

## **Color Spaces**

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## **Color Perception**

- Colour is a part of human perception caused by light being received by the retina of the human eye.
- Light must have a wavelength of between 400 to 700 nm.
- Spectral power distribution caused by light and the reflection from a surface.
- Different SPD may produce the same color sensation. Metamerism.
- Three types of cones in the human eye. Roughly corresponding to Red, Green, and Blue.
- Rod cells are insensitive to colour, but measure brightness.
- Image is encoded through opponent process model
  - Red - Green
  - Blue - Yellow
  - Black White

## **Color Spaces**

- RGB Cube Camera, Computer Monitors. Additive
- CYMK for printing press.
- YUV TV transmission. Separates intensity and colour.

## HSI Color Space

- Human Perception: HSI Model
  - Hue: Red, Yellow, Green, Blue
  - Intensity: Brighter or darker
  - Saturation: How much colour

### **Spherical Coordinate Transform**

- HSI is expensive to compute. Singularities in the conversion (Gray values).
- SCT is cheaper and has no singularities
- Two angles and one scalar

## Fast Color Routines

- Most computer hardware optimized for RGB values.
- Framegrabbers have 24 bit RGB resolution, 16 bit HSI or YUV.
- Conversion in software too slow.
- RGB thresholds not sufficient for robust colour detection.
- Fast RGB check routine.

```
lower = (colrange[MIN].r<<16|colrange[MIN].g<<8|colrange[MIN].b)&0x7efefeff;  
upper = 0x81010100|colrange[MAX].r<<16|colrange[MAX].g<<8|colrange[MAX].b;
```

```
v = *pixel & 0x00fefeff;
```

```
if((((lower - v) & 0x81010100) == 0x81010100) &&  
    (((upper - v) & 0x81010100) == 0x81010100))  
{  
    return obj;  
}
```

## Color Sensitivity

- The response curve for the three channels of a CMOS camera are not identical.
- The human eye is most sensitive to the green channel.
- Therefore, all images have a green tint to them.
- We did some tests and found this relationship
- How to calculate  $g' = 0.75 * g$  ?  
 $g = g - (g \gg 2)$ ;