Assignment #5

Image Compression and Morphological Operations

How TA evaluates your assignments:

Report: half of your score will be graded proportional to the quality of your report. You should provide a distinct section for each problem, include the desired outputs and explain what you've done. Don't forget to discuss your results as well. Note that in your reports, all your figures must have captions. It is not necessary to accommodate your source codes in your reports unless you want to refer to them. Compactness, expressiveness and neatness are of high importance.

Source Code: create an m-file for any problem and write all your codes there. If a problem consists of several sub-problems, separate them by comments in your code. Finally, name your m-files according to the number of the problems.

For evaluating your codes, TA creates two empty folders just beside your m-files, named as "input" and "output" (in the same directory). Then, he copies the input materials into the "input" folder and executes your m-files. Next, the output files will be checked in the "output" folder. Therefore, write your codes so as to load input files from an "input" folder and save the output files in an "output" folder. The exact name of the input and output files will be provided in the problem descriptions.

What to hand in:

You must submit your report (.pdf), source codes (m-files) and output files for each assignment. Zip all your files into an archive file and use the following template to name it:

HW5_XXXXX.zip

where XXXXX must be replaced with your student ID. Your file size must not be bigger than 20MB. If there is any question, don't hesitate to contact us through nasiri.hamid@gmail.com, s.izadi@live.com

The Due Date for This Assignment is: June 30

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1. Consider the following table as the initial dictionary for LZW algorithm:

Index	Entry
1	a
2	-
3	r
4	t

a) Output of the LFW encoder on a sequence is below. Decode the sequence.

3	1	4	6	8	4	2	1	2	5	10	6	11	13	6

b) Encode the decoded sequence using the same initial dictionary. Does your answer match the sequence given above?

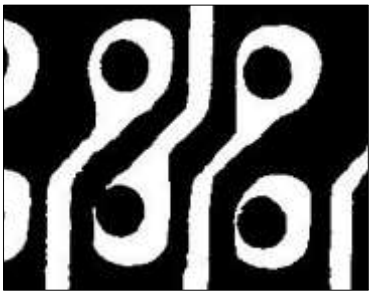
2. For an alphabet $A = \{a_1, a_2, a_3, a_4, a_5\}$ with probabilities $P(a_1) = 0.1$, $P(a_2) = 0.3$, $P(a_3) = 0.25$, $P(a_4) = 0.35$.

a) Calculate the entropy of this source.

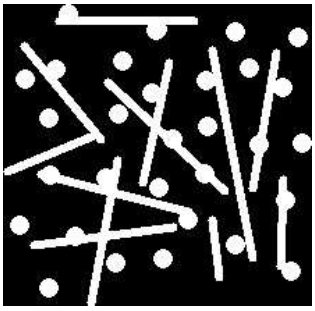
b) Find a Huffman code for this source.

c) Find the average length of the code in (b) and its redundancy.

3. In inspection of electronic circuit cards there is a need to inspect the number of holes and the diameter of the holes, see figure below. We want to measure the number of holes and the diameter using morphology. Use the morphology operators in Matlab to solve the exercise. Verify your implementation on the image 'pcb.jpg'.



4. In this problem you will be separating out various objects from the images using the opening function. For the given image circle_and_lines.jpg, use the opening technique with the appropriate structuring element.



a) Your mission is to separate the circles from the lines. Save your image as 'circle.png' and 'line.png'. The 'circle.png' image should contain only circles, and the 'line.png' image should contain only lines. Explain the structural element you have used. If you have experimented with other structural elements, describe your results and observations. What are the drawbacks or limitations of this method? Compare with the previous methods you have implemented. Apply opening to the same image with the same structural element of different sizes. How the sizes of the structuring elements affect the results.

b) Develop an algorithm; using the appropriate morphological filters, to count how many circles and how many lines are there in 'Circle_and_lines.png' (via 'circles.png'. and 'lines.png'). Label each item in the picture with a distinct integer. Discuss your algorithm briefly, and document your code (label_and_count.m) and your results in the report.

5. In real world applications closing can be used to enhance binary images of objects obtained from thresholding. In this problem you will use the concept of closing to compute the skeleton of the following images.

falcon.jpg

girl.jpg

hotballoon.jpg

dog.jpg

a) Describe your method of computing the skeleton of the images. What kind of structural elements will you be using? What happens when you change the size of the structuring element?

b) Compute the location and center of mass of the shapes for the four pictures. Discuss your algorithm and document your code in the write-up.

c) Compute the location and center of mass of the shapes for the four pictures. Discuss your algorithm and document your code in the write-up.

Good Luck,

Hamid Nasiri

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