Colour spaces and adding colour to grayscale images

1 RGB Colour Space

Colours represented as R,G,B intensities.

The space is modelled geometrically by a cube with axes R,G and B

RGB is used as it is based on the human perception of the visible spectrum - the human eye has R, G and B receptors with different sensitivity at different wavelengths

2 HSV colour space

H(ue)	Specifies the dominant wavelength	$0 \rightarrow 360°$
S(aturation)	High values correspond to vibrant pure colours	$0 \rightarrow 1$
V(alue)	Brightness of colour	$0 \rightarrow 1$

2.1 The geometry of the HSV space

The hue is mapped cyclically, so red corresponds to both 0 and 360, so the HSV space can be modelled by a cylinder

When we map the RGB cube onto the HSV cylinder we get a subset of this cylinder in the shape of a pyramid with hexagonal base, which in turn gives rise to the cone model

2.2 Thresholding

Thresholding produces a binary image from a grayscale image

Easier to colour threshold in HSV space than RGB

Definition: Colour slicing

A portion of the Hue colour channel (range of wavalengths) can be isolated. For better results, also use S and V in conjunctoon

Isolate objects by colour:

- Use an upper and lower threshold on the Hue channel to isolate by colour
- Use a threshold on the Saturation channel to isolate pure colours
- Combine the two outputs with logical AND

Specular highlights

- RGB: very different position in space to original colour
- HSV: similar position in Hue as specular present in Value

Shadows:

- HSV: isolated in the Saturation/Value components

3 CMY colour space