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## Study of Different Image File formats for Raster images

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**Abstract:** In the current digital world, the usage of images are very high. The development of multimedia and digital imaging requires very large disk space for storage and very long bandwidth of network for transmission. As these two are relatively expensive, Image compression is required to represent a digital image yielding compact representation of image without affecting its essential information with reducing transmission time. This paper attempts compression in some of the image representation formats and the experimental results for some image file format are also shown.

**Keywords:** ImageFileFormats, JPEG, PNG, TIFF, BITMAP, GIF, CompressionTechniques, Compressed image processing.

### 1. INTRODUCTION

Digital images generally occupy a large amount of storage space and therefore take longer time to transmit and download (Sayood 2012; Salomonetal 2010; Miano 1999). To reduce this time image compression is necessary. Image compression is a technique used to identify internal data redundancy and then develop a compact representation that takes up less storage space than the original image size and the reverse process is called decompression (Javed 2016; Kia 1997).

There are two types of image compression (Gonzalez and Woods 2009).

1. Lossy image compression
2. Lossless image compression

In case of lossy compression techniques, it removes some part of data, so it is used when a perfect consistency with the original data is not necessary after decompression. Some examples of lossy compression algorithm are JPEG, MPEG and MP3 (Javed2016; Sayood2012; Salomon et al. 2010).

In case of lossless compression techniques, it compressed the text data and on the receiver side exact original data to be reconstructed from the compressed data. Some examples of lossless data compression are PNG(Portable Network Graphics), TIFF. Popular ZIP File format used for compression of data files. It is used when it is important that the original data must be same as decompressed data

Choosing one of these two categories depends on the application and on how much compression ratio required. Image file formats may store an image uncompressed, compressed or vector format.

The size of image files is positively correlated with the number of pixels in the image and the colour depth (bits per pixel). The compression algorithm stores an exact representation or approximation of the original image in a smaller number of bytes, which can be expanded with a corresponding decompression algorithm back to its uncompressed form. Images with the same number of pixels and colour depth can be compressed in very different sizes. For some lossless formats, this feature sometimes results in a smaller file size than lossy formats. For example, graphically simple images (i.e. images with large continuous regions such as line art or animation sequences) can be compressed in a GIF or PNG format without loss and lead to a smaller file size than a lossy JPEG format.

For the display of images on the Internet, PNG, JPEG and GIF formats are most often used.

In this paper some image representation formats are studied and the experimentation has been done on different types of images. This paper focuses on comparison of some of the most used image representation formats on a set of images

## **2. SOME IMAGE REPRESENTATION FORMATS**

### **BMP(Bitmap)**

Image is broken in to the pixels and the color information of each pixel is stored in bits that are mapped out in rows and columns. Bitmap is a bitmap graphics format used internally by Microsoft windows graphics subsystem and used commonly as a simple graphics file formats on that platform

It is an uncompressed format (Sayood2012;Salomonetal.2010).

### **PNG(Portable Network Graphics)**

It is bitmap image format with lossless compression. PNG was created to improve and replaced the GIF(Graphic Interchange Format) image file format .The algorithm used for compression is the combination of LZ77 (Sayood2012;Salomonetal.2010). and Huffman coding such as lossless , very good for image with big areas of one unique color. PNG was designed for distribution of image on the internet not for a portable graphics. It does not support non RGB color space such as CMYK. PNG is a better choice for storing the images that contain text, lines art or other images with sharp transitions that do not transform well in to the frequency domain

### **GIF(Graphic Interchange Format)**

Is a bitmap image format. This format supports 8bit per pixel for each image and it allows a single image to its own palette of up to 256 different colors chosen from 24 bit RGB color space. It supports animation (Sayood2012;Salomonetal.2010). It uses Lempel-Ziv-Welch(LZW) Lossless data compression technique to reduce the size without degrading the visual quality

### **TIFF(Tagged Image File Format)**

Is a bitmap image. It is used mainly for raster images and is the most popular file format for high color depth images with JPEG and PNG (TIFF 1992; Javed 2016).. The most common general purpose lossless compression algorithm is used with TIFF is LZW, which is inferior to PNG (Sayood2012;Salomonetal.2010).

### **JPEG(Joint Photographic Experts Group) (GonzalezandWoods2009;Miano1999;Mukhopadhyay2011)**

Is a algorithm designed to compress grey scale images. It is lossy compression algorithm. The algorithm is based on two visual effects of human visual system. The first humans are more sensitive to the luminance than to the chrominance .Second humans are more sensitive to the change in homogeneous areas than the areas where there is more variations (high frequencies).This algorithm is flexible also. Here compression rate can be adjusted but if we compressed a lot , more information will be lost and result image size will be smaller with higher rate (Mukhopadhyay2011).. We can obtained a better quality but the size of the resulting image will be bigger. This can be achieved by making the coefficient in quantization matrix bigger when we want more compression and smaller when we want less compression

### **JPEG 2000(Joint Photographic Experts Group2000)**

It is wavelet based image compression standard. It is designed as a intention that it will be superseding the quality and compression than JPEG which is based on original discrete cosine transform. So, It has higher compression ratio than JPEG but it usually make the image blurred than that of JPEG (Sayood2012;Salomonetal.2010).

### **ZIP**

This is compression format used to compress the grey scale or colour images .It is lossless algorithm. (Sayood2012;Salomonetal.2010).

### **JBIG or JBIG1(Joint Bi-level Image Experts Group )**

It uses lossless image compression algorithm. Image get enhanced gradually from low resolution as additional compressed data is added. Here arithmetic coding is used (Salomon et al. 2010).

### **JBIG2 (Joint Bi-level Image Experts Group )**

It is new version of JBIG for Bi-level images in desktop, Internet and FAX applications. (Salomon et al. 2010) The content based compression technique is used .The dictionary based methods are used for text regions and Huffman code or arithmetic coding are used for other image contents. This can be either lossy or lossless.

Depending on the application one can choose the file type and the file format (Mohammed Javed1 · P. Nagabhushan2 · Bidyut B. Chaudhuri3© Springer Science+Business Media Dordrecht 2017)

Following are the compression modes with image file formats used

Mode	File Format
Uncompressed mode	TIFF,BMP
Lossy compression mode	TIFF,JPEG
Lossless compression mode	TIFF,PNG,GIF,ZIP,JBIG2

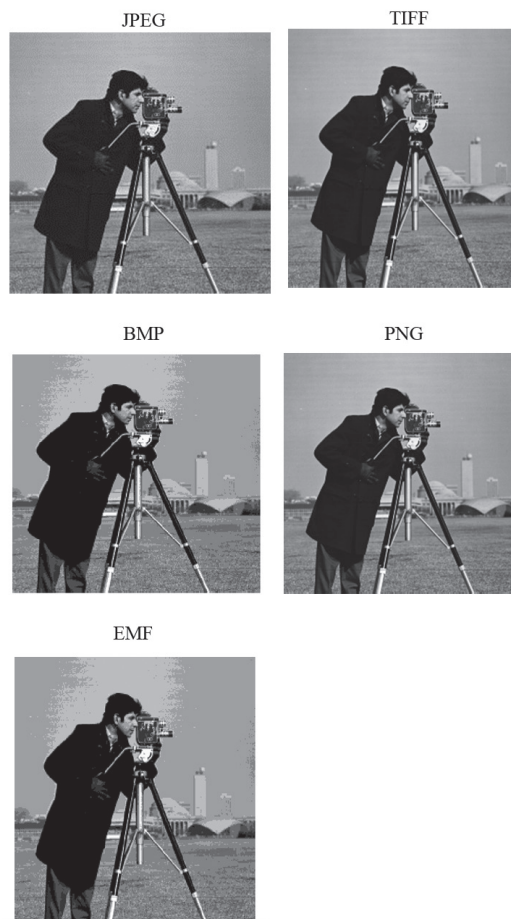
The some important compressed image file formats with their compression schemes are listed in the following table:

**Image Compressed File Formats**

Compression Techniques	BMP	PNG	GIF	TIFF	PDF	JPEG	JPEG 2000	JBIG1	JBIG2
Huffman						Y			Y
LZW			Y	Y	Y				
Arithmetic							Y	Y	Y
Run-length	Y			Y	Y	Y			Y
Symbol based							Y		Y
Bit plane							Y	Y	
Predictive		Y				Y		Y	
Wavelet							Y		

Table1 Compressed image file formats with different compression scheme (Mohammed Javed1 · P. Nagabhushan2 · Bidyut B. Chaudhuri3© Springer Science+Business Media Dordrecht 2017)

Here set of images the images are compressed with TIFF,PNG, EMF and JPEG. We have the results of compression for Blobs, Cameraman ,Football, Peppers, Pout and text images. We can see the results of Cameraman image for JPEG, TIFF,BMP, PNG and EMF.



**Fig.1 Effect of different image file formats with compression scheme on image**

JPEG has big compression ratio, it is ideal for big images and photographs but does not support the images that contain text, line art or other images with sharp transitions. PNG is better choice for these type of images which has lossless compression algorithm. But still JPEG is most commonly used file format for storing and transmitting images in internet. TIFF uses mostly general purpose lossless compression algorithm i.e. LZW which is inferior to PNG (Mohammed Javed<sup>1</sup> · P. Nagabhushan<sup>2</sup> · Bidyut B. Chaudhuri<sup>3</sup>© Springer Science+Business Media Dordrecht 2017)

**Table 2 Size of sample images when stored in some different image formats**

File Names	BMP	EMF	JPG	PNG	TIFF	tiff @ no compression
Blobs	174KB	93KB	18.4KB	3KB	13.3KB	517KB
Cameraman	870KB	68.8KB	43KB	91.5KB	238KB	2540KB
Football	162KB	323KB	17.7KB	155KB	246KB	485KB
Peppers	311KB	770KB	28.3KB	287KB	585KB	931KB
Pout	149KB	73KB	9.92KB	54.1KB	108KB	446KB
Text	142KB	68.8KB	145KB	3.59KB	11.4KB	422KB

### 3. CONCLUSION

From the results obtained, we can say that the BMP image is uncompressed image. TIFF and PNG perform very well. PNG is more powerful than TIFF. I have also compressed it with JPEG to see what would be the size of it when compressed with lossy algorithm, we see that the compressed ratio for this format is also much smaller. For text document, we can see that any of these algorithm perform better but JPEG does not even compress the image because it does not perform very well for diagram with lines and text.

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