Assignment 3
2D Spatial Data, Histogram Equalization, Color Transformation
15 Points for Homework
Due Wednesday, June 3rd, 23:59 (Paderborn time)

Upload your solutions to PANDA using the upload tool entitled with "Assignment 3". Your submission has to include the source code, screenshot(s) of your solution and text input.

1. In class assignment:

(a)   Given is the 3x3 data set:

1	4	5
7	2	4
4	3	3

    (i)   Draw a histogram.
    (ii) Fill the following table as in the lecture on histogram equalization:

r	r/(L-1)	p(r)	$p_r(r)$	CDF	CDF*(L-1)
…	…	…	…	…	…

    (iii) Draw a new histogram of the histo-equalized data set.
    (iv) Write down the new data set:

?	?	?
?	?	?
?	?	?

(b)   Given are three data sets (ds_1, ds_2, ds_3), each 3x3:

0	0.5	1
0.5	0	0.5
1	0.5	0

ds_1

1	0.5	0
0.5	0	0.5
0	0.5	1

ds_2

0	0.5	0
0.5	1	0.5
0	0.5	0

ds_3

    (i)   Convert to RGB-image (ds_1 = r, ds_2 = g, ds_3 = b).
    (ii) Convert to color image (ds_1 = hue, ds_2 = saturation, ds_3 = value) and use color names to describe each element.
        Hint: Decide what hue/saturation/value you could assign to min, mid and max values.

2. Homework:

Use data sets in orion.zip provided under PANDA → Assignment 3.
Pay attention to the data set length and type (DataCharacteristics.txt in orion.zip)!
Make sure you read in the data correctly, check your results with the image AllBands.png provided under PANDA → Assignment 3 (all bands are shown with histogram equalization).
Use band 2 ("b2" → i170**b2**h0_t0.txt) for (a)-(d), and all four bands for (e).

- (a) Calculate the max value, the min value, the mean value and the variance value of this 2D data set.
- (b) Draw a profile line through the line with the maximum value of this 2D data set; you will need coordinate axes to read off values.
- (c) Display a histogram of this 2D data set (instead of bars you may use a line graph to link occurrences along the x axis)
- (d) Rescale values to range between 0 and 255 using your own transformation and display on your screen. Add a legend showing the new maximum and minimum value.
- (e) Carry out a Histogram equalization on each of the four bands and display on your screen (Note: AllBands.png shows a Histogram Equalization).
- (f) Combine the histo-equalized data set to an RGB-image (b4=r, b3=g, b1=b).

You must code (d) through (f) yourself (no libraries allowed).
Upload pictures (*.png or *.jpg) and runnable Python code (*.py) to PANDA for all items besides (a).
Submit min value, max value, mean value and variance as text input via PANDA for (a).

The points you will receive for this assignment depend upon:

- correctness of solution
- effectiveness of visual representation