Perception and Multimedia Computing

Device-Independent Colour Spaces

Friday 2rd Nov 2017

This lab sheet explores sRGB, the device-independent colour space used in most digital displays.

1. This part of the lab demonstrates the ability to calculate the colour specification corresponding to a mixture of two other colours in the sRGB colour space.

(a) The reason why the mixture of two RGB colours is not the simple average of the two colour components is, as discussed in last week's lecture, that sRGB is not a linear colour space. To calculate the effect of mixing two sRGB colours, they need to be converted into a linear colour space (e.g. the CIE XYZ space), averaged in that space, and then the average converted back into sRGB. Implement this as follows:

- Define a class to represent sRGB colour space coordinates, and a class to represent XYZ colour space coordinates; implement suitable constructors for the sRGB class.
- Implement the conversion from sRGB to CIE XYZ, remembering that the conversion in the lecture assumes that the sRGB colour space coordinates are represented on a scale from 0 to 1 (not 0-255). Test your conversion by converting sRGB white – you should end up with XYZ values of around 1 each.
- Implement the reverse conversion, from CIE XYZ to sRGB. Check that you can round-trip colour representations (converting a set of sRGB coordinates to XYZ and back should give the same values that you started with).
- Implement averaging on XYZ colour space coordinates by simply averaging each of the components of the two colours.

If stuck, you may wish to start by reading and modifying the worked answer for part 1 of this week's lab.

(b) Using your sketch, compute the sRGB values for the mixtures of colours you did last week. Check that the values given by your sketch are fairly close to the ones you generated by trial and error. How many colour have you checked? What have you found?

2. This part of the lab plots sRGB colours on the CIE xy chromaticity diagram.

(a) Building on top of your sketches for part 2 of this lab sheet, define and implement a representation of CIE xyY colours, and a conversion from CIE XYZ to CIE xyY.

(b) Using your conversions, convert a number of sRGB colours to CIE xyY, and plot a dot of the sRGB colour at the (x, y) location corresponding to the xyY coordinates. You could plot the colours either systematically, iterating through possible red/green/blue values, or randomly (one random colour selected and plotted per frame).

Further Reading:

- Wikipedia page on sRGB at http://en.wikipedia.org/wiki/SRGB and links there- from.
- Agoston, G.A., Color Theory and its Application in Art and Design, Springer (1979)