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Lecture 16
Color Image Processing

$$\begin{bmatrix} C \\ M \\ Y \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} - \begin{bmatrix} R \\ G \\ B \end{bmatrix}$$

White

Color Models:

- RGB: Perceptually non-uniform, not good in distance capturing notion of
- HSI/HSV
- CIE LAB

Device Color Gamuts

- RGB cube sits within color space
- Use CIE chromaticity diagram to compare
- Not all colors in CIE color space will lie in RGB color space
- Not all colors can be painted despite seeing them on the monitor

Measuring color diff:

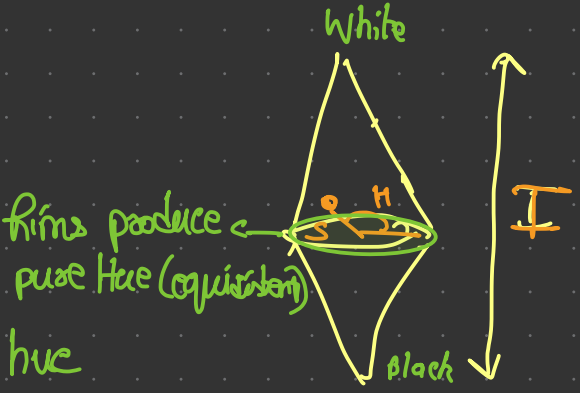
Diff b/w colors in L^*a^*b color space,

$$\text{ColorDist}_{Lab}(C_1, C_2) = \|C_1 - C_2\|$$

HSI color space:

Hue: (H)
- Most dominant wavelength

Saturation (S):
- Amount of white light mixed with hue
- Pure colors are fully saturated [Pink = White + Red is less saturated]

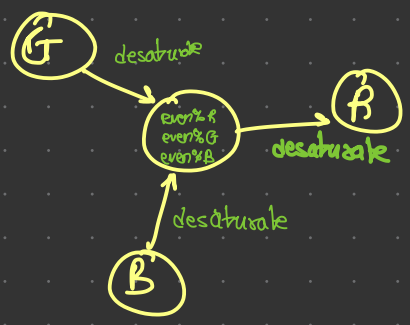


Brightness (I):
- Achromatic notion of intensity $\gamma_I = f(R, G, B)$

RGB → Better for color generation
HSI → Better for color description

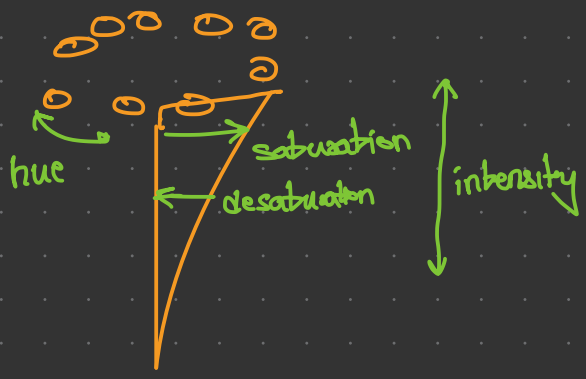
RGB → HSV conversion

Saturation



Rim of circle gives pure hue [s = 1]
Hue dominates less as moving towards centers
At centers no hue dominates (s = 0)

HSI



Conversion

1. Normalise to [0,1]
2. $C_{max} = \max(R', G', B')$
   $C_{min} = \min(R', G', B')$
3. $\Delta = C_{max} - C_{min}$

LMS Color space

→ Performing chromatic adaptation [estimating appearance of sample under diff illuminant]
→ Used in study of color blindness
→ Best mimics human optical system

White balancing is done by calibrating "true white" then recalibrate rest of the points

Von Kries Method

→ Scaling is performed on LMS space to mimic human sensory system better

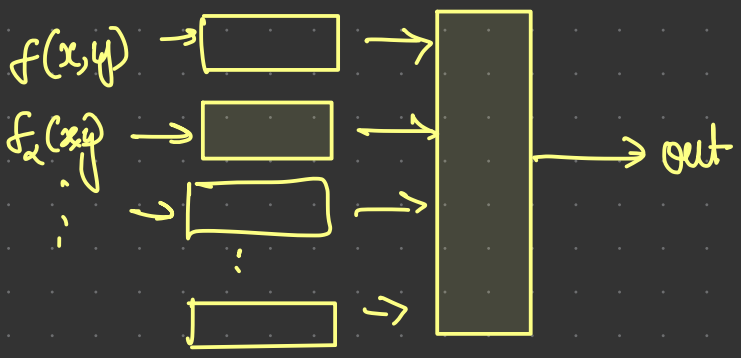
Pseudo Image Processing

→ Assigning colors to gray values based on criterion

→ Mainly for human visualisation

→ Can be used to obtain depth image colorised

Multispectral



RGBA space

A = Alpha for transparency [used in image editing]

$$I_{out} = \alpha I_{fore} + (1-\alpha) I_{bg}$$

$[0, 1]$

Transparent ↳ Fully opaque

Contrast enhancement