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Colour Classification Using Entropy Algorithm in Real Time Colour Recognition System for Blindness People

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Abstract

This article describes the real time instrumentation system to help blindness people for recognize a colour. Colour image captured by the digital camera, and it classified into ten basic colours names (black, brown, cyan, red, orange, yellow, green, blue, magenta, gray and white) by using entropy algorithm. The conclusion of colour classification will be informed to the user in sound or vocal information. This study has used two colour models HSV (hue, saturation and value) and RGB (red, green and blue). The accuracy of Classification using HSV has 90%, and RGB model has 71.5%.

Keywords: Colour Classification, visual impairment, blindness, entropy algorithm

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1. Introduction

Colour has a crucial role in the activities of human life as a guide for completing various activities. Colour is an important factor to perceive and analyze characteristics of an object such as determining the dimensions of an object, and spacing [1]. This variable is the basic for distinguishing one object to another. It can provide a psychological effect on a person such as mood, feeling and perception [2]. The Inability to see the colour becomes a major problem for people with visual impairments or blindness.

A digital colour obtained from combination of RGB (red, green and blue) values are built based on the represents the x-axis, y and z coordinates of Cartesian space. There are also colour HSV models (Hue, Saturation and Value) and other model. The format of these colours can be converted using a specific equation [3]. In reality, although there are many colours from RGB combinations, not all colour name needs to be recognized. The colour of an object generally identified by grouping to the basic colour names such as black, brown, cyan, red, orange, yellow, green, blue, magenta, gray and white. An object called with a certain colour if the colour is most dominant in viewing area. The Viewing area is the middle area in a landscape image that has been observed in real time.

According to the WHO notes that in 2010, the number of people with visual impairment is estimated to be 285 million, with 39 million are blind [4]. These data showed an increasing number of patients with eye disorders in worldwide ranging from 161

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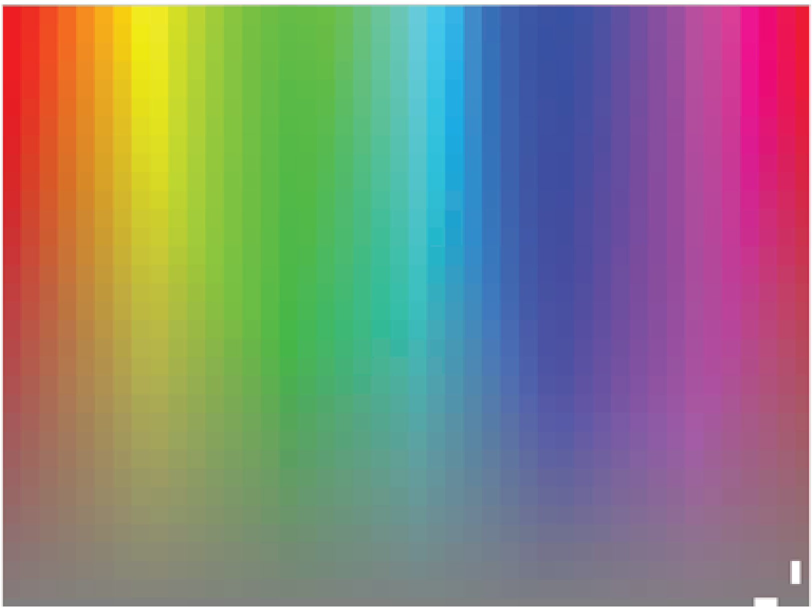

Figure 1: Variation combination of RGB value in 8-bit formats.

million people (about 2.6% of the total world population) consist of 124 million people with low vision capability and 37 million blind in total [5]. WHO on 30 September 1999 launched the Global Commitment Vision 2020 as The Right of Sight is an idea to cope with visual impairment and blindness. This can be prevented or rehabilitated in an integrate manner to reduce the amount of blindness in 2020 [6]. The inventions of the devices for detection and classification colours are expected to be part of the solution to help blindness people in carrying out his activities.

2. Methodology

2.1. Training Colour Test with Entropy Algorithm

The data, the digital colours are obtained from variation combination RGB value in 8-bit formats, is represented by Fig 1.

The data modified and entered in table columns form consist with value of R, G, B and colour names. Here is the problem; every person has a different perception in the classification many colour to basic colours names. It can be caused by many factors such as environmental influences, keen of the eyes and even the colour blind. The RGB data is converted into the HSV format by using the HSV equation [3]. In 3-dimension form, HSV model is described as an inverted hex cone. The determination limit of each groups of colour is based on a specific coordinate. Black is height from the base, white is the middle peak area of inverted cone, and the other colour is determined by the angle degree of circle of hex cone. Thus the HSV value and Colour Name put in the table too. Not all combination RGB data is used for training to the entropy algorithm, only at 450 RGB and HSV values are taken by random. The result of entropy algorithm is the decision tree form to simplify the rules.

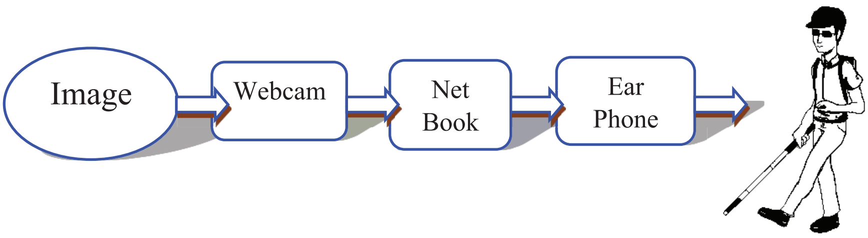

Figure 2: Block diagram instrumentation system.

3. Hardware

The block diagram system is used in Fig 2.

Image captured by webcam which external webcam connected to the net book. The colour names Information done by sound from ear phone. The hardware and software in this system are controlled by program. The block diagram of the program is represented by Fig 2.

4. Calculating the RGB Value in Viewing Area

If P is length of half of the width of the image to be processed (- P for the starting point pixel and + P for the end point pixel) and k is index of start or end pixel coordinate. Coordinates of the pixel can be determined by using the Equation:

$$i_k = \left(\frac{image\ width - 1}{2}\right) + P \quad (1)$$

$$j_k = \left(\frac{image\ high - 1}{2}\right) + P \quad (2)$$

The dominant colour of an object is considered as the main colour of the object. The dominant colour is detected by calculating the average colour of each R, G, and B value of all the pixels certain areas.

4.1. Software

Software that has been built consists of three parts: The Interfacing part; Software designed by using Delphi 7 that have a function to capture an image from webcam with * .bmp format. The image captured every 100 ms (frames per second). This method is carried out to observe objects that have changed colour every time. Image processing part; This part is consists of the calculating the time length of the image that has unchanged, only image that has not changed for certain time would be processed, and it calculated of average RGB value of the central area and determinate of the colour name with entropy algorithm. The sound output part; the sound output is obtained by storing the sound in * .wav format when a colour name was found. Each colour is represented by a single sound. Fig. 4 shows the screen shoot the program that has been created.

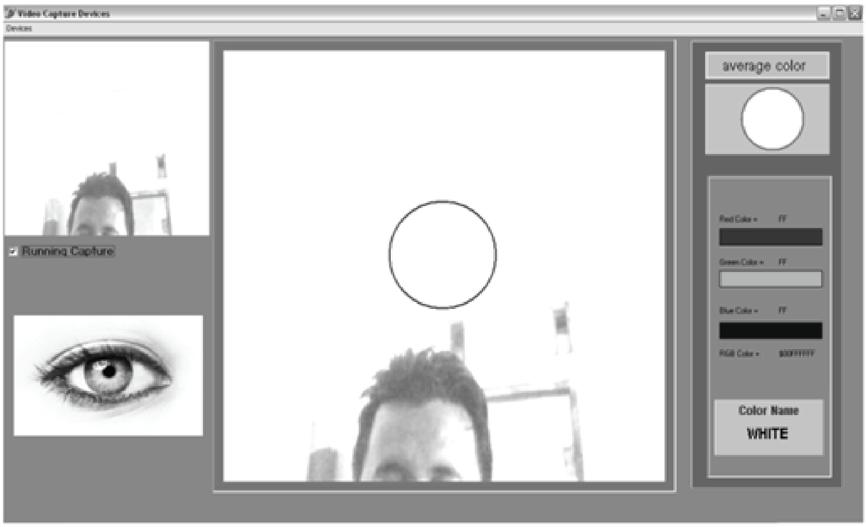

Figure 3: The screen shoots of the program.

5. Result and Discussion

The results of this research are average each RGB value at viewing area. The HSV value is taken by converting equation [3]. Decision tree for RGB and HSV colour model produced by Weka 3.6.0 free software, and it must be converted to a rule in list instruction in a program.

6. Colour Classification Algorithm Entropy

This research used the grouping method based on the general perception of the name of a colour. Colour not grouping based on the coordinates in the HSV colour models [7]. The training results using entropy algorithms of cross validation test on the RGB colour format is 71% where Correctly Classified Instances obtained from 450 data. The results of cross validation test on the HSV colour format is 90% where Correctly Classified Instances obtained from 450 data. Model RGB had smaller success because absence of standard patterns in the grouping of colours. HSV format is higher because in the conversion equation from RGB to HSV had a rounding condition to the certain value. Based on an experiment shows that the HSV colour models Easier to Observe and classify than RGB colour models [1,8]. Object decision tree models of HSV colour seen in the Fig 5.

At the real-time camera system the image captured continuously. When the camera or position of the object is moving or shifting the picture will be changed every time. If all images must be processes in the program, they will be consuming the time. The program is designed not processing all the captured images only when the image is unchanged at certain intervals time.

Some of the difficulties in this system are that is dependent on the quality of camera. Sometimes at the testing showed that the RGB values of same image from difference camera are not always same. There is a camera noise that quite disturb but that is

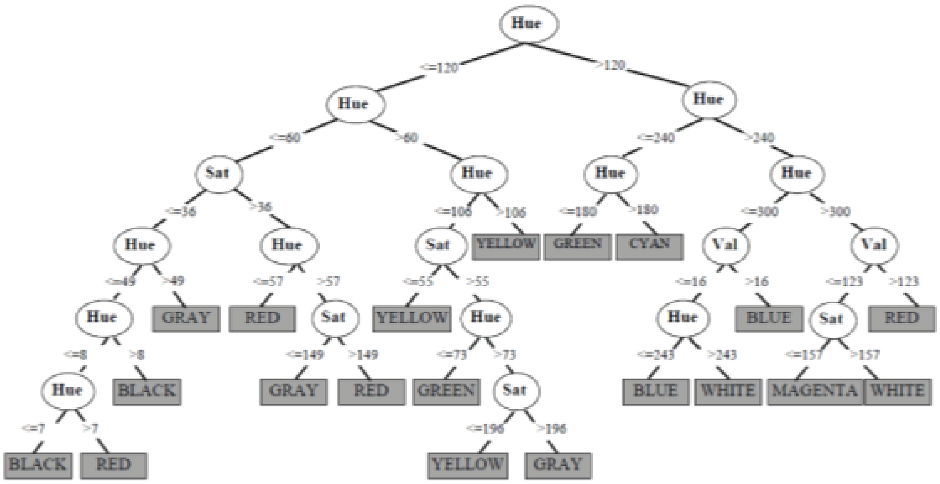

Figure 4: Decision tree Classification in HSV colour model.

not become big obstacle. It required retraining with entropy algorithm for every new camera that will be used.

7. Summary

The conclusion of this research is that the entropy algorithm can be used to classify colours into basic name. Classification using the HSV model is better and efficient than RGB model.

References

[1] P. M. Ong and E. R. Punzalan, Comparative Analysis of RGB and HSV Colour Models in Extracting Colour Features of Green Dye Solutions, (2014), DLSU Research Congress 2014, De La Salle University, Manila, Philippines March 6-8, 2014.

[2] J. Andrew, Elliot and Markus A. Maier. Colour Psychology, *Eff Perceiving Colour Psychol Functioning Hum Annu Rev Psychol*, **65**, 95–120, (2014).

[3] P. Nishad and R. M. Chezian, Various Colour Spaces and Colour Space Conversion Algorithms, *Journal of Global Research in Computer Science*, **4**, no. 1, (2013).

[4] `www.who.int/features/factfiles/blindness/blindness_facts/en/index.html`, WHO, 10 facts about blindness and visual impairment, (2013), Update October 2013.

[5] P. Ibrahim and J. Jagdish, Colour Recognition for Blind and Colour Blind People, *International Journal of Engineering and Innovative Technology (IJEIT)*, **2**, no. 6, (2012).

[6] R. D. Thulasiraj and R. Muralikrishan, Vision 2020, The global initiative for right to sight, *Community Ophthalmol*, **2001**, 20–22, (2001).

[7] Y. Tian and S. Yuan, Clothes Matching for Blind and Colour Blind People., ICCHP 2010, Springer-Verlag. Berlin Heidelberg 2010, Part II, *LNCS*, **6180**, 324–331, (2010).

[8] N. M. Ali, et al., Performance Comparison between RGB and HSV Colour Segmentations for Road Signs Detection, *Appl Mech Mater J*, **393**, 550–555, (2013).