Zürcher Hochschule
für Angewandte Wissenschaften

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Digital Image Processing
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Exercise Sheet 6

1 Color Conversion

In the following, we are looking at at 24-bit RGB color image. Assume that one pixel x has the RGB color coordinates

$$\vec{x} = \begin{pmatrix} 127 \\ 127 \\ 255 \end{pmatrix}$$

1. Which color do we perceive looking at this pixel?
2. If we convert it to grayscale by simply taking the average of all channels—which gray level do we get?
3. If we now carry out the conversion by taking a *weighted* average (ITU weights, as discussed in the lectures)—which gray level do we obtain now?
4. What is the motivation for using weighted averages?

2 Noise Propagation

Given is a *RGB*-image where each channel features Gaussian noise with standard deviation σ_0. The noise in any two of these channels is uncorrelated. If we convert this image to *HSV*, what is the standard deviation σ_V of the noise in the V-channel?

3 Color Correction

1. How would you do if an image featured a *blue* color cast on your *tablet screen*?
2. How would you account for a *red* color cast of a *printout*?

4 Color Coding

Briefly outline what color coding does and what it is good for.

Solutions

Exercise 1

1. Blue-Gray
2. ≈ 170
3. ≈ 136
4. Weighted averages are employed because the human eye features different sensitivity to red, green and blue.

Exercise 2

From your statistics lecture you know that

$$\sigma_V = \frac{1}{\sqrt{3}}\sigma_0$$

Exercise 3

1. Your tablet features *additive color mixing (RGB)*, thus one option would be to reduce blue.
2. The printout features *subtractive color mixing (CMY)*. One option is reducing both *magena* and *yellow*, the second option is increasing *cyan*.

Exercise 4

Color coding means that a grayscale image is converted to a color image by a specific algorithm or strategy. This helps to better capture and understand images, as humans can dinstinguish thousands of colors but only a limited number of gray levels.