TÉCNICO LISBOA

Learning-based Multimedia Processing

2022/2023

IST number: _____

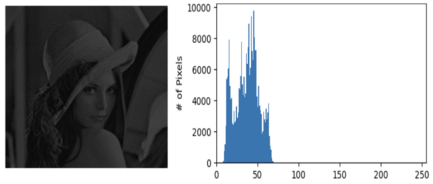
Name: _____

Quiz #3 **Duration: 20 minutes**

Provide clear, legible, and succinct answers.
Always justify your assumptions.

Questions

1. Consider the following image and its histogram. Suggest a pointwise intensity transformation operation that could be used to enhance the image quality.
Discuss the merit of your proposal vs. using histogram equalization.



2. Consider the technique known as *Inverse Filtering*.
a) In what does this technique consist of and for what purpose is it used?
b) What needs to be known for this technique to be applicable, and what are its main limitations?

3. Consider an image of size 100x100 pixels, with the possible pixel values of: {0, 1, 2, 3}. The image histogram (r_k) is as specified in the table below.

a) Compute the new histogram after performing histogram equalization of the image ($s_k = T(r_k)$) and the values conversion table ($s_k(r_k)$).

b) Was a uniform distribution obtained? Why?

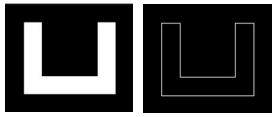
r_k	n_k
0	1000
1	500
2	5000
3	3500

r_k	s_k
0	
1	
2	
3	

s_k	n_k
0	
1	
2	
3	

4. What is the minimum number of monochromatic light sources needed to produce white light? Justify your answer.

5. The image on the left (A) was processed, with the help of morphological operations using a 3x3 square structural element (S), to get the result on the right (B). Identify, justifying your option, the applied operations:



a) $B = (A \ominus S) \cap A^C$

b) $B = (A \oplus S)^C \cup A$

c) $B = (A \ominus S)^C \cap A$

1 –

Apply contrast stretching – find the min and max intensity values of the image (min~=5 and max~= 75) and apply the formula: newImg = (img - min)/(max – min)*255

Contrast stretching keeps the relative distribution of amplitudes of the original image, while histogram equalization tries to produce an histogram with uniform distribution, and thus the image may look less ‘natural’

2 –

a) Frequency based technique for handling image degradation, and recovering the “original” by applying a filter that compensates the observed degradation.

b) assumes a known degradation model; does not work well in the presence of noise

3 –

a)

r_k	n_k
0	1000
1	500
2	5000
3	3500

r_k	s_k
0	0
1	0
2	2
3	3

s_k	n_k
0	1500
1	0
2	5000
3	3500

;

b) no – with discrete images it may not be possible to obtain a uniform histogram;

4 –

2 complimentary colours.

5 -

c) produces the desired result