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Activity 4: Rendering Color

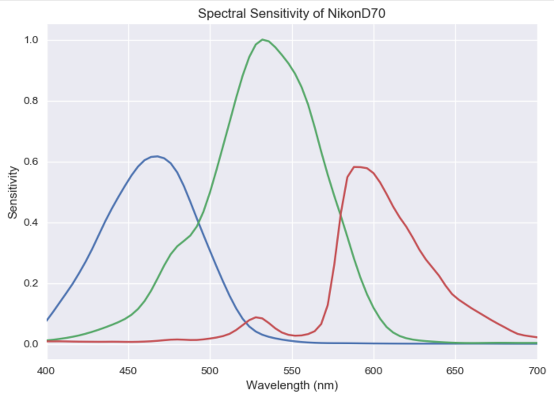
Mary Chris Go / 2014 11122

Goal

to be able to render a color on a square patch using RGB values obtained

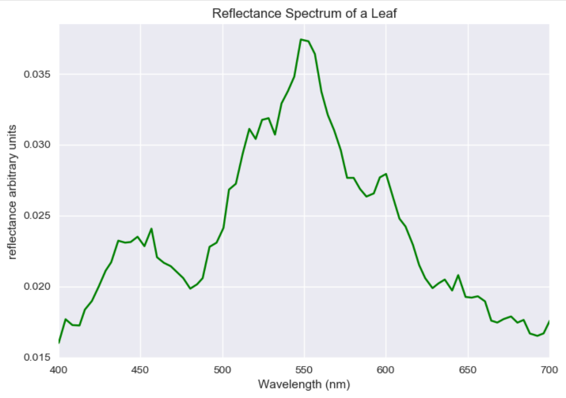
Spectral Sensitivity

From the site given, the spectral sensitivity of NikonD70 was chosen. We used Nikon D3400 at 70mm focal length. You can observe the sensitivity of the camera to color green.



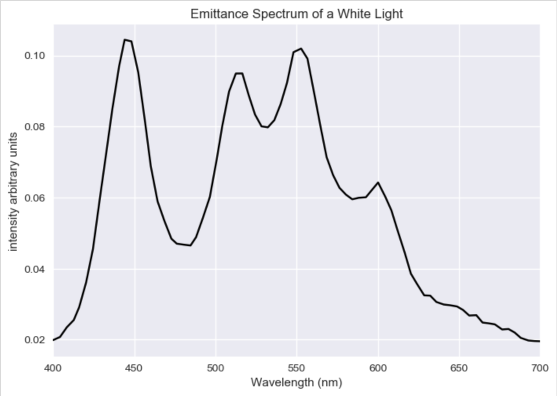
Reflectance Spectrum

The chosen photo was a green leaf from Activity 3. This was biased as I specifically chose this photo since the leaf is green and the spectral sensitivity of the camera will help.



Emittance Spectrum

The light source is a white light and this graph was also obtained from Activity 3.



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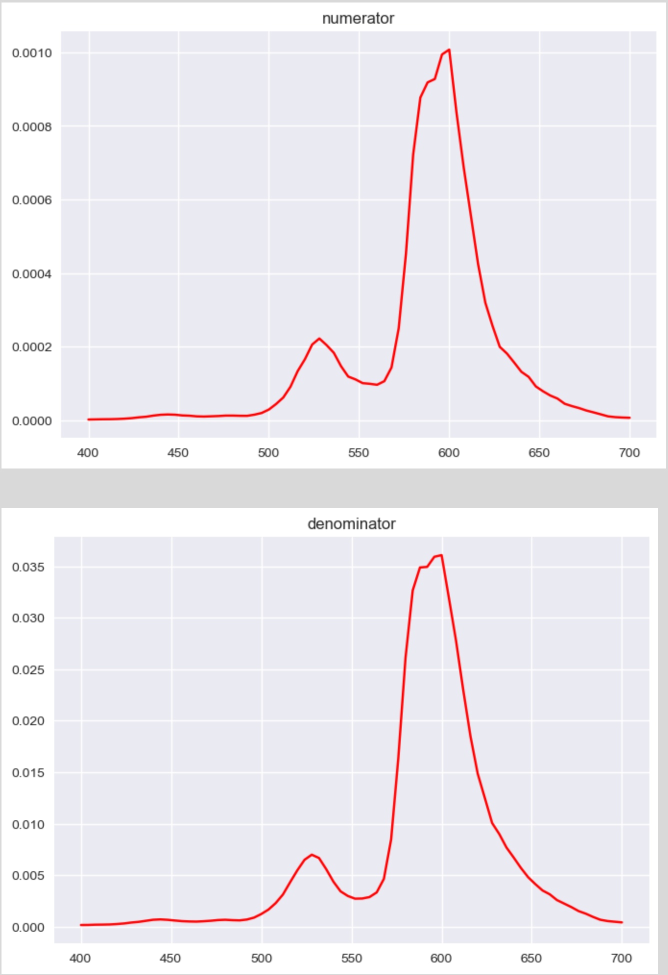
$$DN_i = \frac{\sum M(\lambda)R(\lambda)S_i(\lambda)}{\sum M(\lambda)S_i(\lambda)}$$

```python
#Red
F = np.multiply(red, Y1)
G = np.multiply(F, Y2)
G1 = np.multiply(Y2, red)
plt.plot(X, G, 'red') #numerator
plt.title('numerator')
plt.show()
area1 = np.trapz(G, X)
plt.plot(X, G1, 'red') #denominator
plt.title('denominator')
plt.show()
area2 = np.trapz(G1, X)
```

The following formula was used in identifying the RGB values. On the left, a snippet code from Python (jupyter notebook) of the computation for red channel can be seen. The same block of code was used from the green and blue channel.

The code is very simple. I managed to equalize the shape of each array (76 lines) to be able to use **np.multiply.** For the numerator, I multiplied the spectral sensitivity, reflectance, and emittance spectrum. For the numerator, I multiplied spectral sensitivity and emittance spectrum. From the array I got, I used **np.trapz** to get the area of the curve from the graph. Then I divided the two obtained values and multiplied to 255.

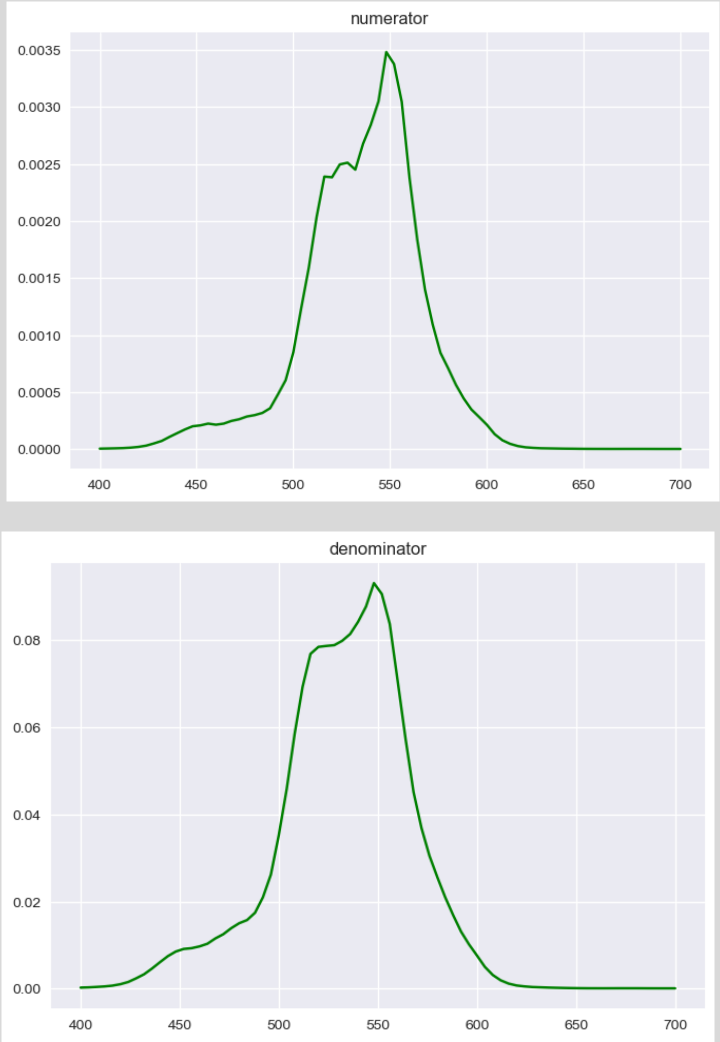


Red Channel

From the formula, these graphs were obtained. You can see only a subtle difference. As mentioned before, area under these curves were obtained using **np.trapz**.

Green Channel

From the formula, these graphs were obtained. You can see only a subtle difference. As mentioned before, area under these curves were obtained using **np.trapz**.



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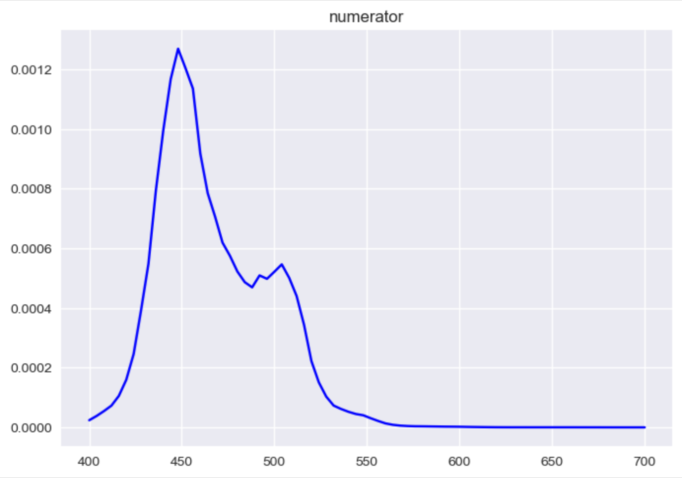

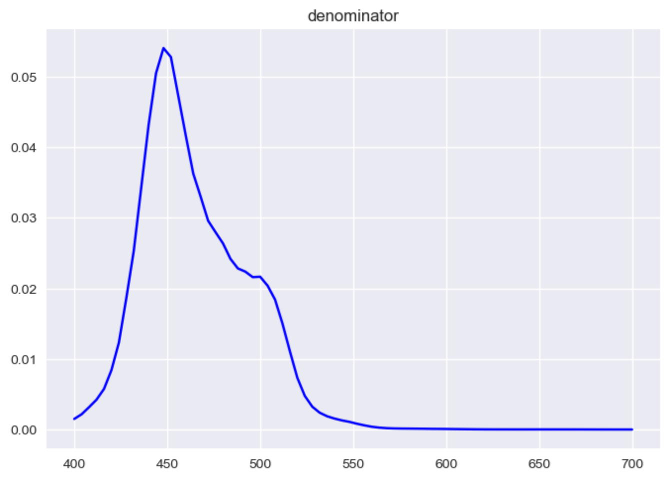

Blue Channel

From the formula, these graphs were obtained. You can see only a subtle difference. As mentioned before, area under these curves were obtained using **np.trapz**.

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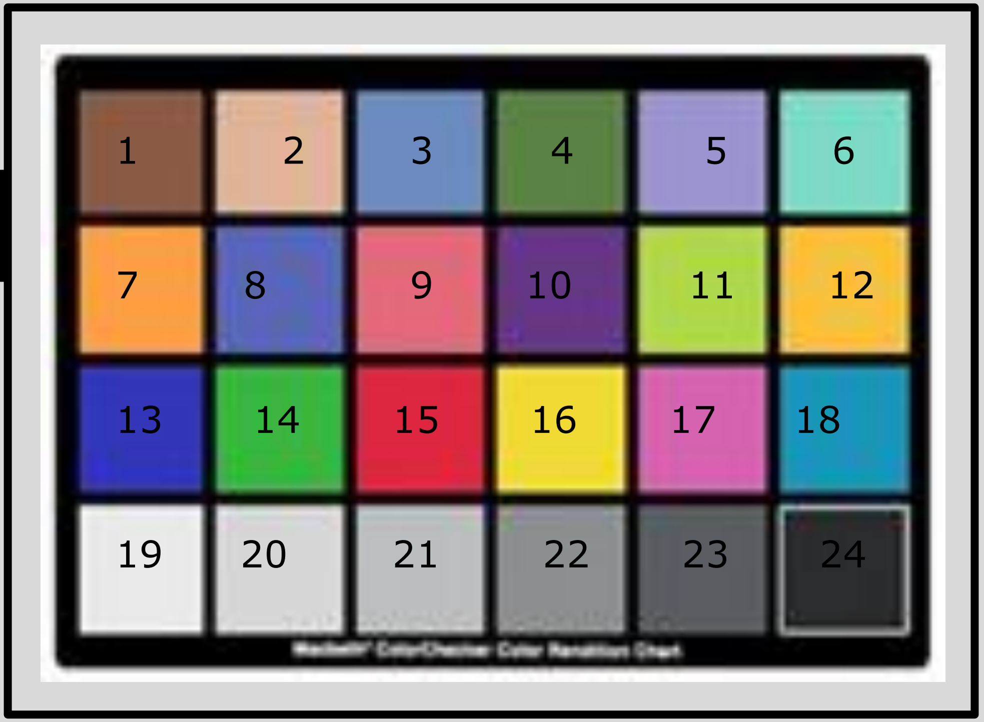
Results

```
Red: 53.35150633770087
Green: 209.78048295221336
Blue: 71.41704397150001
```

The following values were obtained and extracted from the formula mentioned before. These were the input values to extract one color that is similar to the chosen object.

This is the chosen object. A leaf from NIP (sorry nature!).

Using Microsoft Powerpoint, and the obtained values, this is the color of the image. The color rendered was similar to the chosen object shown in the picture.



Macbeth Checker Color

The ColorChecker served as a basis if the algorithm made was correct. The data was given to us via excel. For the next two slides, I tried to copy the colors.

The first row was perfectly copied. The second row slightly deviated with the original colors. The colors were too dark as compared to the theoretical colors.

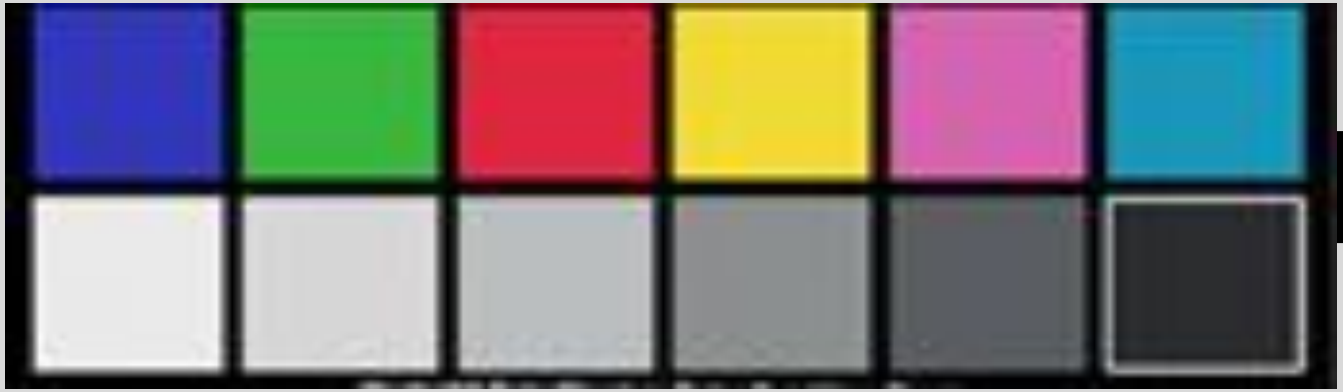
Original

Results

R = 177 G = 99 B = 60	R = 255 G = 154 B = 94	R = 132 G = 192 B = 255	R = 136 G = 125 B = 83	R = 169 G = 128 B = 185	R = 255 G = 154 B = 94
R = 255 G = 158 B = 40	R = 84 G = 94 B = 204	R = 254 G = 108 B = 61	R = 85 G = 36 B = 56	R = 182 G = 210 B = 103	R = 255 G = 154 B = 94

These colors were closer although for the pink, it was different. For the last row, it perfectly copied the theoretical colors.

Original



Results

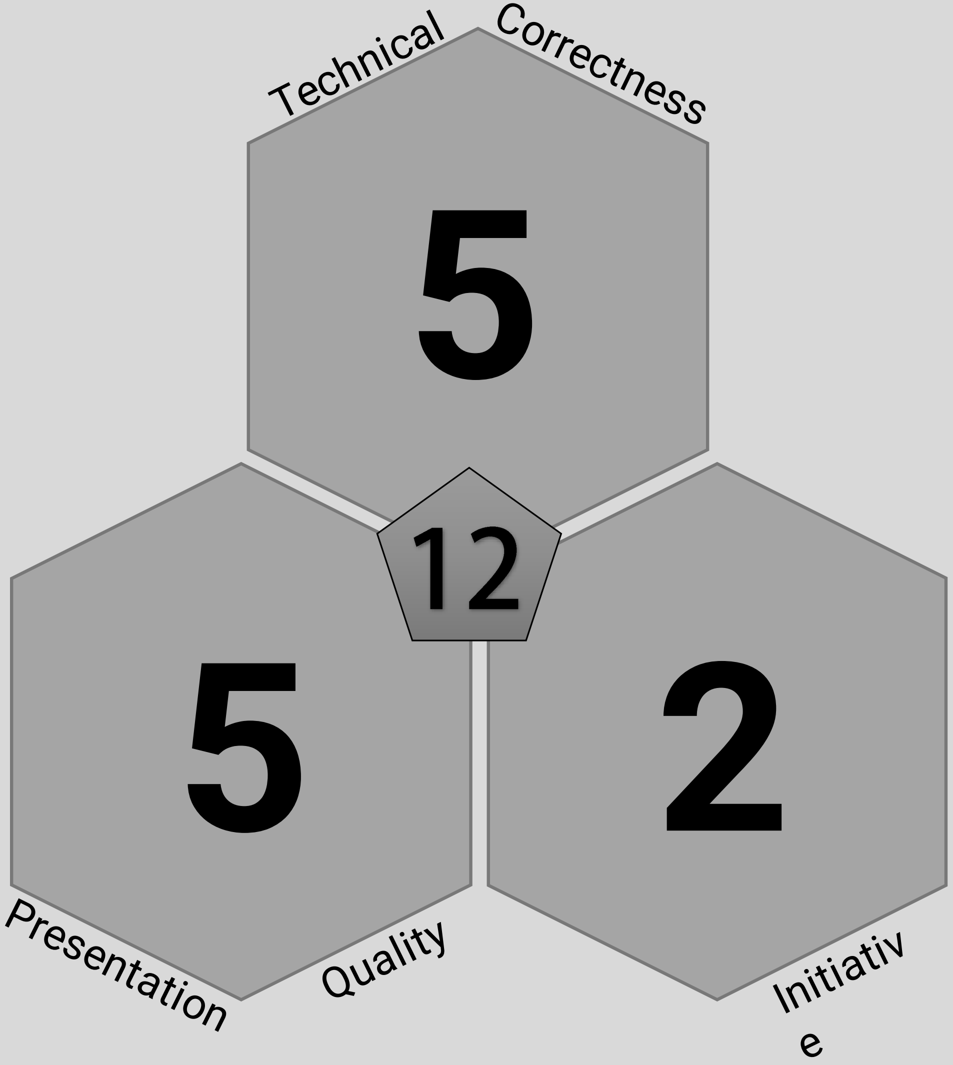
R = 50 G = 70 B = 201	R = 98 G = 192 B = 128	R = 196 G = 52 B = 19	R = 255 G = 225 B = 79	R = 221 G = 82 B = 87	R = 72 G = 147 B =264
R = 226 G = 225 B = 216	R = 221 G = 223 B = 217	R = 179 G = 182 B = 179	R = 152 G = 155 B = 154	R = 91 G = 94 B = 95	R = 33 G = 34 B = 35

Summary

This activity, I tried to make it as a powerpoint presentation as well. I really enjoyed making these slides. It was easy for me to explain using pictures and to make it as simple as possible. I will surely use this for the rest of the activity. Regarding the activity, the coding part was made easy because of the formula given. The only thing I found tedious was the equalization of shapes of the three .txt file. I had to manually delete them and make sure they have the same ‘x’ values. But all in all, I enjoyed making the activity, and making it as creative and simple as possible. I believe that great scientists know how to explain their work well. This way, we get to train ourselves to be ‘great scientists’ ;)

For the Macbeth Color Checker, it was tedious but fun. Although for the pink, the algorithm fails to show the theoretical color. The deviation may also come from the deletion of few lines to make it equal (76 rows).

Self-Evaluation



References

- Data from Activity 3 (AP 187)
- Soriano, M. Sensor, Applied Physics 187