Review of Image Compression Methods

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Abstract— *Everyday some development is taking place in imaging field. The large volume of data is required to be transmitted. It is therefore, mandatory to compress the data as much as possible without compromising with the quality of an image. General techniques are being developed globally to meet out the modern requirement. This review paper is targeted to make a fruitful investigation of such compression methods.*

Keywords—code redundancy, JPEG, spatial redundancy, Wavelet compression

I. INTRODUCTION

Image compression is an important area of the image processing field . There is a consistent dire need of faster image compression & transmission system. This is going to save time and cost both.

II. IMAGE COMPRESSION TECHNIQUES

Every image consists of necessary & useless information. The image compression technique is to filter out the noise & pass the relevant details of the required image. Noise reduction eliminates that part of the signal which is not required by the receiver to comprehend the image.

2.1 Code redundancy:-

Code is like packing & sending the information to the target receiver in lock & key. A code is a system of symbols used to represent a set of information, this is called code word. The 8 bit codes are used for encryption.

2.2 Spatial redundancy:-

The spatial redundancy is used to eliminate the unnecessary information related to intensity of the pixels.

III. STUDY OF IMAGE FORMATS

After the close observation of different image formats it is found that GIF (lossless) does not work with the colour. TIFF (lossy & lossless) is not suitable for web pages. JPEG(lossy) work with 8 bits per pixel. It is up to 30 & move compressed than GIF formats. BMP files are simple but large in size.

Algorithm	PSNR values (in dB)			
	Jet	Lenna	Mandrill	Peppers
Wavelet	32.48	34.66	26.54	34.99
JPEG	30.39	31.73	25.15	31.95
VQ	26.76	29.28	24.45	29.12
Fractal	26.70	29.04	24.29	29.13

Compression methods:-

(a) Lossless compression: The lossless compression uses Huffman coding, Lempel zip & run length encoding.

(b) Lossy compression: There are certain images which contain the unnecessary details eg. Background which is not sensed by human being therefore, this useless information is left over. This method is called the lossy compression.

3.1 Wavelet compression:

the wavelet approach applies a wavelet transform on the images in a pyramid fashion up to the desired scale using the theory of multi resolution signal decomposition with the wavelet representation. It assumes that wavelet coefficients of an image in the finer resolution.

3.2 JPEG Compression:-

The JPEG has become a standard. A DCT is applied to 8×8 blocks of the image to convert the gray level of pixels in the spatial domain into coefficients in frequency domain. The quantized coefficients are rearranged in zigzag form which is further compressed by AC or Huffman coding. The information loss occurs only in the process of coefficient quantization.

3.3 VQ Compression:

Code book is established for image compression having code vectors and each code vector can represent a group of image blocks of size m×m, (m=4 is always used).

LBG [12] algorithms is adopted to meet out 0.5 bpp compression ratio.

3.4 Fractal compression:

It is used for encoding or decoding images. Fractal coding is based on the collage theorem and fixed point theorem. A fractal compression technique breaks the image in 8×8 blocks, called range blocks.

For each range blocks, it searches in a domain pool, for a best matched domain block with the minimum square error. A fractal compressed code for a range block consists of quantized contractivity coefficients in the affine transform, an offset which the average of gray levels in the range block. The most attractive property is the resolution- independent decoding property.

Table 1 performance of coding algorithma on various 256×256 images.

	Compression ratio	Appeared in
Wavelet	≫32	1992[2] 1993[20] 1996[19]
JPEG (DCT)	≤50	1974[1] 1993[18]
VQ	< 32	1980[13] 1989[16]
Fractal	≥16	1992[14] 1992[17]

Table 2. characteristics of four popular image coding methods.

	CPU time	
	Encoding	Decoding
Wavelet	0.35 sec	0.27 sec
JPEG	0.12 sec	0.12 sec
VQ	2.45 sec	0.18 sec
Fractal	5.65 hrs	1.35 sec

Method	Advantages	Disadvantages
Wavelet	• High compression ratio • State-of-the-art	• Coefficient quantization • Bit allocation
JPEG(DCT)	• Current standard	• Coefficient quantization • Bit allocation
VQ	• Simple decoder • No coefficient quantization	• Slow codebook generation • Small bpp
Fractal	• Good mathematical encoding frame • Resolution-free decoding	• Slow encoding

IV. OBSERVATION

Image compression algorithm EZW, JPEG, Fractal methods were tested. The decoded images are shown in figure 1.

In case of the text images all the four methods yield good result at 0.5 bpp. EZW has large PSNR values.

Both EZW and JPEG approaches perform well and the result of EZW has larger PSNR values.

For highly textured images the PSNR values of the four methods are significantly lower.

Original image

Fig. 1 Decode lenna by (a) wavelet, (b) JPEG, (c) VQ, and (d) fractal algorithms

V. CONCLUSION

It has been reviewed that either of the four approaches the results are practically good. But for low bit rate per pixel (bpp)ie. O.25 bpp or lower the embedded zero tree wavelet is better. Wavelet based compression algorithms are profitable.

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