



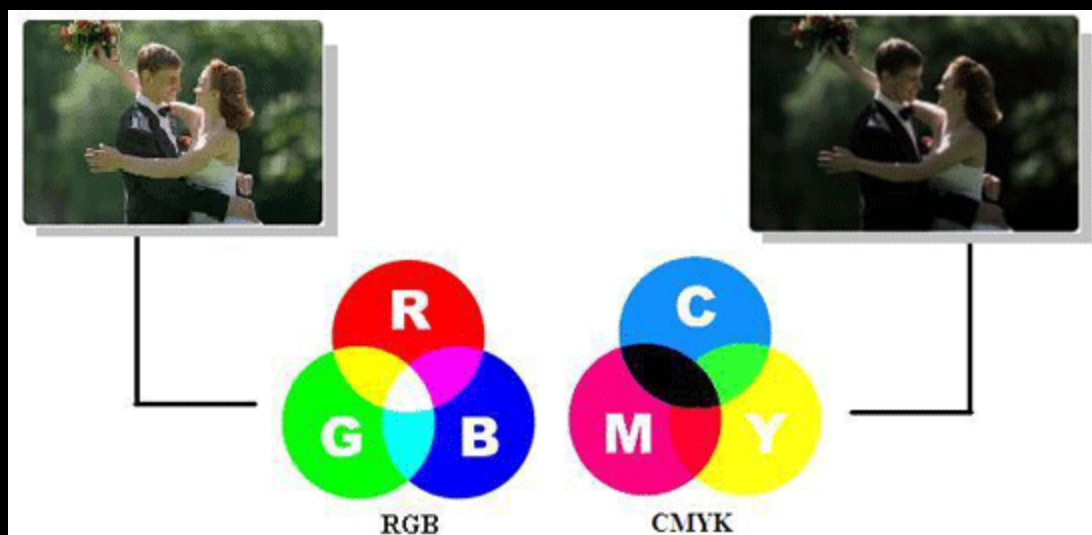
Računarska grafika

predavanja
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Konverzija modela boja

- $\text{RGB} \rightarrow \text{YUV}$
- $\text{YUV} \rightarrow \text{RGB}$
- $\text{RGB} \rightarrow \text{YIQ}$
- $\text{YIQ} \rightarrow \text{RGB}$
- $\text{RGB} \rightarrow \text{HSL}$
- $\text{RGB} \rightarrow \text{CMY}$

- $\text{CMY} \rightarrow \text{RGB}$
- $\text{CMY} \rightarrow \text{CMYK}$
- $\text{CMYK} \rightarrow \text{CMY}$



Konverzija modela boja

- RGB $\rightarrow$ YUV
- $Y = 0,299 \cdot R + 0,587 \cdot G + 0,114 \cdot B$
- $U = R - Y$
- $V = B - Y$

$$\begin{bmatrix} Y \\ U \\ V \end{bmatrix} = \begin{bmatrix} 0.299 & 0.587 & 0.114 \\ -0.147 & -0.289 & 0.436 \\ 0.615 & -0.515 & -0.100 \end{bmatrix} \cdot \begin{bmatrix} R \\ G \\ B \end{bmatrix}$$

Ranges:
R/G/B [0 ... 1]
Y [0 ... 1]
U [-0.436 ... +0.436]
V [-0.615 ... +0.615]

Konverzija modela boja

- YUV → RGB

- $R = Y + 1,14 \cdot V$

- $G = Y - 0,395 \cdot U - 0,581 \cdot V$

- $B = Y + 2,032 \cdot U$

$$\begin{bmatrix} R \\ G \\ B \end{bmatrix} = \begin{bmatrix} 1.000 & 0.000 & 1.140 \\ 1.000 & -0.395 & -0.581 \\ 1.000 & 2.032 & 0.000 \end{bmatrix} \cdot \begin{bmatrix} Y \\ U \\ V \end{bmatrix}$$

Ranges:
Y [0 ... 1]
U [-0.436 ... +0.436]
V [-0.615 ... +0.615]
R/G/B [0 ... 1]

Konverzija modela boja

- $RGB \rightarrow YIQ$
- $Y = 0,299 \cdot R + 0,587 \cdot G + 0,114 \cdot B$
- $I = V \cos 33^\circ - U \sin 33^\circ$
 $I = 0,596 \cdot R - 0,275 \cdot G - 0,321 \cdot B$
- $Q = V \sin 33^\circ - U \cos 33^\circ$
 $Q = 0,212 \cdot R - 0,523 \cdot G + 0,311 \cdot B$

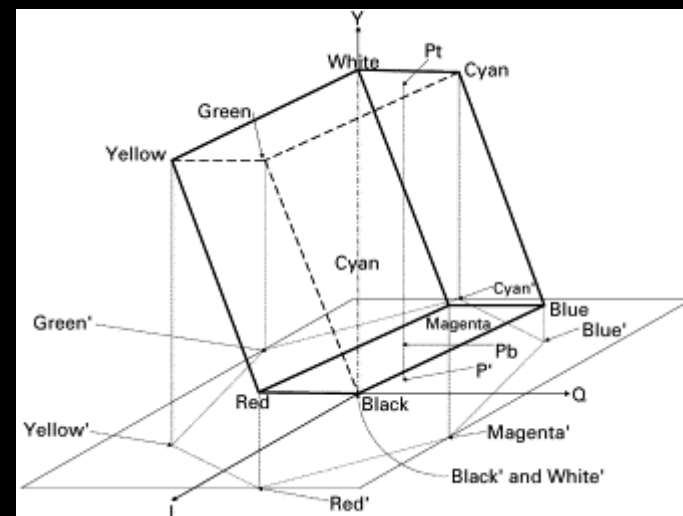
Konverzija modela boja

- $YIQ \rightarrow RGB$

- $R = Y + 0,956 \cdot I + 0,621 \cdot Q$

- $G = Y - 0,272 \cdot I - 0,647 \cdot Q$

- $B = Y - 1,107 \cdot I + 1,704 \cdot Q$



Konverzija modela boja

- RGB $\rightarrow$ HSL

- $$H = \cos^{-1} \left[\frac{(R - G) + (R - B)}{2\sqrt{(R - G)^2 + (R - B)(G - B)}} \right]$$

- $$S = 1 - \frac{3}{R + G + B} [\min(R, G, B)]$$

- $$L = 0,299 \cdot R + 0,587 \cdot G + 0,114 \cdot B$$

Konverzija modela boja

- RGB $\rightarrow$ CMY

- $C = 1 - R$

- $M = 1 - G$

- $Y = 1 - B$



- $R, G, B = 0 \dots 1$

- $C, M, Y = 0 \dots 1$

Konverzija modela boja

- RGB $\rightarrow$ CMY

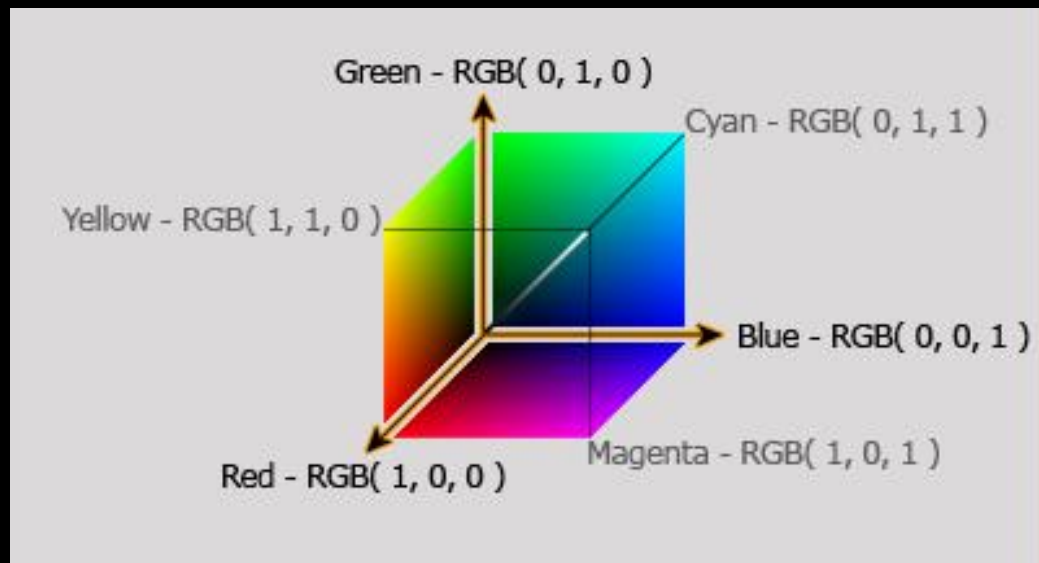
- $C = 1 - (R/255)$

- $M = 1 - (G/255)$

- $Y = 1 - (B/255)$

- $R, G, B = 0 \dots 255$

$C, M, Y = 0 \dots 1$



Konverzija modela boja

- CMY → RGB

- $R = 1 - C$

- $G = 1 - M$

- $B = 1 - Y$

- $R, G, B = 0 \dots 1$

$C, M, Y = 0 \dots 1$

Additive Color Composition

RGB Color Format

Red - RGB(1, 0, 0)

White - RGB(1, 1, 1)

Magenta - RGB(1, 0, 1)

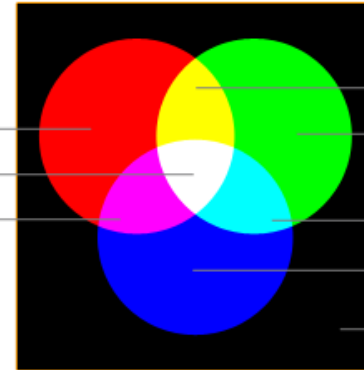
Yellow - RGB(1, 1, 0)

Green - RGB(0, 1, 0)

Cyan - RGB(0, 1, 1)

Blue - RGB(0, 0, 1)

Black - RGB(0, 0, 0)



Subtractive Color Composition

CMY(K) Color Format

Blue - CMY(1, 1, 0)

Black - CMY(1, 1, 1)

Magenta - CMY(0, 1, 0)

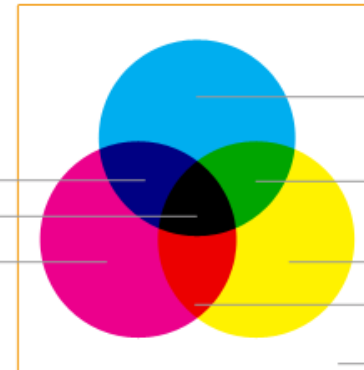
Cyan - CMY(1, 0, 0)

Green - CMY(1, 0, 1)

Yellow - CMY(0, 0, 1)

Red - CMY(0, 1, 1)

White - CMY(0, 0, 0)



Konverzija modela boja

- $CMY \rightarrow CMYK$
- $K = \min(C_{CMY}, M_{CMY}, Y_{CMY})$
- $C_{CMYK} = C_{CMY} - K$
- $M_{CMYK} = M_{CMY} - K$
- $Y_{CMYK} = Y_{CMY} - K$
- $\min(x, y, z)$ – najmanja vrijednost od x, y, z



Konverzija modela boja

- CMYK $\rightarrow$ CMY
- $C_{CMY} = C_{CMYK} \cdot (1 - K) \cdot K$
- $M_{CMY} = M_{CMYK} \cdot (1 - K) \cdot K$
- $Y_{CMY} = Y_{CMYK} \cdot (1 - K) \cdot K$



Zadaci:

1. Pretvoriti boju R:221 G:201 B:017 u YUV ako su boje date u rasponu od 0 do 255
2. Pretvoriti boju C:0,23 M:0,1 Y:1 u CMYK
3. Pretvoriti boju Y:25% I:17% Q:8% u YUV, RGB, CMY i CMYK