Color Blind Image Correction

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Abstract

In recent years, color blindness correction is one of the main topics in human computer interaction. Therefore, in this work we implement color blindness correction algorithm. First of all, we got survey in ishihara [9] image test among 43 students. Second, we detect several people have color blindness problems. Third, we corrected the unrecognized images using several image processing methods. Finally, we tested the corrected images by the color blindness people. As a result, 80 percent of the then were able to see the corrected images.

Keywords: color blind correction

1. Introduction

About 8% of men and 0.5% women in world are affected by the Color Vision Deficiency. As per the statistics, there are nearly 200 million color blind people in the world. Most people see colors with the helping of external light. In contrast, some of them can't distinguish the colors. The reason is the angle of seeing has got abnormality, those people see colors from different sides. The people who are suffering as this disease can see the things as only three different types of color. And some of them can't distinguish the differences of color. [4]

Classification	Incidence (%)	
	Men	Women
Anomalous trichromacy	**5.9**	**0.37**
Protanomaly (red-cones defect)	1.0	0.02
Deuteranomaly (green-cones defect)	4.9	0.35
Tritanomaly (blue-cones defect)	0.0001	0.0001
Dichromacy	**2.1**	**0.03**
Protanopia (red-cones absent)	1.0	0.02
Deuteranopia (green-cones absent)	1.1	0.01
Tritanopia (blue-cones absent)	0.001	0.001
Monochromacy	**0.003**	**0.00001**

Figure 1. Percentage of color blind people

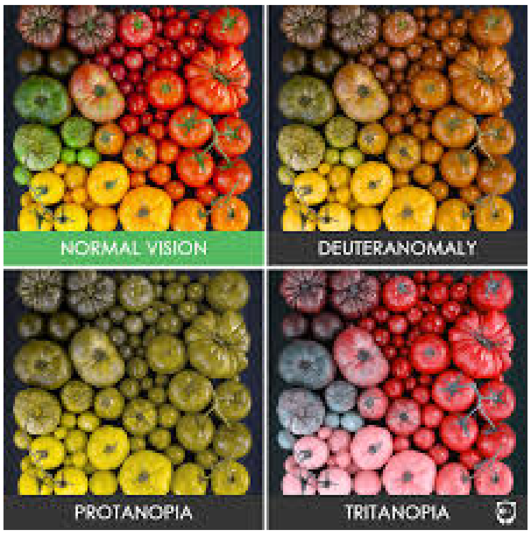
Figure1 is shown the classification of color vision deficiencies and the respective incidence in the caucasian population (RIGDEN, 1999).

Hence, we took survey for preparing study about image processing methods for this group of people. As a result of this survey, some of people who involved in this survey were diagnosed as likely to be suffering as this disease. The reason is that there are so many kinds of people in the world and part of them can't distinguish any color. Therefore, we are choosing this subject in order to find the reason of being cannot distinguish color, how to prevent and find any new technology, method of curing this disease. We tried to analyze how those people could distinguish colors after show them combination of many colors. In this survey, 62.8% of all students who are studying at information technology, 37,2% of other courses' students were involved.

The reason why we included more student from information technology is they make design and technology based on other people satisfaction. During the study, most man students of all participants confused between 3 and 8. This is proof of many participants might be got this disease.

†2. Related works

S. M. W. Masra, A. A. M. A. Shafiee, and M. S. Muhammad are used method. Color blindness or color vision deficiency (CVD) refers to the inability to perceive or distinguish certain colors or shades of colors to some degree. This paper presents different methods of correcting images especially for people suffering from dichromacy: protanopia, deuteranopia and tritanopia. Color transformation, color simulation and colormap approximation are the methods that have been applied in this project for helping color blind people to improve color perception when they seethings in this world.[1-3] Experimental results demonstrate the effectiveness of the proposed methodology. A survey has been conducted to color blind people to test the proposed methodology. The output of the survey shows very promising results, indicating that the proposed method of image correctionusing colormap approximation method is capable of relaying information in the picture or image to the color blind people. [5]



3. Simulating Color Blind

The color blindness of the disease is unlikely to be open to Mongolia and is a common disease in foreign countries. The person suffering from this illness looks differently from ordinary people. On this basis, the program was designed for people. To do this, you have to follow several ready-made sources. [8]

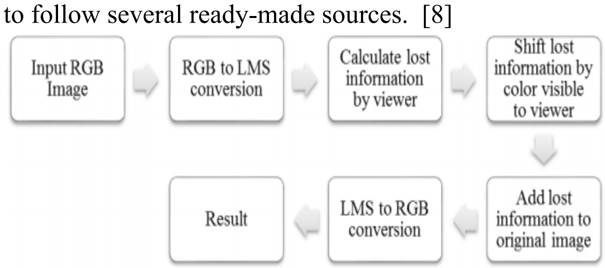


Figure 3. Block diagram of LMS daltonization

As a result, what we did was actually implemented. The Daltonization algorithm used for the corresponding Chroma mode is illustrated by the matrices (1)-(5) below and is defined as follows: for each color, Chroma converts the color from the 0-255 range of the RGB color space to LMS color space (1). It simulates color blindness cb by applying a color vision deficiency matrix that has been experimentally calculated for each color blindness type based on their "confusion lines" (lines in color space that the colorblind person can not distinguish between all colors on that line [4]) (2), and then converted back to RGB color space using the inverse of the RGB to LMS conversion matrix (3). Space precludes including the matrices for all color blindness and types, but we list the resulting values for a person with Deuteranopia.

$$\begin{bmatrix} L \\ M \\ S \end{bmatrix} = \begin{bmatrix} 17.8824\ 43.51614.11935 \\ 3.4556527.1554\ 3.86714 \\ 0.02996\ 0.1843091.46709 \end{bmatrix} * \begin{bmatrix} R \\ G \\ B \end{bmatrix} \quad (1)$$

$$\begin{bmatrix} L_{cb} \\ M_{cb} \\ S_{cb} \end{bmatrix} = \begin{bmatrix} 1.0\ 0.0\ 0.0 \\ 0.494207\ 0.0\ 1.24827 \\ 1.0\ 0.0\ 0.0 \end{bmatrix} * \begin{bmatrix} L \\ M \\ S \end{bmatrix} \quad (2)$$

$$\begin{bmatrix} R \\ G \\ B \end{bmatrix} = \begin{bmatrix} 0.0809455\ -0.130505\ 0.1167211 \\ -0.0102485\ 0.0540193\ -1.113615 \\ -0.0000365\ -\ 0.0041216\ 0.6935114 \end{bmatrix} * \begin{bmatrix} L\ cb \\ M\ cb \\ S\ cb \end{bmatrix} \quad (3)$$

When the simulated color blindness has been derived, we obtain Chroma's compensation values by calculating how erroneous the colorblind person perceives the original color. We calculate the shift s necessary to make the color more visible (4), and then add the compensation values to the original RGB color values (5), resulting in a matrix of the Daltonized color d. The following equations summarize this process.

$$\begin{bmatrix} R\ e \\ G\ e \\ B\ e \end{bmatrix} = \begin{bmatrix} R \\ G \\ B \end{bmatrix} - \begin{bmatrix} L\ cb \\ M\ cb \\ S\ cb \end{bmatrix}$$

$$\begin{bmatrix} R\ s \\ G\ s \\ B\ s \end{bmatrix} = \begin{bmatrix} 0.0 & 0.0 & 0.0 \\ 0.7 & 1.0 & 0.0 \\ 0.7 & 1.0 & 0.0 \end{bmatrix} * \begin{bmatrix} R\ e \\ G\ e \\ B\ e \end{bmatrix} \quad (4)$$

$$\begin{bmatrix} R\ d \\ G\ d \\ B\ d \end{bmatrix} = \begin{bmatrix} R \\ G \\ B \end{bmatrix} + \begin{bmatrix} R\ s \\ G\ e \\ B\ e \end{bmatrix} \quad (5)$$

Our algorithm is similar to other re-coloring algorithms that attempt to preserve color and information. In particular, Chun-Rong Huang's method [7] attempts to re-color the image by clustering colors into regions known as key colors, calculate the color-vision deficiency (CVD) color space empirically, and re-map the colors into CVD space based on the key colors. For each key color, this method re-maps it in consideration with CVD space and other key colors and shifts all colors associated with that key color accordingly. This means that less colors needs to be processed, but if implemented with real-time processing, this algorithm must re-calculate the key colors for each frame and then reformulate how the colors will be re-mapped, which may create significant latency. To reduce computational time, in Chroma each color is mapped to its corresponding Daltonized color in a hash-map as a pre-process before Chroma performs image processing. As Chroma processes each frame, for each pixel it simply looks up the corresponding Daltonized color, records it onto a new image, and finally displays the new image to the user. Although it is hard to judge subjective preferences in terms of re-coloring, our algorithm is more efficient and it demonstrated to be effective for real-time processing.

4. Correction of color blindness

Using the equations in (1)-(5), we got corrected images for testing the color blindness peoples.
It was a matter of discussion and discussion of what to do for the blind people. The picture was shown that they could not see the code for these people.

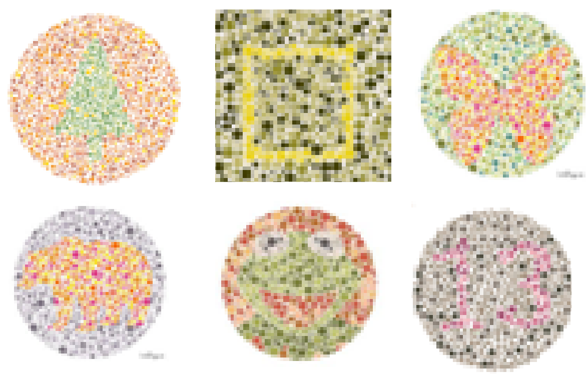


Figure 4. Examples of the Ishihara test

A total of 3 phases were studied during the process. In the first section, the ishihara was tested on the basis of the site.
In the next step, we sent the code to the code to show the main picture with a matlab program. In the last stage, my results improved and the figures in my picture were more pronounced and the survey was effective.

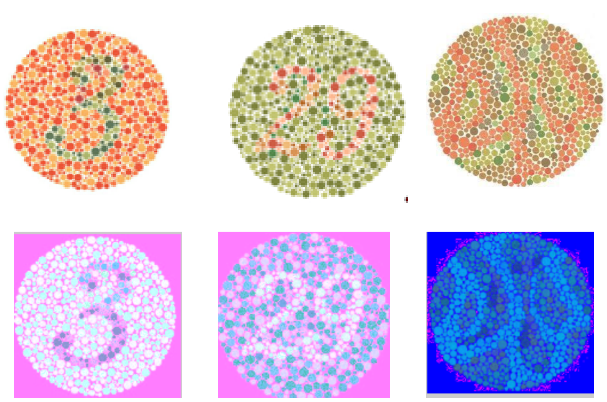


Figure 5. Ishihara test and its corrected images

In the first row of Figure 5, Original ishihara test images are shown, and the second row of Figure 5 is the corrected images using equation (1)-(5).

5. Experimental Results

The survey covered 43 students from across the country and conducted a total of 20 questions. The respondents responded well to the questionnaire and mistakenly reported 3 or 8 groups of men, while the background and the color of the inside were mistaken for red and green.
The first thing that was done was to produce the best results for those people. But the next thing to do is to create a video for these people and make video conversion after seeing the features of those people.

6. Conclusion

The results of the study were very positive. The item was also done according to the methodology .Attendances actively involved in the study, but unfortunately they could not distinguish numbers between 3 and 8. Half of the participants in the first survey did not see it well and 80 percent of the respondents were able to see the next stage.

7. References

1. E. Tanuwidjaja, D. Huynh, K. Koa, C. Nguyen, Ch. Shao, P. Torbett, C. Emmenegger, and N. Weibel, Chroma: A Wearable Augmented-Reality Solution for Color Blindness, 2014
2. N. Halder, D. Roy, P. Roy, A. Chattaraj, and T. Chowdhury, Image Color Transformation for Deuteranopia Patients using Daltonization, IOSR Journal of VLSI and Signal Processing (IOSR-JVSP) Volume 5, Issue 5, Ver. I (Sep - Oct. 2015), PP 15-20 e-ISSN: 2319 – 4200, p-ISSN No. : 2319 – 4197
3. J-B. Huang, S-Y. Wu, and Ch-S. Chen, Enhancing Color Representation for the Color Vision Impaired, National Science Council of Taiwan under Grant No. NSC 96-3113-H-001-011
4. Ch. Falguni D., V. H. Mistry, A Survey on Color Transformation Algorithm for Color Vision Deficiencies, international Journal of Advanced Researches in Engineering, Science and Management, vol 3(8), pp. 1-4. 2016.
5. G. R. Kuhn, Image Recoloring for Color-Vision Deficients, Master Thesis of Computer Science, 2008
6. Jyoti D. Badlani, C. N. Deshmukh, A Novel Technique for Modification of Images for Deuteranopic, International Journal of Advanced Research in Computer and Communication Engineering Vol. 5, Issue 4, April 2016.
7. D. S. Khurge, and Bh. Peswani, Modifying Image Appearance for Improvement in Information Gaining For Color Blinds, International Journal for Scientific Research & Development, Vol. 1, Issue 12, 2014, ISSN (online): 2321-0613
8. E. Celebi, M. Lecca, and B. Smolka., Color Image and Video Enhancement, 2008
9. www.ishihara.com