COLOR MODELS

Most color models in use today are oriented either toward hardware (such as for color monitors and printers) or toward applications where color manipulation is a goal (such as in the creation of color graphics for animation).

The hardware-oriented models:
1. The RGB (red, green, blue) model for color monitors and a broad class of color video cameras;
2. The CMY (cyan, magenta, yellow) model for color printers;
3. The YIQ model, which is the standard for color TV broadcast. The Y corresponds to luminance, and I and Q are two chromatic components called inphase, and quadrature, respectively.

Software-oriented or user oriented models (hue, saturation, brightness) oriented;
Color image manipulation:
1. The HSV (hue, saturation, value) model;
2. The HSI (hue, saturation, intensity) model;
3. The HLS (hue, lightness, saturation) model.

The CMY Color Model

Conversion from RGB to CMY done internally.

\[
\begin{pmatrix}
C \\
M \\
Y
\end{pmatrix} = \begin{pmatrix}
1 & 1 & R \\
1 & 1 & G \\
1 & 1 & B
\end{pmatrix}
\]

The equation demonstrates that light reflected from a surface coated with pure cyan does not contain red (that is, \( C = 1 - R \)), pure magenta does not reflect green, and pure yellow does not reflect blue.
The YIQ color model

The YIQ model is used in commercial color TV broadcasting. Basically, YIQ is a recoding of RGB for transmission efficiency and for maintaining compatibility with monochrome TV standards. The Y component provides all the video information required by a monochrome television set. The RGB to YIQ conversion is defined as

\[
\begin{pmatrix}
Y \\
I \\
Q
\end{pmatrix} =
\begin{pmatrix}
0.299 & 0.587 & 0.114 \\
0.596 & -0.275 & -0.321 \\
0.212 & -0.523 & 0.311
\end{pmatrix}
\begin{pmatrix}
R \\
G \\
B
\end{pmatrix}
\]

The HSI color model

- Hue is a color attribute that describes a pure color (pure yellow, orange, or red).
- Saturation gives a measure of the degree to which a pure color is diluted by white light.
- Intensity, max=1, min=0.

The HSI color model is useful due to two principal facts:
- First, the intensity component, I, is decoupled from the color information in the image.
- Second, the hue and saturation components are intimately related to the way in which human beings perceive color.

Examples of the usefulness of the HSI model range from the design of imaging systems for automatically determining the ripeness of fruits and vegetables, to systems for matching color samples or inspecting the quality of finished color goods.

The HSI color model

- The color components of the HSI model (hue and saturation) are defined with respect to the color triangle.
The HSV or HSI color model
• V : vertical axis. 0 (black) - 1 (white)
• S :

The top the HSV hexagon corresponds to the surface seen by looking along the principle diagonal of the RGB color cube from white toward black.

The RGB cube has subcubes, each plane of constant V in HSV space corresponds to such a view of a subcube in the RGB space.
The HLS (hue, lightness, saturation) color model

• Used by Tektronix, forms the double hexagon subspace

• Hue is the angle around the vertical axis of the double hexagon, with red at 0 degrees.

• Lightness is 0 for black to 1 for white.