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Analysis on Images & Image Processing

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I. INTRODUCTION

Thinking about images or any particular one gives a clear picture in our vision. But to draw or make our vision in reality involves many things. Images can be drawn, painted and also captured. Capturing images is nothing but digital photography. Viewing the digital images in computer make us to think that how the image is developed, viewed, and also how can a black and white image is converted to color and vice versa. Explaining these things about the image is our article.

An image is a matrix form of square pixels which are arranged in the form of rows and columns. There are two general groups of images: vector graphics and bit map. The following are the types of images:

1. **Binary image**: It is a form of digital image where each pixel of it has only one of two colors usually black and white. Here the each pixel is stored in the form of a single bit either 0 or 1.
2. **Gray scale image**: The type of monochromatic image in which both black and white colors combines to give a gray color. The intensity among levels differs with in an image. Pixel value ranges from 0-255.
3. **Palette images**: It manages the finite set of colors in the digital images. There are grayscale (8-bit) and RGB (24-bit) palettes.
4. **RGB image**: The type of image in which the three colors (red, green, blue) are added to form various array of colors. it is of 24 bit.
5. **RGBa images**: It stands for red, green, blue alpha. It is one used for combining multiple images for the creation of visual effects.

As the image files are quite large, so the files type needs large disk usage which in turn slower the download. So, for this many file formats have been introduced like.

JPEG (Joint photographic experts group): In digital photography JPEG is a method used for lossy compression. Here the degree of compression is adjusted by balancing storage size and image quality.

It gives a little perception loss in quality of images. This compression algorithm smoothens the variations of tone and color in photographs. It is a lossy compression method and is not suitable for drawings and other textual or iconic graphics.

GIF (Graphics interchange format): It is a bit map format supported in world wide web for its wide support and portability. It supports 8 bits per pixel and is used for animated images and low resolution film clips. As it has limitations regarding color so it is well suited for simpler images such as logos and graphics.

TIFF (Tagged image file format): It is supported by image manipulation applications and also a format used for storing images. It handles the images and data within a single file. It can be re-saved with same image quality. As it is flexible and adaptable, it supports CMYK images, tiled images, YCbCr images. It cannot be created or opened by common desktop applications.

BMP (Bit map): It is a raster graphics image file format used to store bitmap digital images. It is used for 2D digital images. As the BMP files are relatively large file size due to lack of compression, but many BMP files can be compressed with no loss of data such as zip. It is saved as an extension of .BMP, .DIB.

HDF (Hierarchical data format): It is a set of file formats and libraries to store large amounts of numerical data. It is supported by many commercial and non-commercial software platforms. There are two major versions of HDF, HDF4 and HDF5. HDF4 format has many limitations which lacks a clear object model. It supports many different interface styles leads to complex API. To overcome the limitations of HDF4 another version of HDF5 is proposed.

HDF5 simplifies the file structures namely datasets and groups.

PCX (Personal computer exchange): It was designed during the development of pc hardware. But the formats that are used to support this type are no longer in use. Computer fax programs uses the multi page version of pcx, which uses file extension as .dcx

PS (Post script): It is a programming language used in electronic publishing. These are not produced by humans. Characters % is used for posting comments. Due to the introduction of graphical user interface post script has become successful. It is saved with an extension of .ps.

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PSD (Photoshop document): It is a Photoshop format that keep all the information in an image including all the layers.

XWD(X windows dump image): It manages the network client server computers.xwd files contain different amount of colors. These files are very large in size as they are uncompressed.

PNG (Portable networks graphics): It is a bitmapped image format which gives lossless data compression. Png supports palette, RGB, grayscale images. It doesn't support non RGB images. It is saved with an extension of .png

SECTION II

II. IMAGE PROCESSING

Conversion of an image into a digitized form and performing some operations for enhancing an image or to extract some useful information from it. We can import images through optical scanners or by digital photography. Manipulation of images can be done by compressing or enhancing them for which the output results is to be an altered image.

III. IMAGE PROCESSING PRINCIPLES

They work on two principles: improvement of pictorial information and processing of scene data. Image is a replica of an object. Images are of different types like gray tone images, line copy images and half tone images i.e the conversion of grayscale to binary ones. There are various steps in image processing like preprocessing, segmentation, representation, recognition, interpretation, and knowledge base.

Purpose of image processing:

1. **Visualization:** It observes the objects that are not visible.
2. **Image sharpening:** It helps to view the image better.
3. **Image retrieval:** The interested image is retrived.
4. **Measurement of pattern:** Different kinds of patterns and objects are measured.
5. **Image recognition:** Image objects are distinguished.

Image processing techniques:

1. **Image Embellishment:** Enhancing the image makes better visualization which makes the information better visibility. Which is performed by the following two techniques:

Histogram equalization: It redistributes the intensities of the image of the entire range of possible intensities.

Unsharp masking: Subtracts smoothed image from the original image to emphasize intensity changes.

2. **Undulation:** It operates on pixel neighborhood *Highpass filter*. it emphasizes with rapid intensity changes.

Lowpass filter: Smoothes the images, blurs regions with rapid changes.

3. **Numerical processes:** It performs various function on images like

Add images: Adds two images pixel by pixel.

Subtract images: Subtracts second image from first image pixel by pixel.

Exponential or logarithm: Raises exponential to power of pixel intensity or takes log of pixel intensity

Scalar add, subtract, multiply, divide: Applies the same constant values as specified by the user to all pixels one at a time. Scales pixel intensities uniformly or non-uniformly.

Dilation: Morphological operation expanding bright regions of image.

Erosion: Morphological operation shrinking bright regions of image.

4. **Noise filters:** It reduces the noise in images by performing some stastical deviations.

Adaptive smoothing filter: It sets the pixel intensity value between original and mean value.

Median filter: In neighborhood pixel it sets the intensity value to median intensity of pixel. It eliminates the intensity spikes.

Sigma filter: It sets the pixel intensity equals to mean. It eliminates the signal dependent noise.

5. **Trend removal:** It removes the intensity directions on the image.

Row column fit: It fits the image intensity in a row or column by subtracting fit from data and even chooses the column or row according to trendy that has least sudden changes.

6. **Edge detection:** It is used to sharpen transition of intensity regions.

First difference- It subtracts intensities of adjacent pixels.

Edge detection- It finds the difference between expanded and shrunken image version.

7. **Image analysis:** It extracts the image information

Extraction of image- It extracts some portion of image or full image and creates a new one with the areas that have been selected.

Images statistics- It calculates the statistics (mean, median, standard deviation, variance, average) of the image.

IV. SECTION III

a) Image processing algorithms

Algorithm1 Histogram equalization algorithm is used for improving the constrastion of the image. Usually it increases the constrast of images, especially

VI. SECTION V

a) Conversion and compression techniques

Converting a color image to grayscale image:

If each color pixel is described by a triple (R, G, B) of intensities for red, green, and blue

Lightness: this method averages the most prominent and least prominent colors: $(\max(R, G, B) + \min(R, G, B)) / 2$.

Average: this method simply averages the values: $(R + G + B) / 3$.

Luminosity: this method is a more sophisticated version of the average method. It also averages the values, but it forms a weighted average to account for human perception. We're more sensitive to green than other colors, so green is weighted most heavily. The formula for luminosity is $0.21 R + 0.71 G + 0.07 B$.

Compression: it reduce the number of bits which are used to represent the coded image. Further it can be stored in original format. Two different kinds of compression we can see:

Lossy compression: A lossy compression involves a loss of information compared to the original image. So the image that has been reconstructed is not original once it has been compressed.

Lossless compression: a lossless compression does not involve a loss of information and the reconstructed image is original one even after the compression.

Compression can be explained by Huffman coding.

Algorithm:

1. Firstly, search for the two nodes which has low frequency and which are not assigned to the parent node.
2. Join these two nodes together to a new interior node.
3. Add both frequencies and assign this value to the new interior node

Consider an example:

Symbol	Frequency	Code	Length	total Length
A	24	0	1	24
B	12	100	3	36
C	10	101	3	30
D	8	110	3	24
E	8	111	3	24

Before compression 186 bit

After compression 136 bit

algorithms and also compression method have been explained.

VII. CONCLUSION

This paper deals with types of images and how the images are represented in a digitized form and also the types of image formats and their significances. Image processing techniques,