Designing and developing a model for converting image formats using Java API for comparative study of different image formats

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Abstract- Image is one of the most important techniques to represent data very efficiently and effectively utilized since ancient times. But to represent data in image format has number of problems. One of the major issues among all these problems is size of image. The size of image varies from equipment to equipment i.e. change in the camera and lens puts tremendous effect on the size of image. High speed growth in network and communication technology has boosted the usage of image drastically and transfer of high quality image from one point to another point is the requirement of the time, hence image compression has remained the consistent need of the domain. To cope up with the said problem, time & technology has given many image formats periodically. Researcher has identified the requirement and importance of the problem and prepared and designed conversion model to convert one image format into other image formats using java api and analyze the algorithm by taking different color as well as grey scale image. The presented paper represents conversion model and different image analysis.

Index Terms- Image conversion model, java image api, Comparative study, image size.

I. INTRODUCTION

Need and importance of image: Image is one of the most important techniques to represent data very efficiently and effectively utilized since ancient times. Image is medium for nonverbal communication which is worth a thousand words. Image conveys message fast and effectively with enough opportunity / open ends for imagination as compared to words.

Need and importance of image compression: There are many area of application of image. Quality of image required in these areas are different i.e. in health sector medical image requires high quality. Where images used for social networking does not require much quality. Quality is paid with size. One of the major issues among all problems of image domain is size of image. Equipment makes direct and intense effect to the size of image. i.e. change in the camera and lens puts tremendous effect on the size of image. High speed growth in network and communication technology has boosted the usage of image drastically and transfer of high quality image from one point to another point is the requirement of the time, hence image compression has remained the consistent need of the domain. This shows different requirement of compression in different areas of image application.

Different requirement of compression in different area of image has produced various compression algorithms or image file formats with time. These formats includes [2] ANI, ANIM, APNG, ART, BMP, BSAVE, CAL, CIN, CPC, CPT, DPX, ECW, EXR, FITS, FLIC, FPX, GIF, HDRi, HEVC, ICER, ICNS, ICO, ICS, ILBM, JBIG, JBIG2, JNG, JPEG, JPEG 2000, JPEG-LS, JPEG XR, MNG, MIFF, PAM, PCX, PGF, PICtor, PNG, PSD, PSP, QTVR, RAS, BE, JPEG-HDR, Logluv TIFF, SGI, TGA, TIFF, WBMP, WebP, XBM, XCF, XPM, XWD.

Above mentioned formats can be used to store different kind of images (i.e. grey scale, gradient, image with humans, image with full of colors etc). But each image format algorithm stores the data in their own way and hence size of the same image varies from one algorithm to another algorithm.

To study such variation in the size for the same image I have designed and developed a tool with the help of java api, which takes one image format and converts it into another format. So that, the comparison of the image size, can be performed. From various formats, I have selected only five well known image formats i.e. jpg, gif, png, bmp and tiff.

As number of formats available, it is frequent requirement to convert one format to another one. There are different tools/ ways available for conversion.

To convert the image from one format to the another format, number of tools are available. But I have studied the following two tools for the conversions.

1. Matlab: Matlab has rich library for image processing. It offers variety of operations / functions for image conversion.
2. Java api: java has java.awt.image, com.sun.media.jai and javax.media.jai packages which offer very good image library api for image conversion. Hence we have used java api for the conversion of the image.

II. CONVERSION MODEL

Fig 1 : Image conversion model

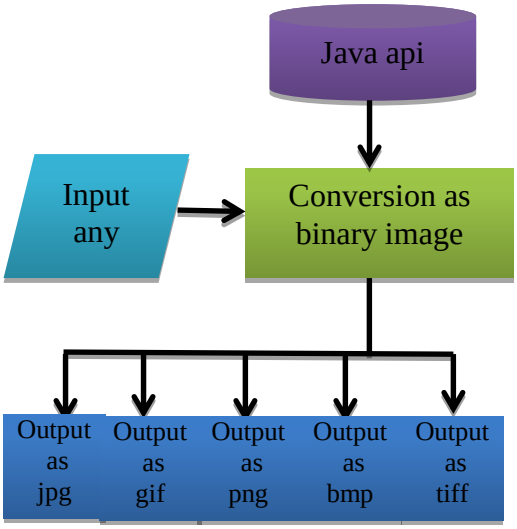


Fig1 shows images conversion model. It takes image in any format as input in the first step. In the second step it converts the imputed image file into the binary file with the help of the java api. Then in the next step the converted binary file is stored as the different image files with the help of the functions available in the java api.

III. SELECTION OF DIFFERENT IMAGES:

To study the size of selected file formats, the researcher has taken different types of images i.e. (1) grey scale image (2) natural landscape (3) human being (4) Full of colors. The reason behind selecting such type of the images is only to study, relation between types of image, size of image with reference to image format.

As the model is implemented using the Java code, the code takes any format from the selected five formats and converts it into the remaining all formats. But for the practical implementation we have taken the jpg file with the following specification:

Width of the image	: 400 pixel
Height of the image	: 300 pixels and
Color model	: 24 bits.

By implementing the model the comparative table for all the four selected files with its size and format is given in table – 1.

IV. COMPRISION OF DIFFERENT COLOR AND GREY SCALE IMAGES

In the table – 1 first column represents the type of the image second onwards all the columns represents the type of image. Each row represents the size of image for specific file format.
After studying the images outcome from the table – 1 , can we assumed that the size of file has direct connection with number of colors? It means a file with more colors, is bigger in size? This question leads the researchers to performs the another experiment with only grey scale images.

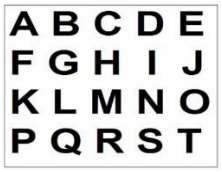
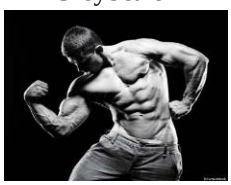
Table 1: Image size comparison table: Color & grey scale

Image	Size(KB) Jpg	Gif	Png	Bmp	Tiff
Grey scale 	11	71	75	351	352
Natural landscape 	10	26	164	351	352
Human being 	31	81	295	351	352
Full of colors 	43	88	341	351	352

V. COMPRISION OF DIFFERENT GREY IMAGES

To study the size of file formats for the grey scale images, we have taken different four grey scale images, which varies in nature (i.e text based, human, single object and multiple objects.) The experiment is performed with the same code, where the file specification is also same and the outcome is in table-2.

Table 2: Image size comparison table: Only grey scale width:400 X height:300, Color model: RGB -24bits

Image-format / Size(KB) / Image	Jpg	Gif	Png	Bmp	Tiff
GreyScale1 	18	23	76	351	352
GreyScale2 	16	43	88	351	352
GreyScale3 	14	37	102	351	352
GreyScale4 	38	141	148	351	352

Data analysis of table2 shows that, size of bmp and tiff has no concern with the color palettes or number of colors, which is same as analysis of table1. This data analysis also confirms assumption made in data analysis of table1. More the colors, bigger the size. Analysis shows, jpg occupies the minimum size, then gif in major cases, in turn png in major cases. In case of bw3 image, gif size is bigger than png which is exception in the trend.

VI. CONCLUSION

By analyzing the table-1 and table-2, following conclusion can be drawn.

1. Jpg occupies less space compare to remaining formats.
2. Jpg occupies less size, gif occupies size greater than jpg but less than png.
3. While BMP and TIFF does not have concern with any parameter except width, height and color model. The size of BMP and TIFF is determined by the following presented formula:

   Image size = width * height * color model(bytes) + header size.

   Researchers have taken width:400 pixels, height:300 pixels and color model: 24bits.

   So size of BMP images =400*300*3+54.
   =360054 bytes.
   =351 KB.

   This outcome is exactly similar to the outcome of BMP column of table-1 and table-2, which proves the success of formula.

   In the similar way TIFF file has header size of 484 bytes.

   The size of TIFF images =400*300*3+484.
   =360484 bytes.
   =352 KB.

   This outcome is exactly similar to the outcome of TIFF column of table-1 and table-2, which proves the success of formula.
4. By viewing the table-1 and table-2, the size does not rely on colors.

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