applied to sub image, it is able to separate the fine details. The main problem of Fourier transform is blocking artifacts. It is removed with the help of wavelet transform. The decomposition of signal using the wavelet transform produces a pair of waveform.

1. Approximate part: The high frequency corresponding to the detail part of the image.
2. Scaling part: The low frequency or smooth part of the image.

EMBEDDED ZEROTREE WAVELET: EZW is developed by Shapiro in 1993[20]. The bit plane encoding method is to be in the EZW encoding. The embedded coding is that process in which the encoding of the transform magnitude is explained. It permits progressive transmission of compressed image. Another name of embedded coding is progressive encoding. This

technique is based on coding that is progressive in order to compress graphics in a bit stream. The decoded image will contain more detail. The encoding of EZW is based on the two main observations.

1. The energy in the sub band is decrease as the scale decrease, when the wavelet transform of the image is to be taken.
2. The large wavelet coefficient are more important than the smaller.

SET PARTITIONING IN HIERARCHICAL

TREE: This is the improved version of the EZW. SPITH was introduced by the "said and Pearlman" in 1996[20].It has better performance and high compression ratio in comparison to the EZW. From the reconstructed image the SPITH algorithm is capable to produce the embedded bit stream with minimum mean square error at various bit rates. The feature of SPITH is.

1. It is used for progressive image transmission.
2. It uses simple quantization algorithm.
3. Fast encoding and decoding.
4. It is mainly used for lossless image compression.
5. The reconstructed image have good quality and high PSNR.

SET PARTITIONED EMBEDDED BLOCK

CODER: The speck has been utilized to exploit clustering of energy in frequency domain. The space in hierarchical structures of wavelet has performed image transformation. SPECK coding is utilizing all characters is characterized by the scalar quantized significance scheme. The properties of speck are.

1. For the reconstruction of the image a single coded bit stream is utilized in order to decode graphics at different rate. It is less than or equal to coded rate.
2. It is employing progressive transmission.
3. It has less computational complexity.

4. It is having rapid encoding as well as decoding .
5. It is having effective performance.
6. It might to utilize in case of lossy and lossless compression.

SPECK ALGORITHM: The algorithm includes encoder and decoder, which is implementing initialization, sorting pass, and refinement pass & quantization steps. The algorithm is using of rectangular portions of image. Such portions or groups are known group of type S . Dimension of a group S is based on dimension of real graphics and sub band level.

Algorithm is maintaining two linked lists named List of Insignificant Sets and List of Significant Pixels. List of Insignificant Sets is containing groups of type of varying sizes.

IMPLEMENTATION: MATLAB

MATLAB 2016 is a high level language for technical computing. It brings at one place visualization, computation and programming in an environment which is very easy-to-use. Here problem and their solutions are explained in a mathematical notation which is very acquainted to us. Some typical uses are: -

- a) Development of Algorithm
- b) Math and computation
- c) Acquisition of Image
- d) Data analysis, exploration and visualization
- e) Modeling, simulation and prototyping
- f) Engineering and scientific graphics
- g) Development of Application which involves building of graphical user interface

BIT PER PIXEL: It is indicating number of bits per pixel. The number of various colors in graphic is depending upon the intensity of color.

Bit rate = (bits /pixel for original image) /compression ratio

COMPRESSION RATIO: Compression in image could be lossless. Lossless compression has been considered for archival purposes. It is used in case of





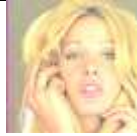
medical imaging, clip art, technical drawings. Lossy compression mechanisms usually stated compression artifacts.

Lossy mechanisms have been suited in case of natural images such as photographs in applications.

Compression ratio = image or graphic size of bits / compressed graphical image size in bits

SSIM: The **structural similarity** (SSIM) index is a method for predicting the perceived quality of digital television and cinematic pictures, as well as other kinds of digital images and videos.

Images used in research

Sr.no	Image Name	Image
1	Airplane.png	
2	Lenna.png	
3	Bird.png	
4	Mandrill.png	
5	Model.png	

RESULT AND DICUSSION: The speck encoding and decoding are implemented in MATLAB and tested on image of different size. The results are presented in term of PSNR, CR, BPP, MSE, SSIM. Table1 indicates the BPP and it should be minimum. Among the entire image in table it should be minimum for image 2. Table2 indicates PSNR value of different image. PSNR is a measure of peak error. PSNR is computed by measuring the pixel difference between the original image and compressed image. For better compression it should be maximum. In the table it should be maximum for image3. Table 3 indicate compression ratio and it is 18.13, 18.23, 18.21,

18.099,18.32 for different image.CR has been found as measure of reduction of detailed coefficient of the data. In process of image compression, it has been found significant to understand how many descriptive coefficients might be discarded from the input data of the original image. The CR can be varied to get different image quality. The more the detail coefficient is discarded, the higher the compression ratio can be achieved.

TABLE1. BPP COMPARISON OF EZW, ESPITH AND SPECK

Image	EZW	ESPIHT	SPECK
Image 1	4.2191	4.02687	4.0123
Image 2	3.756	3.58435	3.4032
Image 3	4.0444	3.85957	3.8032
Image 4	4.1285	3.93982	3.9125
Image 5	4.9203	4.69544	4.5149

TABLE2. PSNR COMPARISON OF EZW, ESPITH AND SPECK

IMAGES	EZW	ESPIHT	SPECK
Image 1	32.93713	35.66	35.8124
Image 2	33.43848	40.3	40.8101
Image 3	27.82307	44.17	44.1912
Image 4	27.77105	39.133	39.23
Image 5	32.76526	38.345	38.89

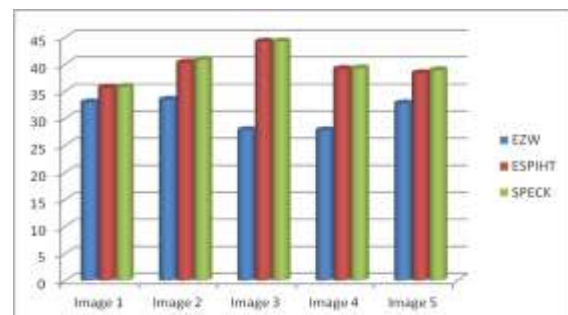


FIG 1. PSNR COMPARISON USING DIFFERENT TECHNIQUE

TABLE3.COMPRESSION RATIO OF EZW, ESPIHT AND SPECK

IMAGES	EZW	ESPIHT	SPECK
Image 1	16.3222	17.3243	18.1368
Image 2	16.4442	17.4422	18.2345
Image 3	16.3341	17.3890	18.2133
Image 4	16.0891	17.0777	18.0999
Image 5	16.8221	17.5409	18.3246

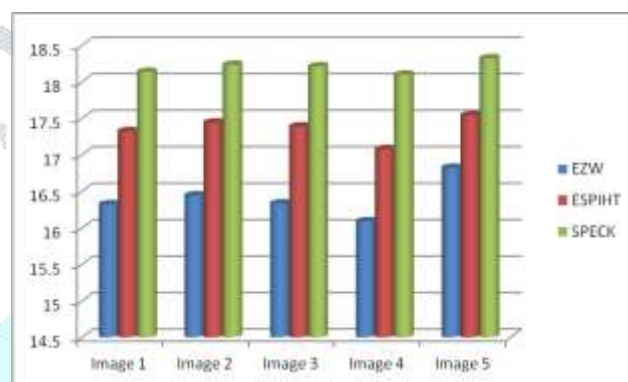


FIG 2. COMPRESSION RATIO USING DIFFERENT TECHNIQUE

CONCLUSION AND FUTURE SCOPE: During image reconstruction, DCT introduce blocking artifacts and false contouring effect. DWT is the only technique which has the capacity of multi-resolution compression and removes blocking artifacts. The lower value of MSE indicates better picture quality. There is an inverse relationship between the MSE and PSNR. So PSNR value is providing good quality of image. CR represents efficiency of compression technique. If CR is increasing then less memory space would be required. Thus compression ratio is always desirable without trade off in image quality. The proposed techniques have high PSNR, least mean square error and least bits per pixels. The scope of SPECK would be better as compare to EZW, ESPIHT in all aspects. There would be minimum loss of quality during image compression. This is without any loss with high peak signal to noise ratio, minimum mean square error. Future scope of research work is to

transmit data without any loss with high peak signal to noise ratio and minimum mean square error.

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