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Apêndice A - Outros Sistemas de Cores

O sistema RGB normalizado (Nrgb) forma um espaço relativamente robusto em relação a variações na intensidade da iluminação, sendo, portanto, especialmente interessante para aplicações de microscopia óptica. O sistema Nrgb é definido de acordo com as seguintes equações:

$$r = \frac{R}{R+G+B}; \tag{A.1}$$

$$g = \frac{G}{R+G+B}; \tag{A.2}$$

$$b = \frac{B}{R+G+B}. \tag{A.3}$$

Visto que r + g + b = 1, dadas duas componentes (r e g, por exemplo), a terceira (b) pode ser determinada por uma combinação linear. Deste modo, basta utilizar duas das três.

O sistema HSI é mais intuitivo para nós, humanos. Ele separa a informação de cor (H e S) da informação de intensidade (I), sendo assim mais adequado à segmentação devido à menor correlação entre as componentes. A componente H (matiz) denota a cor básica, isto é, o comprimento de onda dominante no espectro de luz visível. Já a componente S (saturação) representa a pureza desta cor básica, o quanto de branco está misturado ao matiz. A transformação de RGB para HSI é realizada de acordo com a seguinte formulação:

$$H = \text{arctg}\left[\frac{(G-B)\sqrt{3}}{(R-G)+(R-B)}\right]; \tag{A.4}$$

$$S = 1 - \frac{\min(R,G,B)}{I}; \tag{A.5}$$

$$I = \frac{R+G+B}{3}. \tag{A.6}$$

Os sistemas $L^*a^*b^*$ e $L^*u^*v^*$ também separam a informação de cor da informação de intensidade. De fato, L^* e I se equivalem. Estes sistemas foram definidos pela CIE (*Commission Internationale de l'Eclairage*) a partir de seu sistema XYZ, uma transformação linear do RGB, segundo as equações a seguir:

$$\begin{pmatrix} X \\ Y \\ Z \end{pmatrix} = \begin{pmatrix} 0{,}607 & 0{,}174 & 0{,}200 \\ 0{,}299 & 0{,}587 & 0{,}114 \\ 0{,}000 & 0{,}066 & 1{,}116 \end{pmatrix} \begin{pmatrix} R \\ G \\ B \end{pmatrix}; \quad \text{(A.7)}$$

$$L^* = 116\left(\sqrt[3]{\frac{Y}{Y_0}}\right) - 16 = I; \quad \text{(A.8)}$$

$$a^* = 500\left(\sqrt[3]{\frac{X}{X_0}} - \sqrt[3]{\frac{Y}{Y_0}}\right); \quad \text{(A.9)}$$

$$b^* = 200\left(\sqrt[3]{\frac{Y}{Y_0}} - \sqrt[3]{\frac{Z}{Z_0}}\right); \quad \text{(A.10)}$$

$$u^* = 13L^*\left(u' - u_0\right); \quad \text{(A.11)}$$

$$v^* = 13L^*\left(v' - v_0\right); \quad \text{(A.12)}$$

onde $X/X_0 > 0{,}01$; $Y/Y_0 > 0{,}01$; $Z/Z_0 > 0{,}01$;

$u' = 4X/(X + 15Y + 3Z)$; $v' = 6Y/(X + 15Y + 3Z)$; e

X_0, Y_0, Z_0, u_0, v_0 são os valores para o branco.