Brightness matching

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Abstract

The main objective of this lab is to learn how the brightness matching varies from observer to observer and analyze the results using plot. The brightness matching under three main backgrounds that is: white, black, and mid-gray.

Reference Preparation

Quantum dot technology has expanded display colorfulness and color volume. The colorfulness is very important because of the Helmholtz- Kohlrausch effect, that perceived brightness increases with color saturation as reported by Kohlrausch in 1935, according to Wyszecki and Stiles [1].

Stolitzka et.al developed a test method and computational model for predicting the brightness achieved by HDR (high dynamic range) televisions and computer monitors, those with materials that feature primary colors having high spectral purity. The technological integration of quantum dot materials and emissive pixel lighting is expanding the color gamut level to attain a degree of performance unmatched in today's consumer and professional displays. These displays exhibit highly significant improvements in saturation and brightness due in part to the H-K (Helmholtz-Kohlrausch) effect, where people perceive some colors—notably reds and blues—as far brighter than its reference white [2].

Materials and Methods

In this laboratory simulation we were asked to simulate using a brightness matching GUI which present a reference color patch (left) next to a neutral sample patch (right). We were asked to adjust the sample patch by key presses until the sample appears to match the reference in brightness in trail 1. here are 8 reference patches and 3 background colors. We had to complete a trial for each reference patch (8), on each background color (3), with 2 repetitions (2), for a total of 48 trials.

All .xls files were collected from fellow classmates and the re plots were plotted combining all the observation values. Obtained by everyone in the class.The first plot is of the eight different color patch and followed by Y luminance graph. The following graphs are XYZ converted figure, and now we consider the chroma values of the color and plot it as shown in fig1.

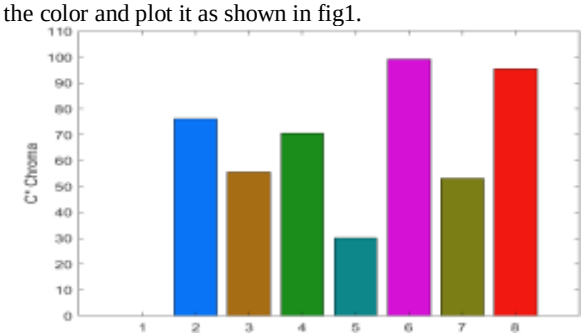

Fig 1. C*Chroma

The values from all the xls files are stored in a variable to processes the entire data at once. Altering these values in required pattern using the MATLAB code to get luminance ratio, luminance, and C* chroma. Luminance ratio (Ymatch/Yref) of matches are plotted using bar plots using hues and background color reference white,black and grey as shown in fig 2. All the statistics of grouping, mean standard deviation of the ratios are found and displayed on the MATLAB. In the last plot the luminance ratio against chroma is plotted using scatter plot and add least-squares fit line to scatter plot as shown in fig 3.

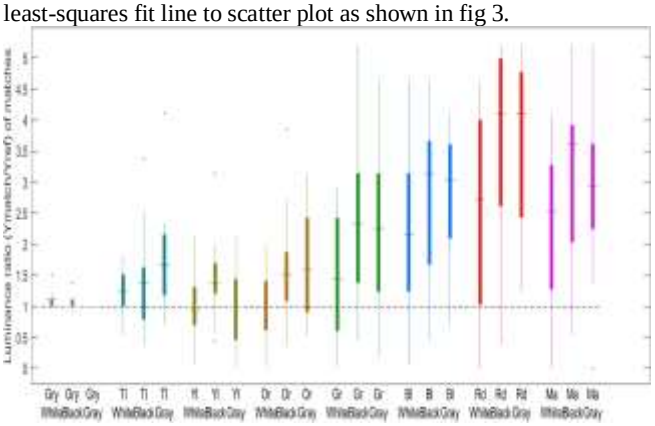

Fig 2. Luminance ratio

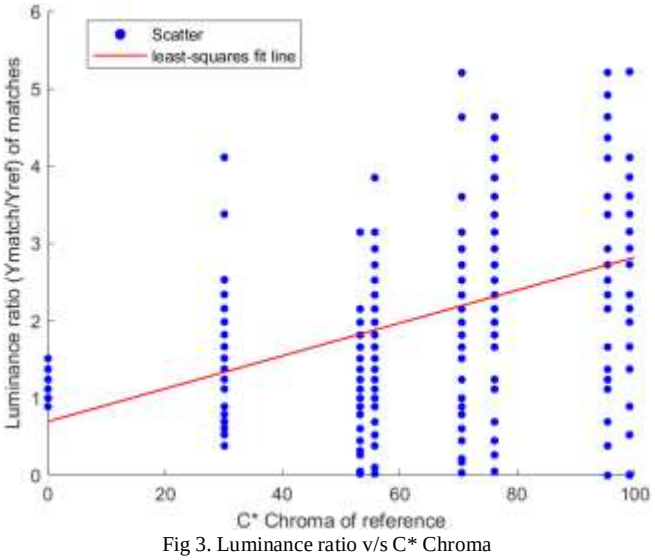

Fig 3. Luminance ratio v/s C* Chroma

References

[1] Wyszecki, Gunter, and Walter Stanley Stiles. *Color science*. Vol. 8. New York: Wiley, 1982.

[2] D. Stolitzka, J. -H. Chong, C. Lee and J. Kwag, "A Model for Very Wide Gamut HDR Displays that Accounts for the H-K Effect," *SMPTE 2020 Annual Technical Conference and Exhibition*, 2020, pp. 1-15, doi: 10.5594/M001922.