Various Raster and Vector Image File Formats

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Abstract: Image File Format is one of the standardized ways of storing digital images, with a large number of image file formats available it would be very difficult and challenging for the user to select appropriate image format for storing the images. Choosing the proper image file format according to the demand of the project or according to a specific parameter is of vital importance. Therefore, in this paper we provide a brief review on most common and different image file formats in order to ease the user to choose appropriate file formats while working with files.

Keywords: Graphics Interchange Format (GIF), Joint Photographic Expert Group(JPEG), Portable Network Graphics(PNG), Tagged Image File Format(TIFF), Encapsulated PostScript (ESP), Portable Document Format (PDF), Adobe Illustrator (AI), Drawing eXchange Format (DXF).

I. INTRODUCTION

Images are an important part of today's digital world. File formats are essential when it comes to compatibility and storing images. An image file format is a standard way to organize and store image data. It defines how the data is arranged and the type of compression (if any) to be used. There are several dozens of different image file formats [1].

Choosing the right image file format to store your image is of vital importance. This paper presents a survey on different image file formats for Raster graphics and Vector graphics which will help us a lot in choosing the appropriate image file format for storing our image

II. TYPES OF GRAPHICS FORMATS

With all of the image options and file formats, it can be a little overwhelming when we are choosing the file type to use. When it comes to graphics and images the type of computer graphic format we use is essential. Two distinct approaches exist for digitally encoding static images. These are known as [2]:

* Raster graphics
* Vector graphics.

III. RASTER GRAPHICS

A Raster also known as Bitmap graphic is any image that uses pixels (tiny squares each capable of storing colour value and opacity) to collectively make up the image. When we zoom in closely to a raster graphic we can see how those tiny square pixels come together to make up the picture [6].

Fig. 1 Raster Graphics

A. Resolution

Raster graphics depend upon having a resolution, which is counted in .dpi *(dots per inch)*.The lower the resolution the smaller the file size [6].

Low-resolution raster graphics would normally be set to 72 dpi and are used very often for web sites and presentations that are intended to only be viewed on a computer screen [6].

High-resolution raster graphics would normally be set to 300 dpi and are mostly used when the image is intended to be printed [6].

B. Scaling

High-resolution raster graphics wouldn't be a good choice for web or screen use as the higher dpi wouldn't be noticeable at all (and so of no benefit) and the higher file size would mean the image takes longer to load into the webpage [6].
A high-resolution graphic (300 dpi) can be resized and saved down to being a low-resolution version (72 dpi) but we cannot scale up a low-resolution graphic to becoming high-resolution. So, it is advantageous to try and get hold of as high a resolution raster image as possible [6].

IV. TYPES OF RASTER IMAGES FORMATS

Raster file formats differ by the amount of data contained in the image. The smaller the file, the less data there is. The amount of data affects both the quality and the colour of the image [3].

The various types of Raster file formats have been described below:

A. Graphics Interchange Format (GIF)

* Graphics Interchange Format files are saved with an extension .gif.
* GIF images are great for creating very low resolution files for website [7].
* GIF also support Transparency and which allows placing the gif over any colour background or even photos, and the border or background in the image won't appear [7].

- GIF files also support a feature called interlacing, which preloads the graphic. It starts out blurry and becomes focused and crisp when it is finished downloading. This makes the transition easier for the viewer and they don't have to wait for long to see the logos or icons on the site [7].
- GIF uses loss less compression [5].
- GIF file format is mainly used for logos and graphics with solid areas of colour [7].

Fig 2: A focussed and crisp GIF image

B. Joint Photographic Expert Group

- JPEG files are saved with an extension .jpg or .jpeg.
- Jpeg files can be relatively small in size, but they still look crisp and beautiful [7].
- Jpegs support up to 16.7 million colours, which makes them the right choice for complex images and photographs [7].
- JPEG have lossy compression and it support 8 bit gray scale image and 24 bit colour images [1].
- It is used for VGA (video graphic Array) display [4].

Fig. 3: A photo of a cat with the compression rate decreasing, and hence quality increasing, from left to right.

C. Portable Network Graphics

- PNG files are saved with an extension .png.
- PNG (1996) is a bitmap image format that employs lossless data compression [1].
- The PNG file format supports 8 bit, 24 bit, 48 bit true color with an optional alpha channel [4].
- PNG was created to both improve upon and replace the GIF format with an image file format that does not require a patent license to use [1].
- Typically, an image in a PNG file can be 10% to 30% more compressed than in a GIF format [1].
- PNG format have smaller size and more colours as compared to others [1].

Fig 4: A PNG image with 8-bit transparency channel

D. Tagged Image File Format

- TIFF files are saved with an extension .tiff.
- TIFF is a file format for mainly storing images, including photographs and line art [1].
- It is one of the most popular and flexible format which can be used for lossless or lossy Compression [1].
- TIFF is a popular format for high colour depth images [1].
- TIFF format is widely supported by image-manipulation applications, and by scanning, faxing, word processing, optical character recognition, and other applications [1].
- For web transmission TIFF files are not used because TIFF files require large size [1].

E. RAW Image Format

- RAW file format includes images directly taken from digital cameras. These formats normally use loss less or lossy compression method and produce smaller size images [5].

- The disadvantage of RAW image is that they are not standardized image and it will be different for different manufacture thus, requiring manufacture's software to view the images [5].
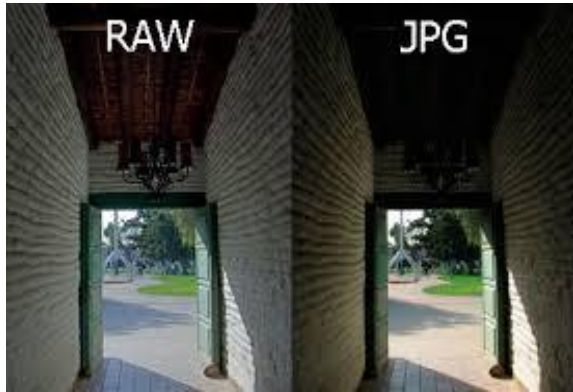
Fig 5: Image showing the difference in JPG an RAW

F. BMP File Format

* The Bitmap (BMP) file format deal with graphic file related to Microsoft windows OS. Normally these files are uncompressed so they are large [5].
* These files are used in basic windows programming [5].
* BMP images are binary files.BMP file does not support true colors [5].

V. VECTOR GRAPHICS

A Vector graphic uses paths (which can be a line, a square, a triangle, or a curvy shape) to make up the image. These paths can be used to create simple drawings, logos, maps or complex diagrams and are very often saved in .EPS format [6].

Vector paths are mathematically created and have individual properties assigned to them such as colour, fill, and outline [6].

If you zoom in on the paths *(or lines)* of vector graphics the line or curve you zoom in on will always be sharp, in focus, and have smooth edges, this is because the line is reproduced by the same mathematical formula each time you zoom in, and so you do not get any blockiness associated with raster graphics as pixels are not used by vector graphics [6] .

Fig.6: Vector Graphics

A. Resolution

Vector graphics are resolution independent, they do not have a .dpi and so is not high or low resolution [6].

The file size of vector graphics is usually very small compared to raster graphics — this is because they do not carry the millions of individual pieces of pixel data information that raster graphics have to hold [6].

B. Scaling

A Vector graphic can be scaled up to the size of a billboard or down to the size of a business card all from the same file [6].

Vector graphics are often produced by using object-based editing software such as Illustrator [6].

VI. TYPES OF VECTOR IMAGE FORMATS

The commonly used Vector Image File Formats are described below:

A. Encapsulated PostScript (ESP)

* Adobe's EPS format is perhaps the most common vector image format. It is the standard interchange format in the print industry [8].
* It is widely supported as an export format, but due to the complexity of the full format specification, not all programs that claim to support EPS are able to import all variants of it [8].
* Ghostview can read it very well but does not have any editing capabilities. Inkscape can only export it [8].

B. Portable Document Format (PDF)

* Adobe's PDF format is very widely used as a general purpose platform-independent document format. And while it is not exclusively used as such, it is also a very good vector image format [8].
* An Adobe Acrobat file that can be both vector and raster, depending on the original artwork. If the original artwork is a vector file, the PDF will be vector art; if the original artwork is a raster file, the PDF will be a raster file. PDF files are often a combination of both [3].
* PDF files are compressed—like jpg files, the compression can be created at a variety of compression levels, which have an impact on the end quality of the reproduction [3].

C. Adobe Illustrator (AI)

* The native format of Adobe Illustrator is the AI format (Adobe Illustrator Artwork), a modified version of the older EPS format [8].
* The AI format is fairly widely supported, but is less ubiquitous than the EPS format, and most programs that read AI can also read EPS [8].

D. Drawing eXchange Format (DXF)

* Drawing eXchange Format is a CAD format from Autodesk, used by CAD tools from many different vendors. Some programs have difficulty reading DXF files with splines (curves), so the Desktop Edition supports line + spline as well as line only output modes [8].

VII. CONCLUSION

As an image file format is a standard way to organize and store image data, in this paper various types of file formats to store Raster and Vector graphics are described as starting with the right type of image can save a lot of time and rework over the course of a project.

Based on the review of various file formats we conclude that vector images are best used for logos and illustrations while Raster images are the standard in digital photography and are commonly used for all graphics once they are published digitally.

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