Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – I • EXAMINATION – WINTER • 2013

Subject code: 714104N **Date: 06-01-2014**

Subject Name: Digital Image Processing and Applications

Time: 10.30 am – 01.00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q:1 Answer the following (Any three) 14

1. Define: 4-connectivity, 8-connectivity and m-connectivity 03

2. Explain Rayleigh noise. Also mention its mean and variance with respect to the gray level of an image. 03

3. What is the advantage of homomorphic filtering? Explain with the help of suitable derivations. 02

4. Draw and explain the gray level transformation function that highlights portion of the image between gray levels L1 and L2 preserving the original information of the image. 03

5. Show that an edge spatial filter is equivalent to subtracting the original image from its smoothed image. 03

Q:2 (a) Suppose **"m"** be the gray-level of the input image, which has to be transformed to output image gray level **"l"** by histogram equalization technique. For an 8-level image of size 64 X 64, we have the following frequency table for the input gray levels. 07

m	0	1	2	3	4	5	6	7
Frequency of m	123	78	281	417	639	1054	816	688

Obtain the resultant gray level **"l"** using histogram equalization technique. Also plot the equalized histogram of the output image.

Q:2 (b) Apply median operator on image shown in following fig 1. Conclude about the results. 07

1	1	7	7	7	8	8	8
6	6	6	5	5	5	1	8
6	6	6	5	5	1	8	8
8	7	7	5	1	8	8	8
8	8	8	5	5	8	8	8
8	8	8	5	1	7	1	8
8	8	8	5	5	7	1	8
8	8	8	5	5	7	1	8

Fig 1 : Image Segment of 8 X 8

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Q:2 (b) Consider the following fig. 2, where each small rectangle represents a pixel and the value inside it is gray level at that pixel. Hence the whole array represents a digital image g(r,c) of size 5 X 5. 07

0	1	0	6	7
2	0	1	6	5
1	1	7	5	6
1	0	6	6	5
2	5	6	7	6

Fig. 2:image segment g(r,c) of 5 X 5

Generate the resultant filtered image by applying a filter mask of 3X3
Of (i) median operator, (ii) max operator

Q:3 (a) List down different types of noises which can be found in an image. How can we estimate mean and the variance of a noisy image? Explain adaptive MMSE filter to remove the noise from the image. 07

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Q:3 (a) Explain the Wiener Filtering for image Restoration and discuss the problems associated with it. Also discuss the remedy available in the form of Constrained Least Square Filtering Technique. 07

Q:3 (b) Apply the high pass mask(Laplacian operator) on the image shown in Fig 3**.** Conclude about the result. 07

20	**20**	**20**	**20**	**20**
20	**30**	**30**	**20**	**30**
20	**30**	**30**	**20**	**30**
20	**30**	**30**	**20**	**30**
20	**20**	**20**	**20**	**30**

Fig 3 : image segment of 5 X 5

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Q:3 (b) X is the image given on the set of black pixels, below. Perform the operation $(X \circ B) \bullet B) \circ B)$ with structuring element B as shown below (Fig 4). Illustrate the resultant image. 07

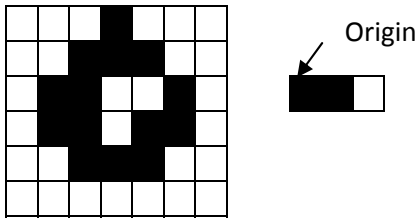
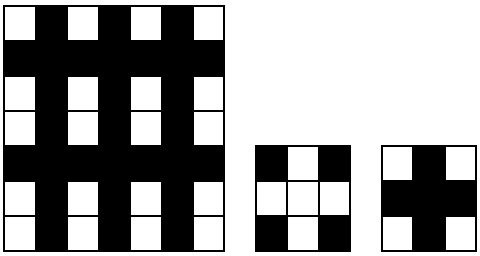


Fig 4: Image segment of 6 x 7

Q:4 (a) The input image and structuring elements are shown in Fig 5, find the hit or miss transformation for the input image. 07



(a) (b) (c)

Fig 5 (a) input image, (b)structuring element *B*, (c) structuring element *W-B*

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Q:4 (a) What is thresholding? Explain the global thresholding technique suggested by Otsu with suitable equations. 07

Q:4 (b) Segment the image shown in fig. 6 below, using the split-and-merge procedure. Also show the quadtree corresponding to the segmentation. 07

0	0	0	0	0	0	0
0	0	1	1	1	0	0
0	0	1	0	0	0	0
0	0	1	1	1	0	0
0	0	1	0	0	0	0
0	0	1	1	1	0	0
0	0	0	0	0	0	0

Fig 6: Image segment of 7X 7

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Q:4 (b) Apply the prewitt masks of the size 3 x 3 on the image shown in fig. 7 below. Conclude about the result. 07

3	3	8	3	3
3	8	6	8	3
8	5	5	5	8
3	8	6	8	3
3	3	8	3	3

Fig. 7: image segment of 5 X 5

Q:5 (a) Explain the Hough Transform Technique in detail with suitable example. 07

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Q:5 (a) What are the three stages of the canny edge detector? Briefly explain each phase. 07

Q:5 (b) Explain any one feature extraction technique for the face recognition system. 07

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Q:5 (b) List out the various applications of Digital Image Processing. Explain any one application in detail. 07

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