

Lecture 6: Color theory

- (1) The transformation from XYZ to RGB space is given by

$$\begin{pmatrix} r \\ g \\ b \end{pmatrix} = \begin{pmatrix} x \\ y \\ z \end{pmatrix} \begin{pmatrix} 2.739 & -1.110 & 0.138 \\ -1.145 & 2.029 & -0.333 \\ -0.424 & 0.033 & 1.105 \end{pmatrix}$$

Find the inverse of this matrix to provide the transformation from RGB to XYZ CIE space. An important property of CIE space is that all colors can be expressed as positive linear combinations of X, Y, Z primaries. What property does this impose on the inverse matrix?

- (2) In addition to RGB and XYZ, another color model, the hue (H), saturation (S), and value (V) system, is also based on a warped version of the RGB cube but is a single cone rather than a double cone, as suggested in the following Figure. In this model, the hue is again mapped to angle, with the hexagon distorted into a circle, as in the HLS system, and the saturation having the same interpretation as with the HLS system. The light's intensity is captured in the value V , which varies from 0 to 1, as shown. Develop an algorithm that converts from RGB into HSV coordinates.

