**VANHACKHATHON 2016**

**Challenge:** Lightbulb Challenge

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**The Problem**

A lightbulb company is designing a new bulb and would like to ensure that the bulbs appear white to the human eye and have a consistent colour temperature over time

In order to check the colour of the lightbulbs as perceived by the human vision system an optical spectrometer was used to measure the light emitted by the bulbs over time. All of the light observed by the spectrometer came from the bulb but as with all instruments there may be some noise in the data

**Part 1**

Given data from an optical spectrometer write a program that calculates the perceived colour of the light as a (x, y) coordinates on a CIE-1931 chromaticity diagram. The program can be written for any platform using C++.

The measurement data is provided as two CSV files per trial in the following format (find in Dropbox link below):

*Wavelengths.csv*

#Bin Number, Wavelength

1, 450

2, 451

…

*Intensities.csv*

#Timestamp, Bin 0, Bin 1, Bin 2, Bin 3

1, 0.00001, 0.002, 0.003, 0.04

2, 0.00001, 0.001, 0.006, 0.08

3, 0.00001, 0.003, 0.332, 0.12

...

At each measurement the optical spectrometer provides an array of intensities where each element corresponds to the intensity of the light at a particular wavelength. The wavelengths of each element are provided in wavelengths csv and the set of measurements in a trial are in intensities csv.

**Part 2**

Determine how stable the perceived colour is over time.

References:

Colour Matching Functions: http://cvrl.ioo.ucl.ac.uk/cmfs.htm

Data: : https://www.dropbox.com/s/igoyvp6jqf9y30n/VanHackathon%20Challenges.zip?dl=0

**The Solution**

**Introduction**

**Part 1 – Calculate Chromaticity Coordinates**

To calculate the CIE chromaticity coordinates we need to first calculate the *tristimulus* values X, Y and Z. To achieve that we have to sum all the results from multiplying the intensity of our lightbulb at each wavelength to the correspondent matching color function.

wi: initial wavelength; wf: final wavelength; int: intensity; cf\_x/y/z: color functions for x, y and z.

Now that we have the *tristimulus*, all we have to do is normalize them to get our coordinates:

**Part 2 – Color Stability**

Analyzing the intensities data file we could see that over the time (rows), for the same wavelength, the values varies a lot. This indicates that the color is not very stable..