International Journal of Computational Intelligence and Informatics, Vol. 2: No. 2, July - September 2012

Efficient Integrated Coding for Compound Image Compression

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***Abstract*- The development of computer and network technologies, image with mixed text, graphics and natural picture are seen everywhere, such as captured screen, web page, scanned electronic documents, slides, posters, compound images and so on. Compound image compression is one of the real-time applications of computer screen image transmission. It is used to reduce the amount of data required to present the digital image and to improve the appearance of an image to a human observer and also to extract quantitative information. To compress a compound image various types of lossy and lossless algorithms are used. This research work deals with the preprocessing, macroblock divisions, transformations, quantization, text block and non-text block analysis, lossy and lossless algorithms are used to compress a compound image to produce a high compression ratio, less compression time and decompression time and high PSNR value than the existing method.**

Keywords- Preprocessing, Transformations, Quantization, PSNR.

I. INTRODUCTION

Digital image processing refers to processing digital images by means of a digital computer. It is composed of finite number of elements, each of which has a particular location and value. These elements are referred to as picture elements, digital elements, pels and the pixels [1]. The pixel is the term most widely used to denote the elements of a digital image. Digital image processing is used in many applications like industrial inspection for tracking and monitoring, medical images for visualization, reconstruction, aircraft correction and disease quantification, satellite imaging for weather and environmental conditions monitoring, telecommunication, cinema, image synthesis, scientific visualization and law enforcement for license plate reading, finger print checking and speed [2] [3]. Example for the Compound image is shown in the Figure.1.

FIGURE 1: EXAMPLE FOR COMPOUND IMAGE.

Here preprocessing is used to improve the quality of images. If the images are too noisy or blurred, the images should be filtered and sharpened. In image processing, filters are mainly used to suppress the high frequencies in the image [4] [5]. The various types of linear and non-linear filters are used to reduce the noise. After preprocessing an image, the images should be segmented and compression has to be done. There are two types of compressions like lossy and lossless compression. For lossy and lossless compression various algorithms are used to compress a compound image. After compression, the decompression process has to be made to get the original compound image.

The paper is structured as follows. In section 2 existing systems are discussed. Section 3 discusses about Proposed systems. In Section 4 Methodology is dealt with. Section 5 deals with the conclusions and Section 6 deals with the Feature enhancement.

II. EXISTING SYSTEM

In the existing United Coding Method (UC) used several lossless coding techniques such as Run-Length Encoding (RLE), Portable Network Graphics (PNG) and gzip are combined into H.264 hybrid coding, and macroblock is the basic coding unit. Preprocessing is implemented to remove noise which helps to improve the compression ratio of an image. In this UC method, various types of compound images are used such as PPT, word, desktop and web image. PNG filter is used for preprocessing and preprocessed image is segmented as text block and non-text block. To compress an image gzip coder a lossless algorithm is applied to text block and lossy algorithm, RLE coder is applied to non-text block for compression. Using United Coding method text and non-text block is combined and finally compression ratio and PSNR value is calculated [6].

III. PROPOSED SYSTEM

In this proposed Integrated coding method various types of compound images like Normal Image, Word Image, Desktop Image, PPT Image and Web images are taken for compression. Before compressing a compound image, pre-processing is implemented for compound images to reduce the noise. For pre-processing median filter is used. Preprocessed image are segmented using macroblock based technique which segments the image as 16X16 non overlapping blocks which are segmented as text block and non-text block [7]. H.264 algorithm is used to compress text block and Deflate algorithm is used to compress non-text block. In the existing method PNG, gzip and run-length encoding algorithms are used for compressing the compound images. So while comparing both existing and proposed method, the proposed method gives the high compression ratio, less compression time and decompression time and high PSNR value than the existing method. The proposed Integrated Coding method provides better result especially for Web Images.

IV. METHODOLOGY

The proposed scheme uses Integrated Coding method which is the combination of lossy and lossless algorithm. The original compound image is firstly preprocessed using median filter. Preprocessed compound image are segmented as 16 X 16 macroblock and this macroblock are segregated as text and non-text block using threshold value. Discrete Cosine Transform (DCT) and Quantization is applied to Text block and Non-Text block. Deflate, lossless algorithm applied to the quantized text block and H.264, lossy algorithm applied to the quantized non-text block for compression.

This greatly enhanced the proposed algorithm in terms of compression time and decompression time. The above processes are depicted in the Figure 2. below

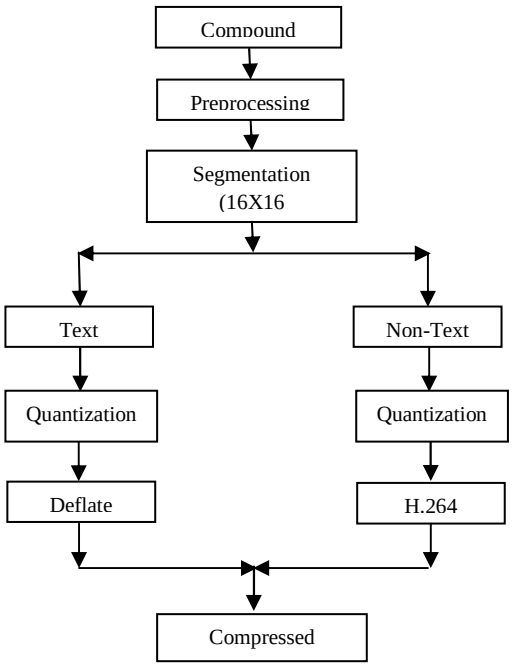


FIGURE 2: FLOWCHART

*A. P*reprocessing

The preprocessing methods are used in most image communication systems which help to reduce image data size. It improves the quality of images. If the images are too noisy or blurred it should be filtered and sharpened.

In image processing, filters are mainly used to suppress either the high frequencies in the image, smoothing the images or the low frequencies, i.e. enhancing or detecting edges in the image [8]. In this proposed Integrated Coding method Median Filter is used for preprocessing. The success of the median filters in the image processing is based on two intrinsic properties edge preservation and efficient reduction of the impulsive noise.

The median filter calculates the median value by first sorting all the pixel values from the surrounding neighborhood into numerical order and then replacing the pixel being considered with the middle pixel value. If the neighborhood under consideration contains an even number of pixels, the average of the two middle pixel values is used.

B. Segmentation

The segmentation is a two-step procedure, including block classification and refinement segmentation [9]. The first step is to classify 16x16 non-overlapping blocks into text and non-text blocks. Each block is scanned to count the number of different colors. If the color value is larger than a threshold T1 (T1= 32), the block is classified as the non- text block. Otherwise, it is classified as text block. The underlying assumption is that a continuous tone picture generally exhibits a large number of different colors. The block classification based on counting different colors can be extremely fast. Figure 3 shows the process of segmentation during the detection of text and non-text block.

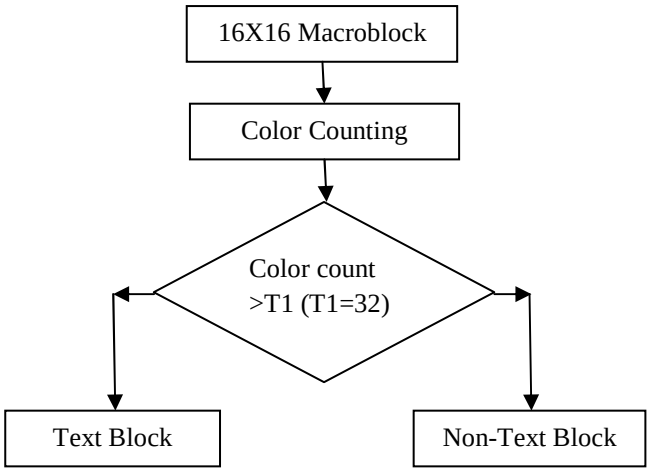


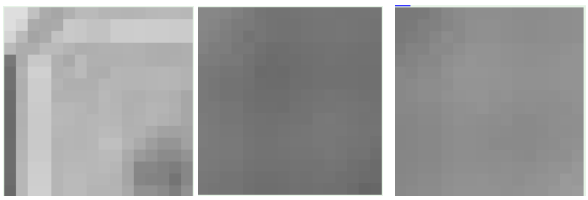
FIGURE 3: FLOWCHART FOR SEGMENTATION

C. Quantization

In Quantization process initially the source image is divided into macroblocks. Discrete Cosine Transform (DCT) is applied to macroblocks for color transformation [10]. This step transforms the input image to a set of values or color components. Color components are converted as RGB and from RGB again it converts into YCbCr color components.

It works on the principle that as human eye perceives changes in brightness better than changes in color, focus more on brightness than the actual brightness level. YCbCr stores more relevant data at a lower accuracy than RGB. Moreover, it is well known that the RGB components of color images are highly correlated [11].

Integrated Coding method is used YCbCr as it represents the human perception of color more closely than the standard RGB model used in computer graphics hardware and stores more relevant data at a lower accuracy. The output of the YCbCr is shown in the Figure 4 respectively.



Y Component ***Cb Component*** ***Cr Component***

Figure 4

A magnitude of the sampled image is expressed as a digital image in image processing and the transition between continuous values of the image function and its digital equivalent is called quantization. The number of quantization level should be high enough for human perspective of fine shading details in the image. Figure 5 shows the effect of quantizing a compound image.

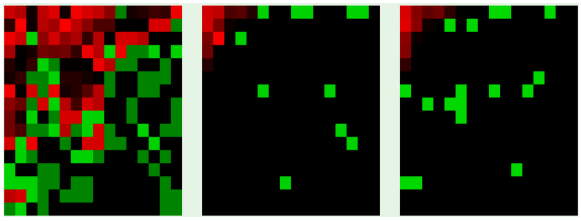


FIGURE 5: QUANTIZATION

D. Text and Non-Text Block Analysis

During segmentation, text blocks are identified. Deflate algorithm is applied to each text block. Deflate is a lossless data compression algorithm and it is a combination of the LZ77 algorithm and Huffman coding. Each text block is compressed using a combination of the LZ77 algorithm and Huffman coding. The Huffman trees for each block are independent of those for previous or subsequent blocks. The LZ77 algorithm may use a reference to a duplicated string occurring in a previous block up to 32K input bytes before [12]. Figure 6 shows the text block analysis using Deflate algorithm.

FIGURE 6: TEXT BLOCK ANALYSIS

H.264 is used to compress a non-text block in compound image. H.264 using distortion separates the text and picture block. This approach used a segmentation driven adaptation strategy to change the H.264 quantization parameter on a 16×16 pixel macroblock basis. Figure 7 shows the non-text block analysis using H.264 algorithm.

FIGURE 7: NON-TEXT BLOCK ANALYSIS

H.264 helps to achieve better image quality in lower possible storage space and transfer images quickly in the condition of limited bandwidth. It increases twice the compression ration under the premise of image quality which would resolve the contradiction between the image compression efficiency and real time transmission.

E. Results of Integrated Coding and its Performance Analysis

The performance of Integrated Coding with the concept of preprocessing the image by Median Filter has been tested in various types of compound images such as normal, word, PPT, desktop and web image. An experiment was conducted for the image size 512 X 512 and for different file formats namely JPEG, TIFF, BMP, PNG and JP2. The average PSNR value for various compound images is shown in Table 1. The Quality of the image is compared for both existing and proposed method and it showed that the proposed method Integrated Coding provides better result than the existing method United coding.

Table 1: Average PSNR in db for Compound Images

Images	United	Integrated
Normal Image	21.49	23.02
Word Image	25.35	26.28
PPT Image	30.97	31.99
Desktop Image	21.66	23.1
Web Image	33.95	34.61

The Quality of image is high for Web Images. By adopting the proposed method the PSNR achieved is 34.61 db for Web Images. Figure 8 shows the graphical representation of PSNR value for compound images.

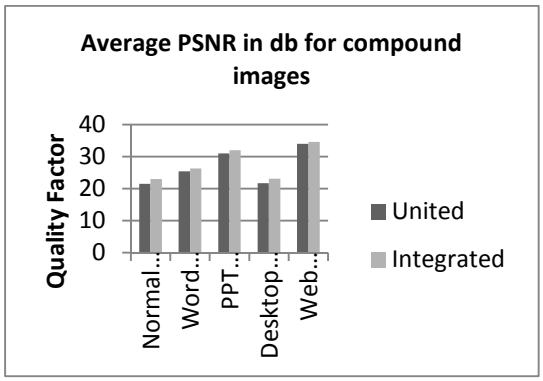


FIGURE 8: PSNR VALUE FOR COMPOUND IMAGES

The Compression time for the image is compared between existing and proposed methods and the average compression time for the various compound images are tabulated in the Table 2. From the table, Compression time to compress an image is less in proposed method especially for Web images.

Table 2: Average Compression Time in secs for Compound Images

Images	United	Integrated
Normal Image	0.31	0.3
Word Image	0.62	0.56
PPT Image	0.74	0.66
Desktop Image	0.46	0.4
Web Image	0.48	0.29

The Compression time for Web images in United Coding is 0.48 secs where as in Integrated Coding it is 0.29 secs. It proved that Integrated Coding is better than the United Coding method. Figure 9 shows the graphical representation of Compression Time for compound images.

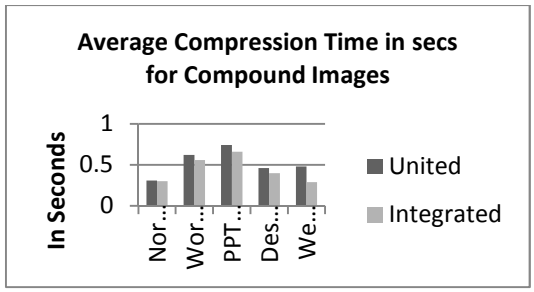


FIGURE 9: COMPRESSION TIME FOR COMPOUND IMAGES

The decompression time for the compound images are compared between existing and proposed and the average compression time are tabulated in the Table 3. From the table, it is observed that decompression time is less in Integrated coding than United Coding.

Table 3: Average Decompression Time in secs for Compound Images

Images	United	Integrated
Normal Image	0.38	0.37
Word Image	0.67	0.61
PPT Image	0.81	0.73
Desktop Image	0.53	0.48
Web Image	0.55	0.35

Decompression time for Web images is 0.35 secs in Integrated where as in United it is 0.55 secs. Integrated Coding provide better results for different types of compound image especially for Web images. Figure 10 shows the graphical representation of Decompression Time for compound images.

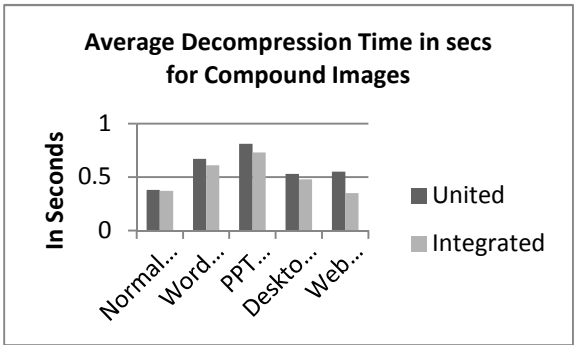


FIGURE 10: DECOMPRESSION TIME FOR COMPOUND IMAGES

V. CONCLUSION

In integrated coding method various types of compound images like Normal Image, Word Image, Desktop Image, PPT Image and Web images are taken for compression. H.264 algorithm is used to compress text block and Deflate algorithm is used to compress non-text block. In the united coding method PNG, gzip and run-length encoding algorithms are used for compressing the compound images.

So while comparing both existing and proposed method, the proposed method gives the high compression ratio, less compression time and decompression time and high PSNR value than the existing method. The proposed Integrated Coding method provides better result especially for Web Images.

VI. FUTURE ENHANCEMENT

In Future, Integrated coding method can be enhanced by Layer based and Object based image compression. It has been implemented to compress compound images. Further different lossy and lossless algorithms can be used to improve the performance of the compression ratio and quality of the image.

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