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Comparitive Study On Color Recognition Methods

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ABSTRACT

Color is the most important information for identification and partition. RGB (Red, Green, and Blue) and HSV (Hue, Saturation, Value) color models were compared with respect to their affectivity in color feature extraction. . The result showed that it is easier to observe and classify colors given clustered data points in HSV color model than in RGB color model. And there is a direct correlation between the concentration level and digital colors in both color models. This paper facilitates a mobile robot vision system for object color recognition. In this paper we have discussed various color identification methods, mainly based on HSV, rg-chromaticity color spaces.

Keywords:- HIS, YCbCr, Rg-Chromaticity, HSV

I. INTRODUCTION

Color plays a role on how we perceive and analyze things around us. It is a result of the interaction between the electromagnetic radiation (visible light), and the object's surface properties. In the human eye, there are photo receptors that respond to the incident light for color perception. These are the cones. Cones are sensitive to any of the three primary colors (Red, Green or Blue). Based on this aspect, a lot of color models were established to quantitatively measure color. Quantitative color measurement is one of the key components in color science, scene analysis, detection and tracking. RGB and HSV color models are one of the simple color models that are widely used today in detection and tracking.
The main goal of this paper is:

- To introduce various aspects of color recognition
- To review some recent and existing techniques.
- To provide a comparative study of existing techniques with their pros and cons, Here we discuss various color recognition techniques which are implemented and recently used for efficient color tracking in the real world. The discussed methods include:

1) HSI model

HSI model is more close to human eye perception of observing color. and the hue (H) parameter are more stable in different light conditions, so it is chose as the main parameters of this system. At the same time, In order to improve the accuracy of identification in different illumination conditions, based on the principle that the apple of human's eye have different reflection to the different illumination, so the value of the second parameter saturation threshold (S) is adjusted dynamically according to the brightness value (I), the run-length coding techniques is used in image fusion process.

2) YCbCr model

YCbCr, Y′CbCr, or Y Pb/Cb Pr/Cr, also written as YCBCR or Y′CBCR, is a family of color spaces used as a part of the color image pipeline in video and digital photography systems. Y′ is the luma component and CB and CR are the blue-difference and red-difference chroma components. Y′ (with prime) is distinguished from Y, which is luminance, meaning that light intensity is nonlinearly encoded based on gamma corrected RGB primaries. Y′CbCr is not an absolute color space; rather, it is a way of encoding RGB information. The actual color displayed depends on the actual RGB primaries used to display the signal. Therefore a value expressed as Y′CbCr is predictable only if standard RGB primary chromaticities are used.

3) rg-chromaticity model

r, g, and b chromaticity coordinates are ratios of the of one tristimulus value over the sum the all three tristimulus values. A neutral object infers equal values of red, green and blue stimulus. The lack of luminance information in rg prevents having more than 1 neutral point where all three coordinates are of equal value. The white point of the rg chromaticity has one third red, one third green and the final third blue.

II. EXISTING COLOR RECOGNITION METHODS

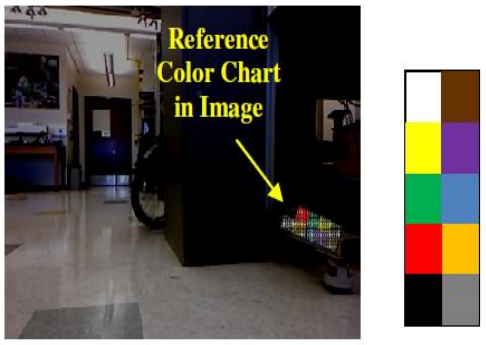
There are many approaches that have been proposed by various authors for color recognition. Some of them are listed below:

FPGA model for color recognition

We capture the video from camera and then process it on FPGA and then display. Image sensors capture data from surrounding and send it to FPGA board. FPGA embedded processor will control sensors and process the measured values .CMOS camera module outputs color information in RGB values. Image received by camera is in form of bayer pattern which is transformed to RGB color space [2]. RGB color space is transformed to HSV. In HSV each pixel represented by 3 components hue, saturation and value. For color segmentation we need to define maximum and minimum limits for HSV components.

Fuzzy based color recognition

With rg-chromaticity, primary and secondary colors can be isolated into specific boundaries in the red and green chromaticity spaces with a fair amount of reliability. Given these boundaries, fuzzy logic can be applied to identify certain colors in systems of robots which rely on color identification where a color camera is used as a global vision source to identify paths that the robots take and also location of their target (a golf ball). In the system, both the robots and the targets are marked with a specific color to aid in the identification of the objects. Adaptive Color Processing used a dynamic correction algorithm which corrected low lit colors to their original color based on the color reference pattern present in the image. The neural networks would be trained on the reference color pattern as shown in fig 2 and would be used to identify the reference chart in the image frame [4]. The transformation between the pattern in the image and the color reference chart is done based on the difference between the colors and intensities. In color Segmentation an image is segmented into components containing colors similar to primary, secondary, and tertiary colors of varying intensities. Candidates of objects known to be a certain color can be isolated in an image frame and examined further.



(a) Image Frame (b) Color Reference Chart

Figure 2: Image Frame Containing Reference Color Chart and Original Color Reference Chart

Color tracking on a mobile vision system

Mouse click on the color that wants to be recognized within the live image. Selected point becomes the center of the cell that will calculate HSV parameters. If the selected cell has ($S > Smin$), ($V > Vmin$), color is assigned and this color becomes a reference color [5]. Search process starts with calculation of the HSV parameters [1]. If all of the requirements for recognition with the reference sample are fulfilled, the cell is declared as recognized, otherwise it is not recognized. Thereafter recognized cells is linked into groups (clusters)

III. COMPARISON

We have discussed various methods used for color recognition proposed by various authors. The motive of all the methods is to detect the color in the image but the techniques are different. Table 1 shows the comparison table of the various methods discussed in this paper.

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Sl.no	Paper Title	Method used	Features	Publication year
1	Color Tracking Vision System For The Autonomous Robot	HSI	more stable in different light conditions	2009
2	FPGA based Color Tracking for Mobile Robot System	HSV	improve color segmentation in different light intensities	2009
3	Interactive Offline Tracking for Color Objects	Boosted Color Bin	multiple bins can be powerful and highly discriminative	2007
4	Mobile Robot Navigation and Target Tracking System	Rg-chromaticity	Boundary detection	2011
5	Mobile robot vision system for object color tracking	HSV	improve color segmentation in different light intensities	2013

IV. CONCLUSION

In this paper different techniques for color identification have been discussed and analyzed. All the methods and techniques discussed in this paper are suitable for color identification. At the same time, in order to improve the accuracy of identification in different illumination conditions an efficient color space is taken into account.

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