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Study on Color Image Processing: A Review Paper

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Abstract: *The goal of Color Image Processing is to show image information for human perception. It is likewise essential step of digital image processing. It offers the applications of image processing which extract the features from image data, from which description, knowledge and facts can be obtained through machine. This system permits user to take hard copy of an image using printer and different output devices along with scanner etc; and additionally store the screen image into the disk file the use of file format (.jpg, .gif, .png etc.). It relates the image properties such as alteration and analysis of pictorial information. Color image processing is split into major areas: full-color and pseudo-color processing. Nowadays image processing is utilized in our everyday life. The maximum effective image processing system is the one that interact with human brain collectively with the human eye. The most important goal of this paper is to review development and implementation of color image processing that's essential to operate upon images and visually enhance the images.*

Keywords: Color models, RGB, CMY, HSI, YIQ, Pseudo-color processing, Full-color processing.

I. INTRODUCTION

The early trade of color image processing of digital images was in the newspaper enterprise and images had been transmitted through submarine cables among London and New York. In early processing digital image produced a coded tape through a telegraph printer. In the mid trade of color image processing which improves to the Bartlane system ended in better quality images and photographic process. Digital image processing utilized in medical imaging, remote earth resources and astronomy. Today's trade of digital image processing has develop vigorously. Today it's utilized in geography, biology, nuclear machine, archeology, regulation enforcement, defence and industry.

Color Image processing is used to offer digital image processing and it's in 2-dimensional format. Digital image processing define the processing of images that are digital in nature through a digital computer. Color image offer a image information for every pixel. On color image pixel is small unit of programmable color . As a raster map or raster graphics images color images are stored in memory. In Computer graphics, raster graphics images are stored in image documents with various formats. A raster graphics images are viewable through monitor, paper or different display medium. It is a dot matrix data structure which represent a rectangular grid of pixels.

Image processing offer 3 simple color models which are known as RGB (Red, Green, Blue) color model. This color models are standard layout of computer graphics systems and it is right for all of it's applications. This RGB color additives are exceptionally correlated and plenty of processing strategies are works on intensity component of an image only. The RGB color space is utilized in color displays. A color images measure the intensity and chrominance of light. It has 3 values per pixel. An images are excellent deal of greater information and it is used to simplify the image analysis. For example, The extraction primarily based totally on color of images and item identification.

Image processing offers numerous features like image shrinking, image scaling, image compression, image rotation. Image compression is work with BMP format gray scale images. Image rotation is used to rotate the image through specific angle. Resembling is used to increase the size of every pixel through a certain factor. Image shrinking is used to shrink the image and it is beneficial for saving the disk space. Image scaling include the zooming and shrinking of an image.

The color model uses standard implementation this is HSI (Hue, Saturation, Intensity). The hue is determined by the dominant wavelength. Visible colors occur among about 400nm (violet) and 700nm (red) at the electromagnetic spectrum [1].

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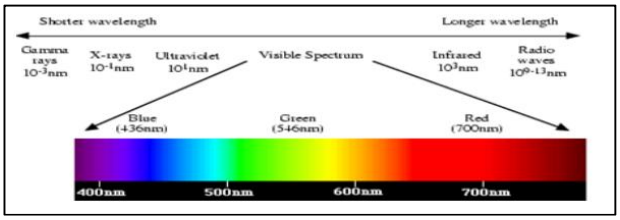

Figure 1: Spectrum

1.1 Color Image Models

To utilize color as a visual cue in multimedia, image processing, images and computer vision applications, the perfect technique for representing the color signal is needed. Color model literature may be discovered in the area of modern sciences, which include physics, engineering, artificial intelligence, and computer science [6]. With the color format, a digital image can record and offer greater information than the gray scale format image does.

Digital acquisition devices (which include scanners and digital cameras) can separate beams of light into 3 primary colors-red, blue, and green, via the help of spectroscopes and filters. In order to record the color information, we want at least 3 parameters (e.g. red, blue, and green) to represent a color. To represent the color information of digital images we use the color model . Since we want 3 parameters to symbolize a color, the ones color models need to be with a 3 dimensional format. The models use a few mathematical functions to symbolize a point position (in the 3 dimensional space) this is assigned to a color. Some of the color models (RGB, CMY, HSI , YIQ) are summarized as follows.

A. Rgb Color Model

The 3 primary colors (red, green, and blue) and their mixture in visible light spectrum are shown in Fig.1. With unique weights, (R, G, B), their combination can imply different colors. After normalizing the values of R, G, B, we are able to get the color cube (Fig.2). The colors at the diagonal line, from the origin to the coordinate (1, 1, 1) of the cube, means the gray-level values [3].

Every color could be presented in a coordinate system when the RGB model is used, in which every of the "primary" RGB colors varies from 0 to maximum value (e.g. from 0 to 1, or from 0% to 100%, or from 0 to 255 brightness levels, etc) [7]. R color and normalized RG colors (r, g) are used to set up the adaptive skin color model because (r, g, R) is much less sensitive to adjustments in light source and appropriate for real world applications [9]. The RGB color model is standard design of computer graphics systems isn't always best for all of its applications. The red, green, and blue color components are incredibly correlated.

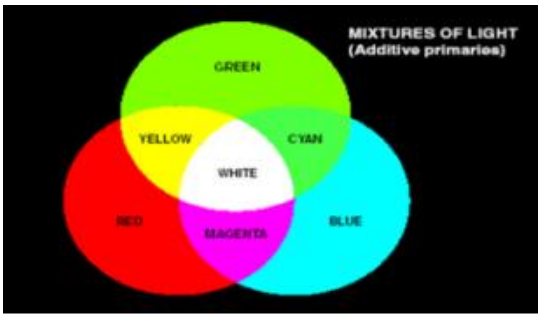

Figure 2: RGB graph of the primary colors

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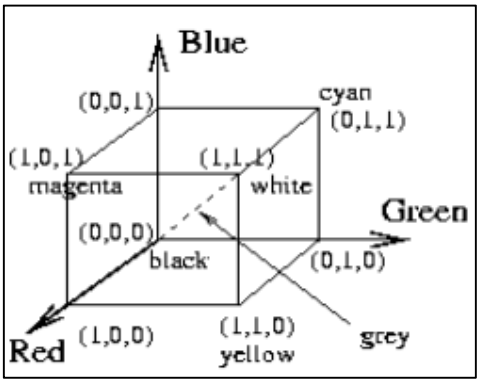

Figure 3: RGB graph of the color cube

B. CMY Color Model

The CMY color model is primarily based totally on complementary colors- cyan, magenta, yellow. This color model may be expressed as

$$\begin{bmatrix} C \\ M \\ Y \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} - \begin{bmatrix} R \\ G \\ B \end{bmatrix}$$

Color system equal proportions of Yellow plus Cyan produces Green, Yellow plus Magenta produces Red, and Cyan ink plus Magenta produces Blue in the CMY. Black is introduced to enhance the quality of images [8]. Fig. three indicates the connection of the component color of the CMY color model. The CMY color model is implemented to the output devices, which include printers [3].

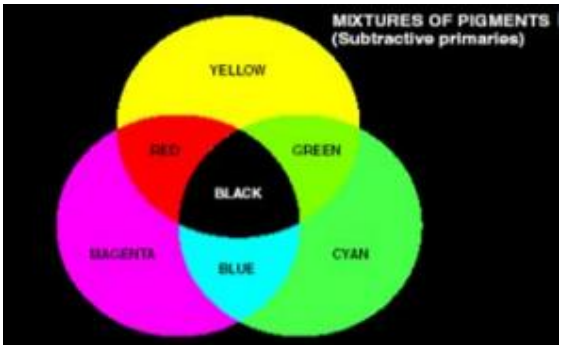

Figure 4: CMY color model

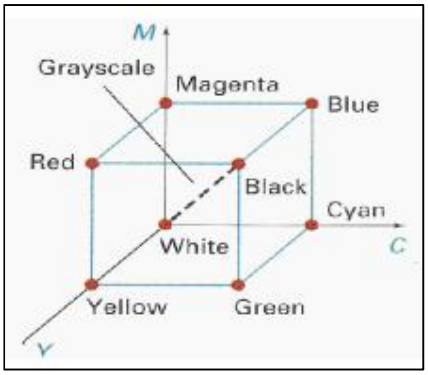

Figure 5: CMY graph of color

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C. YIQ Color Model

The YIQ color model is designed to refer to the characteristics of the human's visual system. In the human's visual system, human beings are greater sensitive to the lightness element than the hue element. So, the YIQ color model is ready to split colors into luminance (Y) and hue (I and Q). The relationship among YIQ and RGB is expressed as

$$\begin{bmatrix} Y \\ I \\ Q \end{bmatrix} = \begin{bmatrix} 0.299 & 0.587 & 0.114 \\ 0.596 & -0.275 & -0.321 \\ 0.212 & -0.523 & 0.311 \end{bmatrix} \cdot \begin{bmatrix} R \\ G \\ B \end{bmatrix}$$

in which Y is the luminance, I and Q indicate the weights of hue. The advantage of the YIQ color model is that we will address the luminance aspect independently. The YIQ color model is the standard model implemented to the signal transmission of color TV sets [3].

D. HSI Color Model

HSI model is proposed to enhance the RGB model. The Hue Saturation Intensity (HSI) color model intently resembles the color sensing properties of human vision. To method that converts from RGB to HSI or back is extra complex than with different color models [2].

I denotes the light intensity, H denotes the hue that shows the measure of the color purity, S is the saturation (the degree of a color permeated the white color). It means the color is with the low white color if a color is with excessive saturation value. The relationship among HSI and RGB may be defined as [3].

$$I = \frac{1}{3}(R+G+B),$$

$$H = COS^{-1}\left\{\frac{\frac{1}{2}[(R-G)+(R-B)]}{[(R-G)^2+(R-B)(G-B)]^{\frac{1}{2}}}\right\}$$

$$S = 1 - \frac{3}{(R+G+B)}[\min(R,G,B)]$$

II. Color Image Processing

The utilization of color for image processing is inspired by two key factors. First, color is an important descriptor that also simplifies the identification and extraction of objects from the image. Color image processing is divided into two main parts: pseudo-color and full color processing.

2.1 Pseudo-Color Image Processing

Pseudo color processing(also known as false color means assigning colors to grey values, on the basis of a given criterion. The name pseudo or false color is applied to distinguish the color assignment process from the process associated with true color for human visualization and interpretation of gray-scale events in an image or image sequence. The fact that human beings distinguish thousands of colors shades and intensities from only two dozen or so shades of the grey is one of the main reasons for coloring.

2.2 Full-Color Image Processing

Techniques for full color image processing fall under two categories. In the first category, each component image is constructed independently and a composite color image from the individual elements is then established. One work directly with color pixels in the second category. Due to the at least three color images, color pixels are actually vectors. In the RGB system for example, every color point could be interpreted as a vector in the RGB coordinate system extending from the source to that point.

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Let c represent an arbitrary vector in RGB color space:

$$c = \begin{bmatrix} C_R \\ C_G \\ C_B \end{bmatrix} = \begin{bmatrix} R \\ G \\ B \end{bmatrix}$$

This equation shows that the components of c are at one point simply the RGB components of a color image. When the color components are a coordinate function (x, y), the notation is used

$$c = \begin{bmatrix} C_R(x,y) \\ C_G(x,y) \\ C_B(x,y) \end{bmatrix} = \begin{bmatrix} R(x,y) \\ G(x,y) \\ B(x,y) \end{bmatrix} - \text{pq}(2)$$

MN vectors such as c(x, y), x = 0,1, 1, 2,...,M- l; y = 0,1,2,,...,N- 1, are present on an image of the size M X N. It should be kept in mind clearly that Eq.(2) represents a vector with spatial variables of x and y components. Two conditions have to be met for the equivalence of each color component and vector-based processing: First, both vectors and scalars must be covered by this process. Second, it must be independent of all other components for each component of the vector.

III. Conclusion

The study in this is an introduction to color image processing and covers topics decided on to present the reader a solid background in the techniques used on this branch of image processing. Our treatment of color basics and color models was prepared as foundation material for a field this is in its personal right wide in technical scope and areas of application. In particular, we centered on color models that we felt aren't only beneficial in digital image processing however could additionally provide the tools essential for further study in this area of color image processing. The discussion of pseudo color and full-color processing on an individual image foundation offers a tie to techniques.

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