E5ADSB Exercises 3 – Image processing

KPL, 2018-09-05

Exercise 1

Working with grey scale images in Matlab

1. Load the image "cameraman.tif" into Matlab using the command `I=imread('cameraman.tif')`
2. What is the size and data type of `I` and how many bytes does it take up in memory? Explain.
3. Show the image using the command `imshow(I)`. You can also try the command `imtool(I)`
4. Find the minimum and the maximum pixel value in the image.
5. Convert the image from uint8 (8-bit unsigned integers) to doubles in the range [0; 1].
6. What is the result of
    a. adding a positive constant (scalar) to the image?
    b. subtracting a positive constant (scalar) from the image?
    c. multiplying the image by a positive constant greater than 1?
    d. multiplying the image by a positive constant less than 1?
7. Calculate the negative of the image. Show it in the same figure as the original using `subplot`.
8. Convert the negative image to uint8 and write it to a file using the function `imwrite`.
9. Cut out a subimage (50x50 pixels) of `I` that contains the cameraman's head. Show.
10. Shrink the original image to half its size in both directions by simply taking every other pixel in both directions. Show and write to file.

Exercise 2

Working with colour images in Matlab

1. Load the image "pepperswithsquares.bmp" into Matlab.
2. What is the size and data type of the image?
3. Subtract the Red, Green and Blue (RGB) components of the image and show them as grey scale images in a subplot similar to Figure 2.4 on page 25 in Marques. Explain.
4. Convert the original image into a grey scale image by taking the average value (mean) across the three colour layers.

Exercise 3

Image enhancement using a basic point transformation

1. Load the image "washed_out_aerial_image.tif" into Matlab.
2. Show the image.

3. Find and show the histogram om the image using `imhist`. Explain.
4. Apply the *Power Law Transformation* (sometimes called gamma correction), see Marques chapter 8.3.3, to the image. Experiment with different values of γ in the range $[1; 10]$. Which one is better?
5. Show the histogram of the enhanced image.
6. Also try values of γ in the range $[0; 1]$. Explain.