

Color transform from RGB to IHS and back

Forward transform from color channels Red, Green, Blue to channels Intensity, Hue, Saturation:

$$0 \leq R \leq 1$$

$$0 \leq G \leq 1$$

$$0 \leq B \leq 1$$

$$I = R + G + B \tag{1}$$

$$H = \begin{cases} (G - B) / (I - 3B) & \text{if } B = \min(R, G, B) \\ (B - R) / (I - 3R) + 1 & \text{if } R = \min(R, G, B) \\ (R - G) / (I - 3G) + 2 & \text{if } G = \min(R, G, B) \end{cases} \tag{2}$$

$$S = \begin{cases} (I - 3B) / I & \text{if } 0 \leq H \leq 1 \\ (I - 3R) / I & \text{if } 1 \leq H \leq 2 \\ (I - 3G) / I & \text{if } 2 \leq H \leq 3 \end{cases} \tag{3}$$

Backward transform from channels Intensity, Hue, Saturation to color channels Red, Green, Blue:

$$0 \leq I \leq 3$$

$$0 \leq H \leq 3$$

$$0 \leq S \leq 1$$

$$R = \begin{cases} I(1 + 2S - 3SH) / 3 & \text{if } 0 \leq H \leq 1 \\ I(1 - S) / 3 & \text{if } 1 \leq H \leq 2 \\ I(1 - S + 3S(H - 2)) / 3 & \text{if } 2 \leq H \leq 3 \end{cases} \tag{4}$$

$$G = \begin{cases} I(1 - S + 3SH) / 3 & \text{if } 0 \leq H \leq 1 \\ I(1 + 2S - 3S(H - 1)) / 3 & \text{if } 1 \leq H \leq 2 \\ I(1 - S) / 3 & \text{if } 2 \leq H \leq 3 \end{cases} \tag{5}$$

$$B = \begin{cases} I(1 - S) / 3 & \text{if } 0 \leq H \leq 1 \\ I(1 - S + 3S(H - 1)) / 3 & \text{if } 1 \leq H \leq 2 \\ I(1 + 2S - 3S(H - 2)) / 3 & \text{if } 2 \leq H \leq 3 \end{cases} \tag{6}$$

Sources:

- Haydn, R., Dalke, G.W. and Henkel, J.: *Application of the IHS color transform to the processing of multisensor data and image enhancement*. Proc. of the International Symposium on Remote Sensing of Arid and Semiarid Lands, Cairo, pp. 599-616, 1982.
- Göpfert, W.: *Raumbezogene Informationssysteme*. Wichmann, Karlsruhe, 1987.