Exercise 1: Basics (1) - First Steps

1.1 Reading, displaying and writing digital images

Exercises

1. Read a grayscale image (for example *cameraman.tif*) with Matlab (`imread()`) and save it again in the formats *GIF*, *TIF*, *PNG* and *JPEG* (`imwrite()`). How does the file size differ between these formats?
2. What is the range of the intensity values of the image? Scale the gray value image to the value range [0, 1] and display the image both as a gray value and as a binary image on the monitor (`imshow()`).
3. Read a RGB color image (for example *peppers.png*) using `imread()` and display it. What are the size and the dimensions of the image array variable?
4. Read a gray scale image with provided (pseudo-)colormap (indexed image) (for example *corn.tif*) with Matlab (`[I,Imap]= imread()`) . What are the size and the dimensions of the image array variable? Display the image with and without applying the colormap.
5. Break down a color image (for example *peppers.png*) into its three individual color components according to the RGB model.
6. Plot (`plot()`) is the default function to plot x,y-line plots. Plot a line intensity profile for a grayscale image. Draw the plot output into the image output.
7. Create an own color map and display a gray value image as a pseudo color image using this color map.

1.2 Simple image properties

Exercises

1.9 Determine the histogram (`imhist()`) for a grayscale image and represent it both as a discrete probability density function $h_g(g)$ and as a grayscale cumulative distribution function $p_g(g)$ (`cumsum()`).

1.10 Transform a grayscale image G back into another grayscale image Gt using its grayscale cumulative distribution function $p_g(g)$. How do the two images differ? (Hint: Look at the respective histograms and the solution to 1.9).

1.11 Calculate the mean value g, variance σ^2 and the extreme values g_{min} and g_{max} of the gray values $g(x, y)$ of a gray value image *as simply as possible* using Matlab.

1.12 Transform a gray scale image $G = g(x, y)$ into a binary image $B = b(x, y)$ with

$$b := \begin{array}{ll} 1 & | \quad g > \theta \\ 0 & | \quad \text{else} \end{array}$$

Use for this

1. a direct (compact) Matlab instruction and
2. a transformation by means of a look-up-table (LUT.)

1.13 Generate an image with a synthetic gray wedge (or with a grid pattern) and check the phenomenon of Mach's bands.