

RESEARCH ARTICLE



ISSN: 2321-7758

ANALYSIS OF DIFFERENT IMAGE COMPRESSION ALGORITHM ON SATELLITE IMAGES

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ABSTRACT

In this paper two compression algorithms viz. SPIHT and JPEG2000 which are wavelet based are compared on the basis of image quality measures such as CR, MSE and PSNR on two images satellite image and lena image. It is analysing that both the algorithms are scene based in case of lena image SPIHT gives better result than JPEG2000. In case of Bergi Dam JPEG 2000 gives better result than SPIHT.

INTRODUCTION

Digital Image is a two-dimensional function, $f(x, y)$, where x and y are spatial (plane) coordinates, and the amplitude of at any pair of coordinates (x, y) is called the intensity or grey level of the image at that point. When x, y and the amplitude values of f are all finite, discrete quantities, we call the image a digital image (Gonzalez, R.C. et al., 2011).

Digital Image Processing: The field of digital image processing refers to processing digital images by means of a digital computer.

Digital images usually require a very large number of bits, this cause's critical problem for digital image data transmission and storage. Image compression is one of key techniques in solving this problem(Gonzalez, R.C et al.,2011).

Compression is achieved by the removal of one or more of the three basic data redundancies first is Coding Redundancy:when less than optimal code words are used. Second is Interpixel Redundancy results from correlations between the pixels of an image. Third is Psychovisual Redundancy due to data that is ignored by the human visual system (i.e. visually non essential information).

Usually image compression can be divided into two main categories. One is Lossless where every single bit of data that was originally in the image remains after the image is uncompressed, the other is lossy compression reduces an image by

permanently eliminating certain information, especially redundant information.

In this paper three compression algorithms have been implemented first is SPIHT (Set Partitioning in Hierarchical Tree) This algorithm was introduced by Amir Said and William A Pearlman in1996 (said et al., 1996). Which is Optimized for progressive image transmission here significant bit is transferred first then next significant bit so we get good image quality with a high PSNR. Second one is JPEG2000 makes use of the wavelet and sub-band technologies. The core compression algorithm is primarily based on the Embedded Block Coding with Optimized Truncation (EBCOT) of the bit-stream. The EBCOT algorithm provides a superior compression performance and produces a bit stream with features such as resolution and SNR scalability and random access.

Study Area: In this paper we compare both the wavelet base technique on different images. We take satellite imagery from google earth, Leena image which is most use imagery for digital image processing and fruit image

Mathematical Analysis:

We compare all the images on the basis of four mathematical parameters

Compression Ratio is the measure of ratio between bytes in original image to the bytes compressed image (Santa-Cruz,D. et al., 2000).

$$C_R = \frac{n_1}{n_1}$$

Mean Square Error: The mean square error measures the error with respect to the center of the image values, i.e. the mean of the pixel values of the image, and by averaging the sum of squares of the error between the two images.

$$MSE(u, v) = \frac{1}{MN} \sum_{m=1}^M \sum_{n=1}^N |u(m, n) - v(m, n)|^2$$

where, u (m, n) and v (m, n) represent two images of size m x n. In our case, u is the original image and v is the reconstructed image. (Santa-Cruz,D. et al., 2000).

Peak Signal to Noise Ratio(PSNR): The PSNR is a single number that reflects the quality of the reconstructed image and is measured in decibels (db) (Santa-Cruz,D. et al., 2000).

$$PSNR = 20 \log_{10} \left(\frac{S}{RMSE} \right)$$

Where S is the maximum pixel value and RMSE is the root mean square error of the image.

Methodology

In this paper we have compare wavelet based compression algorithms that is SPIHT and JPEG2000 on the basis of quality measure parameter as discussed in above section applied on google earth image of bargi dam as shown in fig. 1 and lena imagery as shown in fig. 2. The research activity evolved according to these steps: after the selection of the images set the image compression techniques were applied on them; then, the images were evaluated qualitatively in order to establish the impact of the different techniques on image interpretability; finally, a quantitative evaluation of compressed images was performed in order to estimate the MSE, and the PSNR compared with the original images.

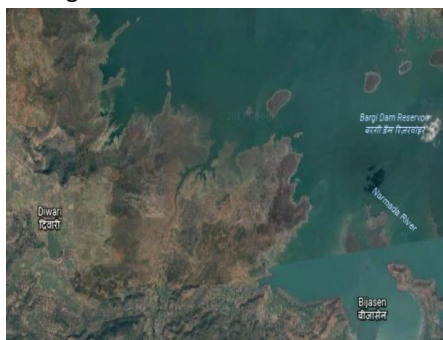


Fig 1. Bargi Dam Reservoir



Fig 2. Lena Image

Analysis and Interpretation:

Analysis of Bargi Dam:

Mean Square Error of Decompressed Image

CR	SPIHT	JPEG2000
2:1	0.71	0.34
10:1	1.51	1.16
12:1	0.88	0.51
14:1	0.72	0.28
16:1	0.93	0.39

PSNR of decompressed image

CR	SPIHT	JPEG2000
2:1	12.55	13.59
10:1	11.23	11.36
12:1	12.53	13.00
14:1	16.45	17.01
16:1	19.25	19.63

Analysis of Lena Image

MSE of decompressed image

CR	SPIHT	JPEG2000
2:1	0.30	0.63
10:1	0.56	1.17
12:1	0.58	0.85
14:1	0.28	0.54
16:1	0.3	0.8

PSNR of Decompressed Image

CR	SPIHT	JPEG2000
2:1	11.6	11.2
10:1	14.2	13.8
12:1	16.1	15.7
14:1	19.6	18.00
16:1	21.7	20.8

RESULTS

With the same compression ratio JPEG2000 has better performance than SPIHT in case of Bergi Dam on the other hand in case of lena image SPIHT gives better result than JPEG 2000. So, it is conclude that both the algorithms are scene based. SPIHT gives better result where frequency variations are high in case of lena image on the other hand JPEG 2000 gives better result where low frequency variations. High PSNR values show that the quality of the resulting image is of higher quality for the tested image. There should be a decrease in image quality with CR increase. As a result, is dramatically deteriorated when CR is high.

Conclusion

This paper basically analyses two compression algorithms viz. SPIHT and JPEG2000 these technique is basically based on the wavelet. The observation are carried out and compared on the basis of image quality measurement. These measurement are the CR, MSE and PSNR. The images are taken for the analysis satellite image and lena image. The result of calculated values are analysis and compared. It is noticed that both the algorithms lena image for SPIHT gives better result than JPEG2000 but case of Bergi Dam JPEG 2000 gives better result than SPIHT.

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