

Fourth Year Mechatronics Department
CSE496-Elective Course (2): Digital Image Processing
Mid Term Exam
Time Allowed 90 minutes.
Spring 2015



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Faculty of Engineering

Student Name:	Student ID:
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Exam Consists of 5 Questions in 6 Pages. **Students are not allowed to use any ready-made MATLAB functions related to image filtering or histogram operations.** Assume any Missing Information. Each Question is Weighted by 20 MARKs.

1- Supply the missing words:-

- a) Image processing is used to improve image quality for and
- b) Computer vision defined as a discipline in which.....
- c) The three types of computerized process are 1)....., 2)....., and 3).....
- d) Digitization means.....
- e) Optical power is , with f measured in meters. The unit is called the
- f) The human eye brings nearby points into focus on the retina by.....
- g) If the intensity values of an image ranges from 0 to 2×10^7 , then atransformation is recommended.
- h) Setting thesignificant bit to zero does not affect much the appearance of the image.
- i) Sharpening the images is commonly accomplished by performing a spatial.....of the image field.
- j) Histogram equalization.....dark images.
- k) Thefilter is used to remove the salt and pepper noise.
- l) Edges are detected by.....

EXTRA SPACE

2- Assume the histogram of the opposite image is modeled/approximated by the Gaussian function $p_r(r) = \frac{1}{\sigma\sqrt{2\pi}} \exp(-\frac{(r-\mu)^2}{2\sigma^2})$ where μ and σ are the mean and standard deviation of that image, and $r \in \{I_{min}, \dots, I_{max}\}$. Answer the following questions:-

1	2	3	4	5	6	7	8	8	8
9	1	2	3	4	5	6	7	8	8
8	9	1	2	3	4	5	6	7	8
7	8	9	1	2	3	4	5	6	7
6	7	8	9	1	2	3	4	5	6
5	6	7	8	9	1	2	3	4	5
4	5	6	7	8	9	1	2	3	4
3	4	5	6	7	8	9	1	2	3
3	3	4	5	6	7	8	9	1	2
3	3	3	4	5	6	7	8	9	1

a) Find and Plot $p_r(r)$ assuming $r \in \{1,2,3,4,5,6,7,8,9\}$. Note that the function must satisfy the PMF conditions.

Solution

- b) Adjust the image intensities such that its new histogram matches the PMF/PDF: $p_z(z) = Ae^{-z}$. You must consider the Gaussian distribution given in (a) as the original image histogram. Find the r - z map as well as the value of the parameter A.

Solution

3- Write a MATLAB function that reads an input image and a mask size $n \times n$. The function carries out a median filter on the given image. Express the time taken by that function in terms of the parameter n . Important: You are not allowed to use the `sort()` MATLAB function.

Solution

- 4- A) Write a MATLAB function that applies a mask of size $n \times n$ on an input image. B) Use the function in (A) to write another function to find the edge map of an image using the Compass operator.

Solution

5- Using the backward difference approximation, derive a 3D mask for the Un-sharp Masking process. Note that the input of this process is a 3D image.

Solution