



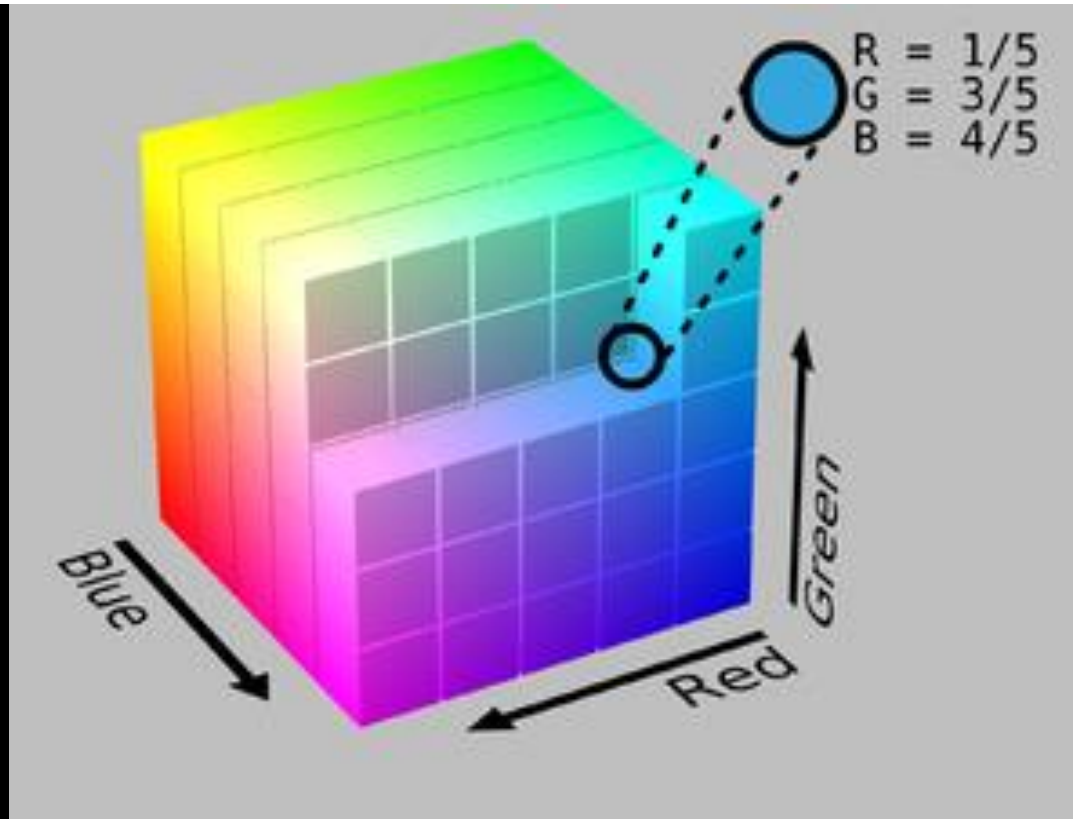
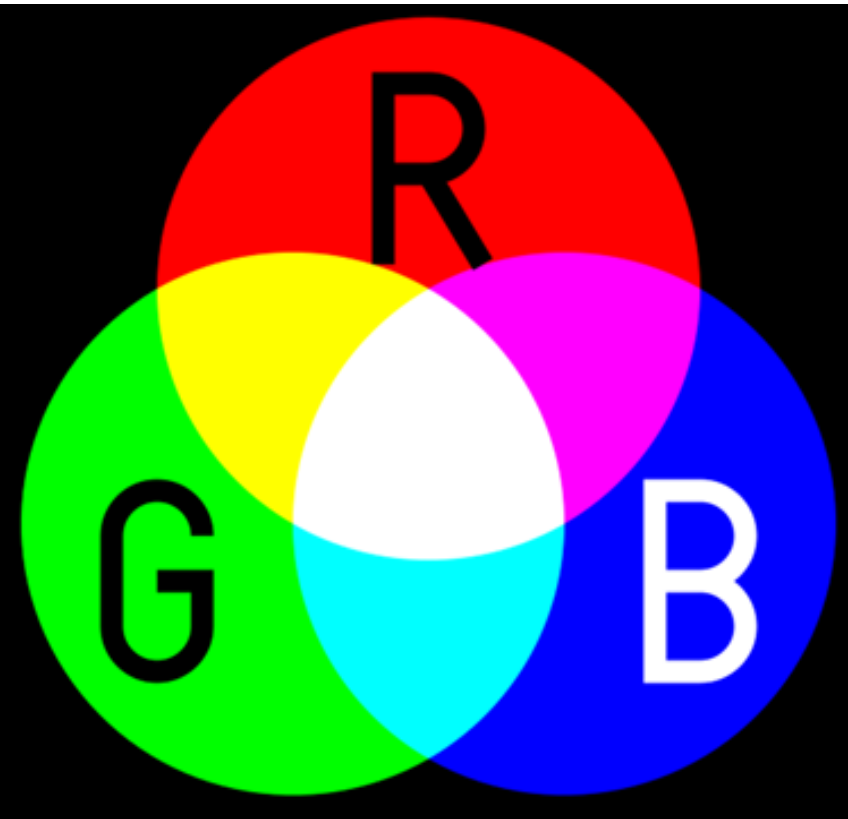
Digital Image Processing

Color Space Conversion

17-Feb-23

RGB

► RGB Color Space



YUV

- ▶ YUV is a color encoding system

$$Y = 0.299 * R + 0.587 * G + 0.114 * B$$

$$U = -0.169 * R - 0.331 * G + 0.5 * B + 128$$

$$V = 0.5 * R - 0.419 * G - 0.081 * B + 128$$

$$R = Y + 1.13983 * (V - 128)$$

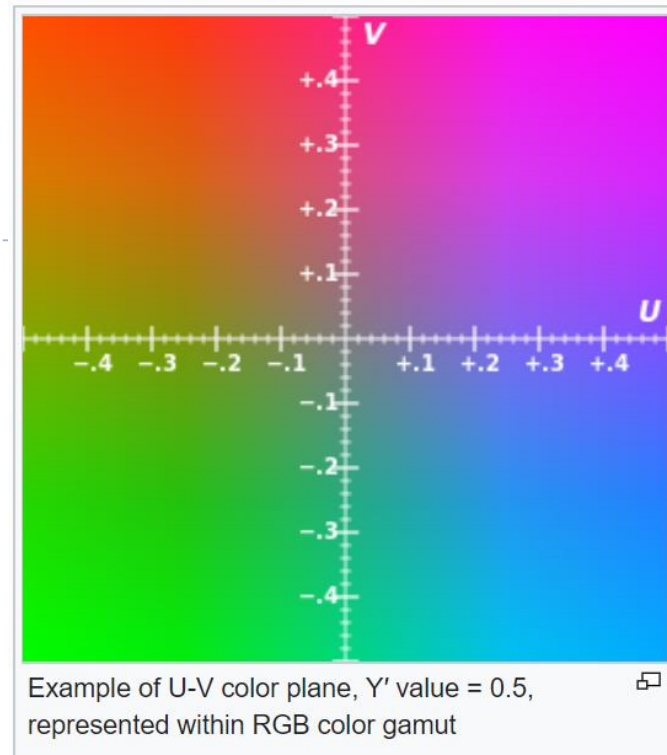
$$G = Y - 0.39465 * (U - 128) - 0.58060 * (V - 128)$$

$$B = Y + 2.03211 * (U - 128)$$

$$Y \in [0, 255]$$

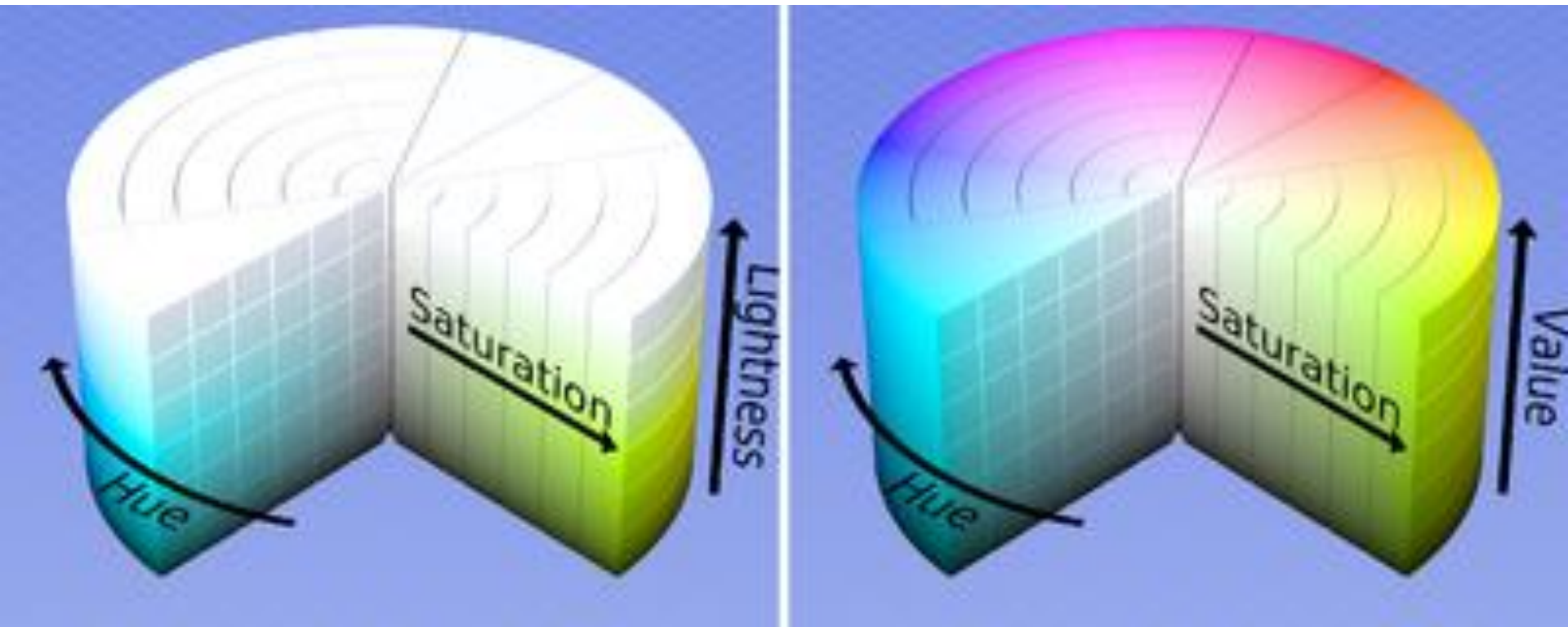
$$U \in [0, 255]$$

$$V \in [0, 255]$$



HSL & HSV

► HSL & HSV Color Space Model



HSL & HSV

$$h = \begin{cases} 0^\circ & \text{if } \mathit{max} = \mathit{min} \\ 60^\circ \times \frac{g-b}{\mathit{max}-\mathit{min}} + 0^\circ, & \text{if } \mathit{max} = r \text{ and } g \geq b \\ 60^\circ \times \frac{g-b}{\mathit{max}-\mathit{min}} + 360^\circ, & \text{if } \mathit{max} = r \text{ and } g < b \\ 60^\circ \times \frac{b-r}{\mathit{max}-\mathit{min}} + 120^\circ, & \text{if } \mathit{max} = g \\ 60^\circ \times \frac{r-g}{\mathit{max}-\mathit{min}} + 240^\circ, & \text{if } \mathit{max} = b \end{cases}$$

$$s = \begin{cases} 0 & \text{if } l = 0 \text{ or } \mathit{max} = \mathit{min} \\ \frac{\mathit{max}-\mathit{min}}{\mathit{max}+\mathit{min}} = \frac{\mathit{max}-\mathit{min}}{2l}, & \text{if } 0 < l \leq \frac{1}{2} \\ \frac{\mathit{max}-\mathit{min}}{2-(\mathit{max}+\mathit{min})} = \frac{\mathit{max}-\mathit{min}}{2-2l}, & \text{if } l > \frac{1}{2} \end{cases}$$

$$l = \frac{1}{2} (\mathit{max} + \mathit{min})$$

$$s = \begin{cases} 0, & \text{if } \mathit{max} = 0 \\ \frac{\mathit{max}-\mathit{min}}{\mathit{max}} = 1 - \frac{\mathit{min}}{\mathit{max}}, & \text{otherwise} \end{cases}$$

$$v = \mathit{max}$$

References

- ▶ <https://en.wikipedia.org/wiki/YUV>