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Removing Coding and Inter Pixel Redundancy in Image Compression

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Abstract

The Digital image plays an important role in today's digital world. Storing and transmitting digital images efficiently is a challenging job. There are lots of techniques for reducing the size of digital pictures. This paper adapts the following method. The digital technique is separated into high and low resolutions. The low intensity and high intensity pixels single-handedly is dense and decompressed using three diverse algorithms to hit upon out the occurrence of low down intensity pixels in the picture. Totally six algorithms are experienced by means of benchmark images and the most excellent scheme is selected for concluding compression. A Comparison is made between the results obtained using these techniques and those obtained using JPEG 2000.

Keywords: Peak signal-to-noise ratio, Compression Ratio, Bits per pixel, singular value decomposition, bi-orthogonal

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1. Introduction

Computers simplify human life; however, they result in vast amounts of digital data in different areas. However, the confront is saving and get back this vast amount of information. The saving property necessary intended for it too enlarges the rate of the on the whole structure. If several systems are utilized for removing the digital information devoid of trailing the unique facts, after that the rate is able to be hack behind to convinced level. Picture compression process is given toward decrease the amount of bits essential on the way to outline a figure, one after the other it also used to decrease the memory space and broadcast cost. The size of large images can be reduced by compressing them, so that the memory requirements are reduced significantly.

Compression mechanisms for images can be broadly divided into lossy and lossless algorithms [1- 3]. Lossy compression results in loss of figures throughout the development of decompression whereas in lossless the decompressed information be accurately corresponding toward the novel information. The strength of low intensity pixels on compression is deliberate here. The aim of this paper is to study some segmentation-based image compression algorithms.

2. Literature review

Variable Block Size Segmentation was presented by Ranganathan et al. [4]. It divides the figure hooked on different amount chunks and predetermines the chunks based lying on the uniqueness displayed through the pixels within the chunk. Chee [5] won developed the block-oriented highest Posteriori distribution for picture compression as a substitute of division the image block into boundary, monotone & surface blocks, it will sub divided the image into priori probability. Vector quantization

offered all the way through Ratakonda et al. [6]. The participation image is separated by encoded size block with the help of guidance set. It generates a code book. By means of training set and coding book the image is reconstructed. Ahuja [7] was developed the multiscale segmentation. Multiscale segmentation is established the use of a remodel which gives a hierarchal-dependent section of the picture hooked on areas distinguish in the aid of using grayscale homogeneity. The wavelet-based tree categorization is specified by Hsin et al. [8]. Bradley et al. [9] offered distributed source coding method. JPEG was intended for compressing shaded or black and white picture of ordinary and physical world scenes [10-12]. It is a lossy compression technique. Quad tree image compression was presented by Kawai et al. [13]. Quad tree is made up of hierarchy like structure. Branches are divided into 4 subordinate quad trees [14]. Major plan of this method is a picture is separated by blocks and replace the identical. Novel image is alienated evolved from the two threshold point and two stacks. The superiority of the compression ratio is exaggerated through threshold values [15]. The proposed algorithm gives the reimbursement of a variety of techniques to decrease idleness there in low and high strength pixels.

3. Algorithms Applied

3.1. Arithmetic Encoding

One of the lossless compression techniques is Arithmetic encoding. Often occurring symbols are encoded with fewer bits. It converts the input image as symbols and the symbols are converted to floating point numbers that is greater or equal to zero and less than one. It will be encoded extremely close to optimally.

3.2. Arithmetic Encoding

Quad tree is a lossy compression in this technique an image is decomposed into variable length blocks which might be eventually quantized the usage of a tree established vector quantifier. In Quad tree structure every chunk separated hooked on quarter identical quadrants. Quad tree structure is used to reduce the intensity difference in adjacent blocks also.

3.3. Vector Quantization

Vector quantization is a lossy compression technique. It compresses the data using small bit rate. It encodes a picture by discrete vector.

3.4. Discrete Cosine Transform

Discrete cosines transform technique is employed in picture representation and cassette system. DCT techniques are used to separate images into different frequencies. In that frequency less important frequencies are removed using quantization. In the decomposition stage more important frequencies are retrieved. DCT is used to save more information in fewest coefficients [16-19].

3.5. Biorthogonal

Most images are smooth. It seems responsible for the reconstruction subband coding strategy for image analysis to correspond to the original basis with another suitable wavelet. Biorthogonal discrete wavelet transform provides together octave level occurrence and spatial timing of the examined indicator. It is always employed to resolve and pleasure extra and supplementary superior difficulty. The DWT techniques are originally supported on the efficiently carried Conjugate Quadrature Filters. On the other hand, there is a problem in Conjugate Quadrature Filters showing towards nonlinear segment belongings. It is avoided within bi-orthogonal transform algorithms.

3.6. Singular Value Decomposition

The image is separated by their corresponding color values of matrix pixel and is decomposed into smaller size by considering only the necessary the input image Some of the singular values are significant while the others are small and not significant.

4. System Architecture

Figure1 illustrate the algorithmic ladder wherever an input picture is separated into two sections like elevated and short intensity pixels. Elevated intensity pixel (MSB) is considered for stage 1. The three different algorithms viz., Arithmetic encoding, Vector Quantization, Quad tree decomposition are used for encoding the high intensity pixels and short intensity pixels alone. Prefer along with most excellent algorithm based on their performance metrics.

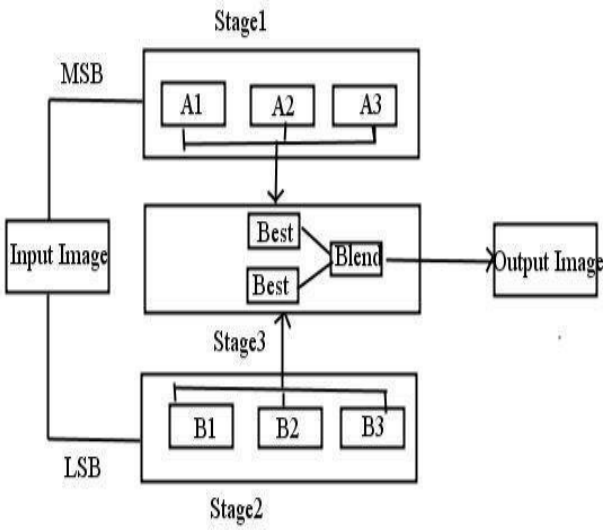


Figure 1. System Architecture

A1- Arithmetic encoding
A2 - Quad-tree Decomposition
A3 - Vector Quantization
B1 –Discrete Cosine Transform
B2 – Singular value decomposition
B3 – Bi orthogonal

4.1. Algorithm Basics

The LSB are processed in stage 2. The three different algorithms like Bi Orthogonal, DCT and SVD are used for encoding along with short intensity pixels and high intensity pixels are alone. Choose along with best one based on the performance metrics. In conclusion the most excellent two algorithms are blended for compressing the image.

1. Imread('imagenme')
2. [n,n1]=find(∞ >=125)
   2.1 Do DCT,SVD,Biothogonal
3. [m,m1]=find(∞ <125)
   3.1 Do Arithmetic encoding,Quadtree,Vector Quantization
4. Choose the best and blend together
5.if (∞ >=125 do biorthogonal)&&
   5.1 (∞<125do Arithmetic encoding)
6.End.

5. Experimental Results

Table 1 presents the observations for stage 1 results. It is observed that the arithmetic encoding results in a very high PSNR with a small reduction in the reconstructed image quality. Compression ratio and bits per pixel of A1 and A2 methods are almost same. Among the three performance measures Arithmetic encoding have a very high PSNR and better bits per pixel and compression ratio for all six testing images. It shows arithmetic encoding provides better compression than other two reported techniques.

Table 2 shows the comparison of outcome between the performances of the three schemes. In the midst of the three methods Bi Orthogonal gives the enhanced outcome than DCT and SVD on behalf of elevated intensity pixels. DCT supplied restructured lena picture by a PSNR rate 33db, bit rate of 4.02 bpp and compression ratio is 1.98. The bi orthogonal produces fewer vague rebuilt lena pictures by elevated PSNR rate 56db at a bit rate of 5.50 bpp and compression ratio is 1.45. Observably, the biorthogonal produces an enhanced PSNR and compression ratio than others but a reserved higher in bit rate. Adding together, it is conditional so as to the biorthogonal outcome in a 23db achieve in superiority.

This result in an improved rate distortion measure which is the desirable factor (i.e.) the bit rate is reduced. This is practical in the sense that the information content present in an image is more in larger images. The purposive presentation events like PSNR, Bit rate etc., intended for different imagery as well as normal picture and additional normal imagery is put into a table in table 3.

With a focus on highlighting the involvement completed through the planned job a evaluation flanked by the recital of the planned frame work and JPEG 2000 scheme is agreed inside table 4. Obliviously in that table so as to reduce distortion consequently giving better PSNR than that of JPEG 2000. For the lifting test image with an acceptable amount of distortion, the compression ratio be elevated, and the bit rate is very little 0.4 bpp. Proposed Hybrid compression method gives 6.2038 % better than JPEG 2000.

From table 5, the basic techniques compared with proposed algorithm.

From table 6, the proposed algorithm compared with recent techniques also. The proposed algorithm provides better bits per pixel than recent techniques that are used in image compression.

From table 7, our planned work employed enhanced CR, BPP and PSNR than 2D technique.

Table 1. Comparison of three different methods for Low intensity

Method/ Image	Compression Ratio			PSNR (dB)			Bits per Pixel		
	A1	A2	A3	A1	A2	A3	A1	A2	A3
Cman	1.3376	1.3713	1.3712	64.4631	29.5617	16.5553	5.9810	5.8338	5.8345
Baboon	1.7016	1.8061	1.8158	62.3231	25.8523	17.1116	4.7014	4.4293	4.4059
Barbara	2.1694	2.3666	2.4448	61.1853	24.7652	12.9916	3.6876	3.3804	3.2722

Boat	1.3699	1.3979	1.4200	64.1750	25.1497	16.7412	5.8398	5.7229	5.6338
Lena	1.7360	1.8191	2.9661	62.2715	26.0758	13.0168	4.6082	4.3978	2.6911
Peppers	1.8838	1.9922	2.0512	61.8109	25.1516	13.7079	4.2468	4.0157	3.9002
Avg	1.6997	1.7922	2.011517	62.7048	26.09272	15.0207	4.8441	4.6299	4.2896

Table 2. Stage 2 Results: Comparison of three different methods for High Intensity

Method/ Image	Compression Ratio			PSNR (dB)			Bits per Pixel		
	B1	B2	B3	B1	B2	B3	B1	B2	B3
Cman	2.7120	3.4201	2.4153	31.3975	27.3274	53.6704	2.9499	2.3391	3.3123
Baboon	1.9040	2.1312	2.0577	35.4460	30.3937	54.7389	4.2017	3.7538	3.8879
Barbara	1.5530	1.6721	1.6279	30.8394	28.6364	56.0489	5.1513	4.7845	4.9142
Boat	2.5928	3.2848	3.0163	30.0763	28.1392	53.4605	3.0855	2.4355	2.6522
Lena	1.9893	2.2857	1.4522	33.2852	30.6399	56.9466	4.0215	3.5000	5.5087
Peppers	1.7385	1.9230	1.8587	33.8769	25.1516	54.9235	4.6016	4.1602	1.7937
Avg	2.0816	2.4528	2.0713	32.4868	28.3813	54.9648	4.0019	3.4955	3.6781

Table 3. Proposed Methodology

Image	CR	PSNR(db)	Bitsper Pixel
Cameraman	15.211	53.6704	0.5073
Baboon.tif	13.5188	54.7389	0.5918
Barbara	12.1828	56.0489	0.6567
Boat.gif	15.3717	53.4605	0.5204
Lena.gif	12.2543	56.1890	0.6528
Pepers	12.7149	54.9842	0.6292

Table 4. Proposed method compared with JPEG 2000

Image	CR		PSNR		BPP	
	JPEG2000	Proposed	JPEG2000	Proposed	JPEG2000	Proposed
Cman	11.82907	15.211	51.7398	53.6704	0.6763	0.5073
Baboon	9.66183	13.5188	52.1387	54.7389	0.8280	0.5918
Barbara	10.57641	12.1828	51.7413	56.0489	0.7564	0.6567
Boat	11.38466	15.3717	51.6626	53.4605	0.7027	0.5204
Lena	10.33592	11.1839	51.7953	56.9466	0.7740	0.7153
Peppers	12.03188	12.7149	51.5532	54.9842	0.6649	0.6292
Avg	10.96996	13.36385	51.77182	54.97492	0.733717	0.60345

Table 5. Proposed compared with basic techniques

Image	Dimensions	BMF	TMW	JPEG-LS	JPEG 2000	CALIC	Proposed
Camera	512X512	4.060	4.098	4.314	4.535	-	0.5073
Baboon	512X512	5.714	5.738	6.037	6.107	-	0.5918
Barb	512X512	3.959	4.084	4.691	4.600	4.584	0.6567
Peppers	512X512	4.241	4.251	4.513	4.629	4.394	0.6020
Lena	512X512	4.314	4.300	4.607	4.684	4.096	0.6528
GoldHill	512X512	4.238	4.266	4.477	4.603	4604	0.6974

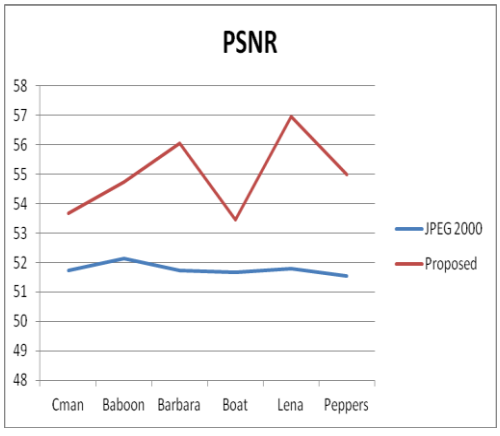
Table 6. Proposed method compared with recent techniques

Image	Dimensions	VBS	APC	ETC	Proposed
Camera	256X256	3.949	-	-	0.5073
Baboon	512X512	5.663	2.60	-	0.5918
Barb	512X512	3.1815	3.75	1.223	0.6567
Peppers	512X512	4.199	-	0.905	0.6020
Lena	512X512	4.280	3.45	0.766	0.6528
GoldHill	512X512	4.207	4.20	1.137	0.6974

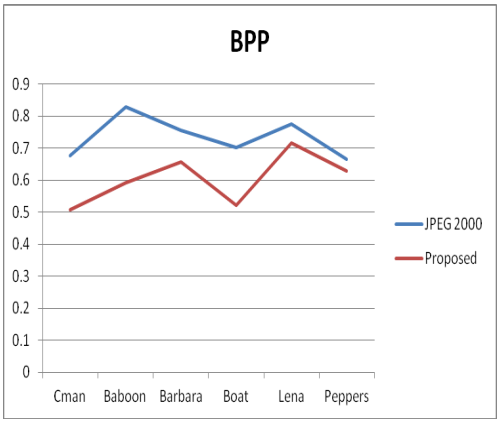
* VBS-Variable Block Size coding *APC- Adaptive Predictive Combination *ETC - Encryption then compression

Table 7. Result compared with recent techniques

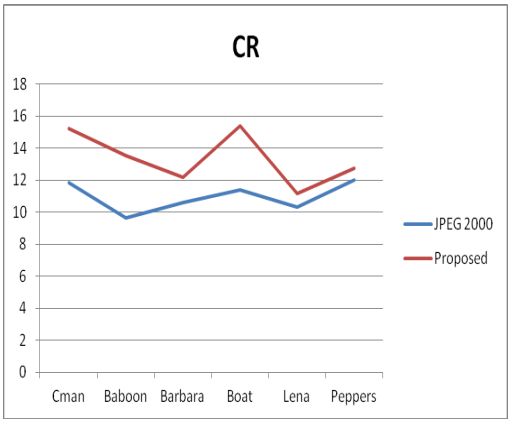
Image	CR		PSNR		BPP	
	2D	Proposed	2D	Proposed	2D	Proposed
Cman	9.661	15.211	29.616	53.6704	1.186	0.5073
Barbara	10.479	12.1828	27.840	56.0489	1.098	0.6567
Boat	8.795	15.3717	28.003	53.4605	1.628	0.5204



(a)



(b)



(c)

Figure. 2. The Impact of the anticipated effort on different performance measures by changeable the amount of the unique picture (a) Image Vs PSNR, (b) Image Vs BPP, (c) Image Vs CR

The chart exposed here, represent the force of the planned effort on a variety of recital events. It clearly shows proposed work provides better PSNR, BPP than JPEG 2000.

6. Conclusion

In this study, a combination of low and high intensity-based image compression model was presented. There have been a lot of methods developed to get better compression efficiency. JPEG2000 is the most popular standard used in many devices. This article measured together low and high intensity pixels in compression and examination is carried out in three steps. The LSB & MSB are considered separately for six different algorithms, three applied on each. Among the six methods the best is chosen for low and high intensity pixels and applied for compressing the image. It is brought into being that the mixture technique gives enhanced outcome than JPEG 2000.

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