Color

- Spectral Model
- 3D Color Spaces
- Color Systems
- Color Computation

Spectral Model

- Spectral Distribution

  $$D = \{f : U \in \mathbf{R}^{+} \rightarrow \mathbf{R}^{+}\}$$

- Infinite Dimensinal Space

  $$c = f(\lambda)$$

Physical Color Systems

- Sensors $\{s_i\}$, $i \in \mathbf{N}$

  $c(\lambda) \to (c_1, \ldots, c_n)$

  $c_i = \int c(\lambda) s_i d\lambda$

  – (ex: eye)

- Emitters $\{e_i\}$, $i \in \mathbf{N}$

  $e_i = d_i(\lambda)$

  $c(\lambda) = \sum c_i d_i(\lambda)$

  – (ex: tv)

- Finite Dimensional Space

Metamerism

- Perceptual Phenomenon

$c(\lambda) \equiv \sum c'_i$

- Grassman Law
  - 3 Dimensions

Color Coordinates

- Color Combination Functions

  $1 = \sum r_i(\lambda) d_i(\lambda)$

- Computing Color Coordinates

  $c_i = \int c(\lambda) r_i(\lambda) d\lambda$

Luminance-Chrominace Decomposition

- Color Information

  (c_i) and $\alpha(c_i)$

  (same color / different intensity)

- Chrominance

  $c_i' = \frac{c_i}{\sum c_k}$

- Luminance

  $L(c) = \sum l_i c_i$

- Color Decomposition

  $C = C_c + C_l$

Chromaticity Diagram

- Maxwell Plane

  $\pi = \{(x_i) : \sum x_i = 1\}$

- Color Solid

  (Cone)

- Spectral Colors

  (Curve)

- Purple Line

- White Point and Gray Line

Color Spaces

- RGB
- XYZ

Color Conversion

- Change of Basis

$\tilde{c}_i = \sum a_{ij} c_i$

$\tilde{c} = cA$

Color Computation