Project Proposal   Image Processing, CSCI 55700 | Dr. Mihran Tuceryan

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Title: Image Filter for a Color Deficient Person (Color Blindness)

Goal: A color deficient person cannot distinguish the difference between some colors. Such deficiency is known as color blindness. Such condition is caused by the absence of some color-sensitive pigment in the retina's corn cells. Out of all the persons diagnosed by color blindness, 90% of them will be suffering from some kind of red-green deficiency in which they cannot distinguish red and green color. Figure-1 given below shows an example of the vision of a color blind person.

colors as seen with normal vision   same colors as seen with red-green color deficiency
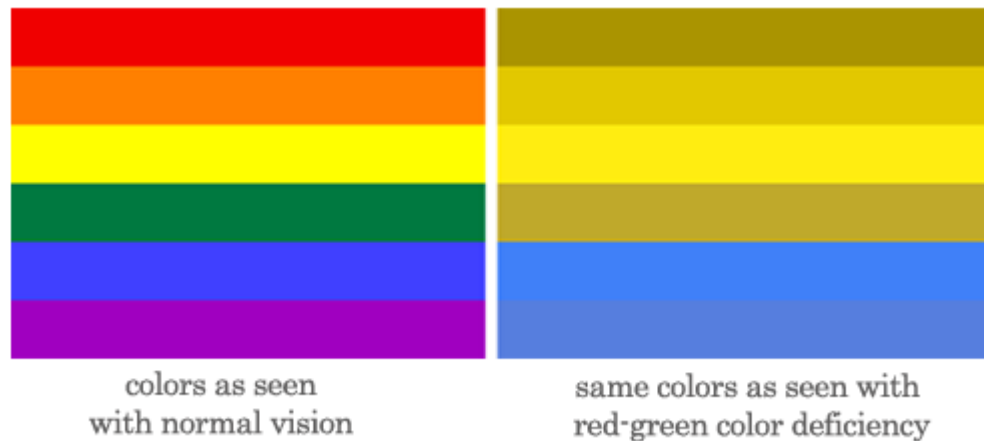
Figure-1 [1]

Aim of the project is to develop a filter for a color blind person so that they can perceive the image details and color dynamics in much better way and try to explore the effectiveness of different method to do the same in order to improve the vision of a color blind person.

Approach: The first approach to do the filtering process involves the use of RGB color contrasting in which we can adjust the RGB values of the image in order to enhance the contrast between Red and Green color and make them appear different. The second approach will use LMS Daltonization Algorithm, where LMS stands for Long (564–580nm), Medium (534–545nm) and Short (420–440nm) wavelength sensitivity of three types of cones cells of the human eye. This algorithm involves the shifting of the wavelengths away from the invisible spectrum to color deficient person towards the spectrum that is visible to them. Along with the implementation of the above mentioned approaches I will also simulate the vision of a color blind person so that we can test the effects of the above mentioned approaches and will also try to implement Delta E method to check up to what extent the algorithms will change the images after applying the filter. I am still looking for some better approaches which I will include in future reports.

Inputs: Input data will be any image that have combination of vivid colors so that we can make sure that our implementation works properly and the filtered image are accurate enough.

Outputs: Output will be the filtered image suitable for a color blind person so that he/she can differentiate the red and green color. Figure-2 given below is a sample for the color blind person's vision before and after the filter.

Figure-2 [2]

Equipment OR Tools to be used: Tool used: MATLAB's image processing toolbox.

References:

- [1] http://understandinggraphics.com/design/designing-for-color-blindness/
- http://www.daltonize.org/2010/05/lms-daltonization-algorithm.html
- [2] http://www.telegraph.co.uk/technology/news/11882403/New-app-lets-colour-blind-people-see-for-the-first-time-their-reactions-are-amazing.html
- http://www.mathworks.com/help/images/index.html
- Modifying Images for Color Blind Viewers, William Woods, Electrical Engineering Department, Stanford University, USA
- Color Contrast Enhancement for Visually Impaired People, Anustup Choudhury and Ge´rard Medioni, Department of Computer Science, University of Southern California, USA.
- http://www.color-blindness.com/coblis-color-blindness-simulator/