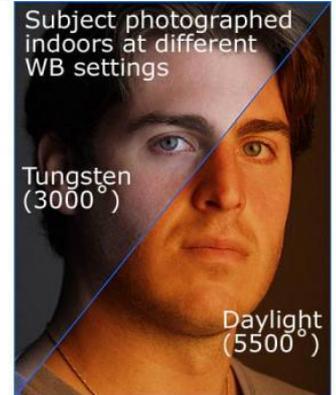


Color Loader

Daniel H. Chang
PSYCH 221 Project
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Motivation

- Color Balancing
 - Humans have color constancy – cameras do not!
 - Involved problem of restoring unknown surfaces and illuminants to “look right”.
 - Needs surfaces, lights, and cameras data to serve as test cases.



Motivation

- Online database for surface reflectances, illuminants, and camera sensors.
 - What's currently out there?
 - How can we improve upon what exists?



The Data

[The camera sensors](#) ([gzipped](#)).

[Illuminants used for most of our experiments with real images](#) ([gzipped](#)) ([info file](#)).

[Measured illuminants \(normalized\)](#) ([gzipped](#)) ([info file](#)).

[The derived set of training illuminants](#) ([gzipped](#)).

[The derived set of testing illuminants](#) ([gzipped](#)).

[The reflectance database](#) ([gzipped](#)).

Several researchers have asked for specific subsets of the above reflectance dataset. Some were in PR-630 spectrophotometer (380-780nm in 4nm steps).

- [1269 Munsell chips](#) ([gzipped](#)).
- [355 Krinov reflectances](#) ([gzipped](#)).
- [120 Dupont paint chips](#) ([gzipped](#)).
- [170 natural objects](#) ([gzipped](#)) ([info file](#)).
- [7 book covers measured by ourselves](#) ([gzipped](#)) ([info file](#)).
- [21 samples of cardboard and construction paper](#) ([gzipped](#)) ([info file](#)).
- [2 more samples of cardboard and construction paper \(duplicates, likely not intended\)](#) ([gzipped](#)) ([info file](#)).
- [1 spectra of the wall of the SFU vision lab](#) ([gzipped](#)) ([info file](#)).
- [7 cloth samples measured by ourselves](#) ([gzipped](#)) ([info file](#)).
- [24 Macbeth color chart patches measured by ourselves](#) ([gzipped](#)) ([info file](#)).
- [19 paint-chips measured by ourselves](#) ([gzipped](#)) ([info file](#)).

Spectral Data

The spectra in the table below is data I used while at [Cornell's Program of Computer Graphics](#). I do not know its origin or its accuracy, however it seems to have been gathered from a variety of sources. Other spectra are available at the following sites:

- [Cornell Measurement Data](#)
- [Lappeenranta University of Technology](#)
- [MGF Material Libraries](#)
- [Columbia-Utrecht Reflectance and Texture Database](#)
- [Principles of Digital Image Synthesis](#)

ACOUSTICAL PLASTER	
LIGHT_BUFF	
ASPHALT FLOOR TILES	
DARK_BLUE_31	DARK_BLUE_FLEXACHR
TOLEDO_RED	
ASPHALT WALL TILES	
LIGHT_GREEN_184	PINK_190
BARE AREAS AND SOIL	
BLACK_EARTH	CLAY_LOAM
DRY_SOIL_B	DRY_SOIL_C
SAND	WET_SOIL_A
WET_SOIL_C	
BRICK	
DRYDRESS BRICK_1	DRYDRESS BRICK_2

FTP directory /pub/eos/pub/spectra/ at ftp.eos.ncsu.edu

To view this FTP site in Windows Explorer, click [Page](#), and then click [Open FTP Site in Windows Explorer](#).

```

*****
**                               **
**      North Carolina State University      **
**      Information Technology FTP server      **
**                               **
*****

Welcome anonymous user from rescamp-08-127157.Stanford.EDU!
Current anonymous users: 1          Maximum anonymous users: 25

```

[Up to higher level directory](#)

```

10/04/2006 12:00AM      Directory .
05/26/2005 12:00AM      Directory ..
03/10/1994 12:00AM      3,986 README
06/22/1993 12:00AM      2,116 basis.functions
11/04/2004 12:00AM      59,551 dupoint_spectra_10.asc
05/01/1994 12:00AM      26,160 dupont.spectra_10
05/01/1994 12:00AM      143,760 dupont.spectra.2
05/01/1994 12:00AM      703 munsell.description
05/01/1994 12:00AM      15,936 munsell.spectra_10
05/01/1994 12:00AM      76,672 munsell.spectra.2
11/04/2004 12:00AM      31,775 munsell_spectra.asc
11/04/2004 12:00AM      84,351 object_spectra.asc
05/01/1994 12:00AM      3,702 objects.description
05/01/1994 12:00AM      37,059 objects.spectra_10
05/01/1994 12:00AM      203,659 objects.spectra.2
03/07/1993 12:00AM      3,702 objects_descrip.asc

```

Objectives:

- Data transparency:
 - Users can access (or even make their own) datasets
 - Aids in color balancing algorithm testing
- Interaction with the data:
 - Choose the data you want.
 - Display RGB representation of scenes.
 - Provide resultant RGB data.

Data and Data Parsing

- Dataset format:

starting comments

dataset_type

#items, nm_step, nm_start, nm_end

item_name

item_description

reflectance_data

next_item_name

item_description

reflectance data

this is a dataset for surfaces

SURFACES

10, 4, 380, 784

BananaPeel

A yellow peel of banana

0.001

0.021

0.032

...

0.00

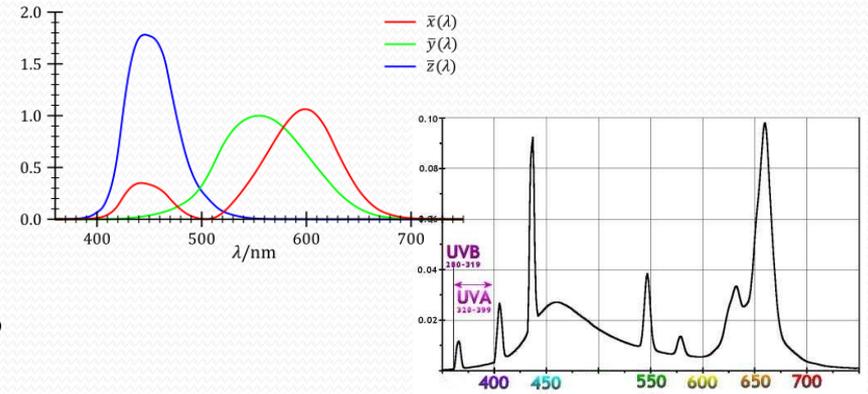
Apple

A Red Delicious apple

0.72

Methodology

- User creates dataset
- Parse data and build matrices
- User selects camera, light, and up to 50 surfaces
- ColorLoader calculates RGB data:
 - Uncorrected: [Surfaces] * [Light] * [Camera]
 - “Ideal”: [Surfaces] * [D65] * [XYZ matching] * [sRGB]
- Display scenes, output numerical RGB



Methodology - Color Loader

- Java web applet
 - Cross platform
 - web-accessible
- A demo!

Color Loader

This interactive web applet creates RGB scenes using a user-specified camera, light source, and collection of surfaces. The purpose of this website is to motivate the problem of color balancing, as well as to provide useful RGB and spectral data for testing color balancing algorithms.

Select from a variety of cameras, lights, and surfaces. Click on the "Render!" button to see an RGB representation of what the scene would look like for the chosen camera and light source. Then, compare that against the "ideal" representation of the scene under D65 daylight and the "ideal" camera - the XYZ color matching functions. You can also use your own data for cameras, lights, and surfaces! Visit one of the default data file URLs to learn how to format and use your own datasets.

For different cameras and lights, the scene may look really off with respect to the ideal scene! The problem of color balancing is to take an unknown illuminant and an unknown scene and attempt to get as close to the "ideal" representation as possible.

This applet also outputs the uncorrected and ideal RGB values in the text box at the bottom of the page. These can be used to test out color balancing algorithms.

Step 1: Enter Data URL

Enter a web URL for your valid data file, then click Update! Visit the default dataset locations to learn about creating and using your own datasets.

Update Cameras Data	<input type="text" value="http://www.stanford.edu/~dhchang/ColorLoader/CamData.txt"/>	<input type="button" value="Default"/>
Update Lights Data	<input type="text" value="http://www.stanford.edu/~dhchang/ColorLoader/LightData.txt"/>	<input type="button" value="Default"/>
Update Surfaces Data	<input type="text" value="http://www.stanford.edu/~dhchang/ColorLoader/SurfData.txt"/>	<input type="button" value="Default"/>

Step 2: Choose Variables

Choose 1 Camera, 1 Light, and up to 50 surfaces for your scene.

Camera: Camera Description

Light: Light Description

Surfaces: CTRL and SHIFT for multiple selections

<input type="text" value="MB_DarkSkin"/> <input type="text" value="MB_LightSkin"/> <input type="text" value="MB_BlueSky"/> <input type="text" value="MB_Foliage"/> <input type="text" value="MB_BlueFlower"/> <input type="text" value="MB_BluishGreen"/> <input type="text" value="MB_Orange"/>	<input type="button" value="->"/>	<input type="text" value="MB_DarkSkin"/> <input type="text" value="MB_LightSkin"/> <input type="text" value="MB_BlueSky"/> <input type="text" value="MB_Foliage"/> <input type="text" value="MB_BlueFlower"/> <input type="text" value="MB_BluishGreen"/> <input type="text" value="MB_Orange"/>
Available Surfaces		Selected Surfaces

Uncorrected RGB Representation of Image:

"Ideal" Representation - D65, XYZ functions * sRGB:

Step 3: Render Image

Render the scene to display the uncorrected and ideal RGB scenes.

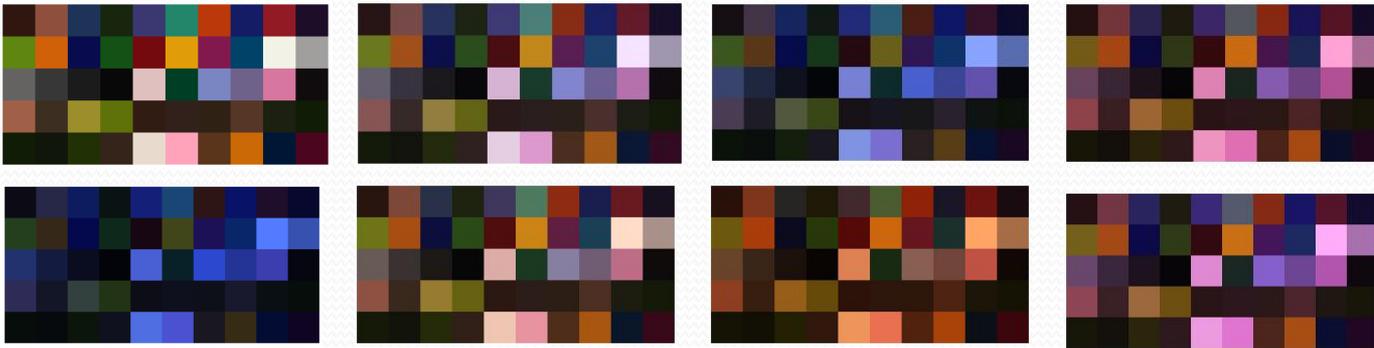
- Uncorrected RGBs = Surfaces * Light * Camera Sensor
- Ideal RGBs = Surfaces * D65 * XYZ matching fns * sRGB matrix

Step 4: Get RGB Data:

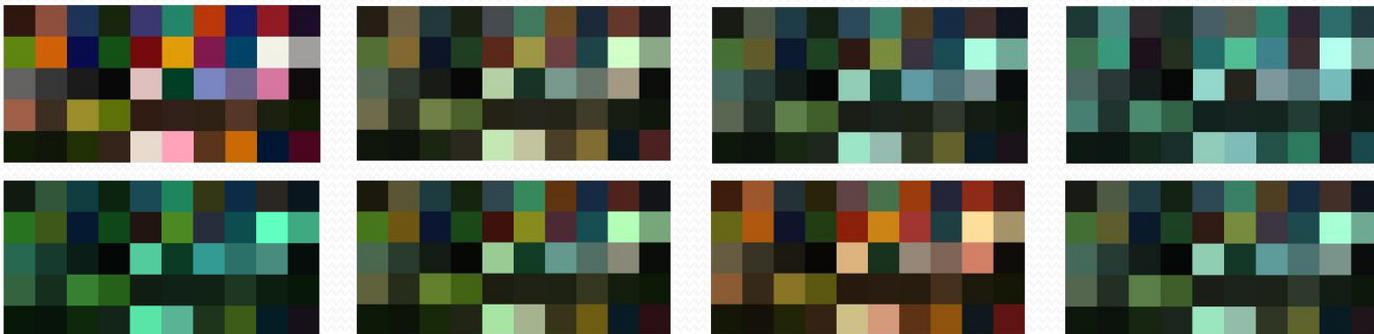
RGB Values Displayed Here.

Practical Value

- Compare Lights



- Compare Cameras



Future Work

- Gamma correction.
- Automatic script generation of data .txt files.
- Expanded Databases.
- Plot the raw spectral data.
- Illuminant estimation?

Acknowledgments

- Data available from
 - http://kobus.ca/research/data/colour_constancy_synthetic_test_data/index.html
 - Imageval's ISET utility
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