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Ontology of Heterogeneous Image File Formats and their Disparate Applications

Kauthar Abdulazeez[1], Sohit Agarwal[2]
[1]Suresh Gyan Vihar University, Jaipur, India, kauthar.abdulazeez@gmail.com
[2]Suresh Gyan Vihar University, Jaipur, India, Sohit.agarwal@mygyanvihar.com

ABSTRACT

Different image formats are available in the world today which are used for various purposes, this paper elaborates the Ontology of different Image File Formats and their various applications. Digital images are saved in various Image File Formats which have different properties and features which are ideal for a particular use. A digital image is primarily classified into two types, raster or vector type. Image format elucidate how the information in the image will be stored. Image file format is a systematic way of storing and arranging digital images. Image file format can store data in compressed format (which may be lossy or lossless), uncompressed format or a vector format. Some Image format are suitable for a particular purpose while some are not. TIFF Image type is good for printing whereas PNG or JPG, are best for web. Analysis of the basic Image File Format have been carried out practically and the result is displayed in the coming section.

Key words: Digital Image, Image format, compressed, uncompressed, Raster, Vector.

1. INTRODUCTION

Imagine the world today without images, images have played a crucial role in this digital era. Digital image is a numerical 2D or 3D illustration of a physical object or scene [30]. Digital images are taken using any device that is facilitated with camera or having ability to capture any visual scene. Images are used for communication in a visual view of the information to be passed. The image can be stored using different measures of image file formats. Digital images are stored in various format. Every image format has its own features associated to it. Today, different image formats are available which are used for various purposes, this paper elaborates the Ontology of different Image File Formats and their varying applications, Digital images are saved in numerous Image File Formats which have different properties and features which are ideal for a particular use. Transferring images from time to time is required for easy access, change of view, x-ray images, documentation and other purposes thus, they can be compressed slightly or more subject to the use.

2. IMAGE FILE FORMAT

Image File format continue to evolve, becoming more complex as revised software versions inculcate new features or functionalities. An image file format is a standard specification for organizing and storing digital images, the information in the Image is encoded into bits of data for storage. All images are having a particular extension attributed to it, which identifies the type of format used to store the image. Numerous image file format are used nowadays which have some unique features and these features are associated with the image stored in that image format. Conventional Image file format have a unique three letter extension that follows the name of the image. The extension passes information to the operating system on the type of image format and the type of application that must be used to open it.

An Image encoded into bits of data and stored in a specific image format is recognized as an image, and it provides useful information such as its matrix size to aid communication with the file. Any program which adheres to the standard of the format
can open the file and display the image.

3. CLASSIFICATION OF IMAGE FILE FORMAT

Digital Images are classified into Raster and Vector format, they can also be stored based on these formats. Raster image also called bitmap image is a type of image composed of picture elements organized in a grid of pixels to form an image [34]. These pixels depicts a number of bits like color depth, color etc.
Raster images are composed of grid of pixels organized to form an image, therefore resizing it will alter the quality of the image. If the resolution is low, the image should be small to conserve the quality. Raster images are prioritized for painting.
 While vector image consist of paths made up of curves, lines, angles and points that works on
geometric representation or mathematical equation. Vector images are smooth at any feasible size. A vector image does not depend on the resolution, hence the output quality is not affected if the image is contracted or expanded.

3.1. Difference between Raster and vector Images

The table below distinguish the differences, advantages, and disadvantages between raster and vector images.

Table 1. Difference between Raster and Vector Images
GIMP: GNU Image Manipulation Program   [5]

Raster	Vector
They are composed of pixels, organized to form an image	They are composed of paths, guided by mathematical equations or formulas
File sizes are large	File sizes are small
Colors can be blend together and are rich	Colors cannot be blend easily without rasterizing
Compromised by change of dimensions and resolution	Scalable to any dimension and resolution
It is able to give explicit editing	Details are less, notwithstanding provides exact paths
Raster software comprises of GIMP graphics and other graphics editor	Vector software comprises CorelDraw, Inkscape, and Illustrator
Graphics cost less	Graphics cost more in Vector than in Raster
Ideal for painting	Ideal for drawing
File types include .gif, .jpg, .png, .tif, .psd, .bmp;	File types include .eps, .ai, .cdr, .svg, .pdf

Figure. 1. Raster Image   **Figure. 2.** Vector Image
Size: 8.60 MB   Size: 5.88 MB
As we can see, the size of the vector image is greater.

4. ANALYSIS OF HETEROGENEOUS IMAGE FILE FORMAT

There are numerous types of image file format, we are going to take some to analyze them below;

4.1. TIFF (.tif, .tiff)

TIFF stands for Tagged Image File Format. TIFF is a raster file format that uses a lossless compression, therefore it's quality or information is not lost, TIFF image quality can be restored sequel to its manipulation. TIFF is also utilized in large file sizes with high quality images. TIFF is flexible, therefore it can be lossless or lossy. Most web browsers doesn't support TIFF image format, it takes time to load the image. TIFF images uses .tif or .tiff as its extension. TIFF is extensively utilized in photography, archival record, publications and very high quality prints. A picture was taken in JPEG and converted to TIFF, we realized that the size of the image have increased from 6 MB to 8.58 MB.
Fig. 3, shows a typical example of TIFF image.

Figure. 3. TIFF Image,   img.tiff
Size: 8.58 MB

4.2. Bitmap (.bmp)

Bitmap or BMP Image File is a raster file format that was developed by Microsoft for Windows system. Bitmap file format is utilized to store bitmap images mostly on Microsoft

Windows. Bitmap file format can store both monochrome and color image in different color depths, data compression, color profiles and alpha channels. In Bitmap file format, there is no compression or loss of information, therefore the quality of Bitmap image is extremely high but it also has a very large file size. Bitmap image is good for archival copies and high standard scans. Fig. 4, is an example of Bitmap image.

Figure. 4. BMP image,
Size: 8.6 MB

4.3. JPEG (.jpg, .jpeg)

The acronym "JPEG" stands for Joint Photographic Experts Group, it was developed by Joint Photographic Experts Group committee in the year 1992. JPEG is a lossy file format, which shows that the image can be compressed to get a smaller size. The degree of compression is determined by the application used. The compression of the image result to a loss of quality but in most cases it's not recognized except if the compression is greater. JPEG files are very popular on the internet and widely used format for digital cameras that supports eight-bit grayscale images and 24-bit color images (eight bits each for red, blue, and green). It is also utilized in various photographic businesses, social media and for personal use, as it is more convenient. As the file is compressed more space is created for more images to be stored on a single memory and makes it easy to transfer the file. Fig. 5, is an example of a JPEG image.

Figure. 5. JPEG image
Size: 5.90 MB

4.4. GIF (.gif)

GIF acronym stands for Graphics Interchange Format, it was developed by an online service provider CompuServe led by an American scientist Steve Wilhite on 15 June 1987. GIF is an image file format limited to an 8-bit palette or 256 colors. GIF is a lossless compression format. GIF is mostly used in graphics with limited colors like logos, diagrams, shapes, cartoon image, plain diagrams, web graphics, and some dithered images. GIF is commonly utilized on the World Wide Web due to its vast portability and support between operating systems and computer programs. GIFs are widely used in animation, which provides animation effects [20]. The size of GIF files are typically small and portable. GIF image format support both static and animated images. Fig. 6 is an example of GIF image.

Figure. 6. GIF Image
Size: 2.32 MB

4.5. SVG (.svg)

The acronym SGV stands for Scalable Vector graphics. SGV is a vector file format for two-dimensional graphics format developed by World Wide Web Consortium (W3C) since 1999. SGV files are created for displaying vector graphics usually on the web. SVG represents its images using a text format based on Extensible Markup Language (XML) [21]. SVG graphics support interactivity and animation. Fig. 7, is an example of SVG image.

Figure. 7. SVG Image
Size: 5.88 MB

4.6. PNG (.png)

PNG acronym stands for Portable Network Graphics, is a lossless image file format designed as an open-source and a replacement of GIF format. PNG files supports eight-bit palleted images and 24-bit true color (16 million colors) as compared to GIF which supports 256 colors. PNG can store chromaticity and gamma data for enhanced color correspondence on diverse platforms. PNGs are designed to interactively work online like on web pages but not recommended for print [19]. PNG image is having a lesser size as compared to most of the image format, as we can see below the size is lesser as compared to other images. Fig. 8, is an example of PNG image.

Figure. 8. PNG Image
Size: 4.35 MB

4.7. PDF (.pdf)

The acronym PDF stands for Portable Document Format, is an Image file format that was created by Adobe in 1993, to display documents, images, text formatting, and graphics irrespective of operating system, web browser or software. PDF is standardized as ISO 32000, it is a vector graphics but can also display in raster graphics. PDF is a sophisticated application that is not only used for documents and images but can also be used for file attachments, encryption, and metadata [23]. PDF format is usually utilized for printing purposes as it's more convenient. Fig. 9, shows a typical example of PDF image.

Figure. 9. PDF image
Size: 5.91 MB

5. CONCLUSION

While we are having different image file format available in the world today which are used for various reasons, we are able to classify this format into Raster and Vector format, we further analyzed these formats to see their properties, how they are utilized in different facet and their various applications. As digital images are saved in various Image File Formats which have different properties and features which are ideal for a particular use, we have examine the differences in image file formats, in terms of their size, graphics, flexibility, quality, and applications. We are able to conclude that Vector images are more clear than Raster images but the size of the images are large as compared to Raster, We have also realized that JPEG images are more convenient for photographic business, social media and personal use as it can be easily compressed without noticing any reduction in quality and it would save more space. PNG image is having a lesser size as compared to most of the image format therefore, it is more suitable for web pages. Choosing the right Image file format when capturing a photo is crucial. This analysis has manifested a clear picture of how the Image file formats are and how best we can utilize them for various purposes.

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