

Exercises for Image Processing 1 - WiSe 2012/13

Exercise 6

1. A collection of scanned handwritten text documents has to be compressed. Each document will be stored as image. The pixels can be classified into “text” and “background”. The „text“ can be black, red, yellow green or blue. It is known that

- a text document typically has 90% background pixels,
- the colors of the “text” occur with the following probabilities:

black	80%	red	5%
yellow	1%	green	2%
blue	12%		

- a) What is the entropy of the documents?
- b) Design a Huffman code for the pixels.
- c) What is the average code word length?
- d) What is the redundancy of the following 4-bit-code:

background	0000	black	1000
red	1001	yellow	1010
green	1011	blue	1100

(4 Points)

2. Implement an grayscale image segmentation algorithm by using the following steps:

- apply the sobel operator for both x and y direction such that you get a g_x and a g_y image.
- compute a gradient magnitude image g_m by computing for every pixel $g_m = \sqrt{g_x^2 + g_y^2}$.
- find the local minima (using 4-neighborhood) in g_m .
- implement a seeded region growing algorithm, such that :
 - the already found local minima are labeled as the seeds.
 - every unlabeled pixel being neighbor of an already labeled pixel is put into a priority Queue (the pixel value of g_m is used as negative priority, i.e. the smaller the value the higher the priority).
 - the pixel with highest priority will be removed and added to the neighboring labeled region. If there are more than one region, choose any.
 - add the neighbors of this pixel to the priority queue and repeat taking pixels from the queue until it is empty.
- Return an image where every region is filled with the color of its seed pixel.
- Apply this algorithm to the image lena.png.

(6 Points)