VIT UNIVERSITY
(Estd. u/s 3 of UGC Act 1956)

Term End Examination - November 2013

Course : ECE404 - Digital Image Processing **Slot: C1**

Class NBR : 1461

Time : Three Hours **Max.Marks:100**

Answer ALL Questions

1. a) Explain - photopic or bright-light vision. **[2]**

   b) Explain the following terms based on human eye ability in viewing the image. **[4]**

   i) Brightness adaptation

   ii) Simultaneous contrast

2. Consider two intensity values I_1=2 and I_2=240, the corresponding ΔI_1=0.01 and ΔI_2=4. Calculate the respective weber ratio and what do you infer from those ratios? **[4]**

3.(a) Compute 2D-DFT for the 4 X 4 gray scale image f(m,n) shown below **[10]**

$$f(m,n) = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \\ 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \end{bmatrix}$$ Also find IDFT of the obtained coefficients .

OR

3.(b) Compute the Harr Transform $T= HFH^T$ of the 2×2 image **[10]**

$f(m,n) = \begin{bmatrix} 3 & -1 \\ 6 & 2 \end{bmatrix}$ Compute also the inverse Harr Transform $F = H^TTH$ of the obtained result.

4. Prove that DFT diagnolises the circulant matrix. **[6]**

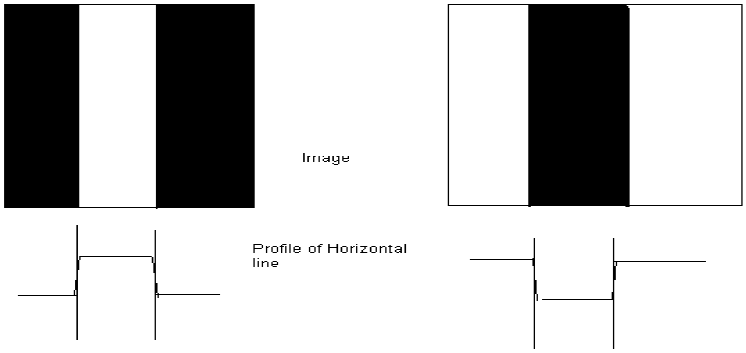
5. The compass gradient operators of size 3 x 3 are designed to measure gradients of edges oriented in eight direction: E, NE, N,NE,W,SW,S,SE. Give the form of these eight operators using coefficients valued 0,-1, or 1. Specify the gradient direction of each mask, keeping in mind that the gradient direction is orthogonal to the edge direction. **[6]**

6. A 4 × 4 image is given by **[8]**

$$f(m,n)=\begin{bmatrix}3 & 2 & 1 & 4\\ 5 & 2 & 6 & 3\\ 7 & 9 & 1 & 4\\ 2 & 4 & 6 & 8\end{bmatrix}$$

Filter this image using a median filter with the mask (3 x 3) assume, replicate padding.

7. a) Sketch for the given edge model, the gradient and Laplacian of each profile. **[4]**



b) Perform the image enhancement using second derivative Laplacian mask on the given image. **[6]**

1	2	2
4	3	1
1	0	2

8. A blur filter is given by h (m,n) = $\begin{bmatrix}0 & 0.05 & 0.05 & 0\\ 0.15 & 0.1 & 0.1 & 0.15\\ 0 & 0.1 & 0.1 & 0\\ 0 & 0.1 & 0.1 & 0\end{bmatrix}$. Find the deblur filter using **[10]**

Wiener filter approach with $\sigma_x^2 = 200$ and $\sigma_w^2 = 100$.

9. a) Gray level histogram of image is given below. **[10]**

Gray level	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Frequency	**400**	**700**	**1350**	**2500**	**3000**	**1500**	**550**	**0**

Compute the gray level histogram of the output image obtained by enhancing the input by the histogram equalization technique.

b) Give an example where histogram equalization technique, compress the discrete gray level range of the image.

10.(a) Consider an 8 x 8 image as shown in Fig. Gray levels in the image are ranging from 0 to 7. Perform image segmentation using region growing technique. **[10]**

5	**6**	**6**	**6**	**7**	**7**	**6**	**6**
6	**7**	**6**	**7**	**5**	**5**	**4**	**7**
6	**6**	**4**	**4**	**3**	**2**	**5**	**6**
5	**4**	**5**	**4**	**2**	**3**	**4**	**6**
1	**3**	**2**	**3**	**3**	**2**	**4**	**7**
0	**0**	**1**	**0**	**2**	**2**	**5**	**6**
1	**1**	**0**	**1**	**0**	**3**	**4**	**4**
1	**0**	**1**	**0**	**2**	**3**	**5**	**6**

OR

10.(b) The speed of a bullet in flight is to be estimated by using high speed imaging techniques. The method of choice involves the use of TV camera and flash that exposes the scene for K second. The bullet is 2.5 cm long, 1cm wide, and its range of speed is 750 ± 250 m/s. The camera optics produce an image in which the bullet occupies 10% of the horizontal resolution of a 256 x 256 digital image. **[10]**

i) Determine the max. value of K that will guarantee that the blur from motion does not exceed 1 pixel.

ii) Determine the min. number of frames per second that would have to be taken inorder to guarantee that at least two complete images of the bullet are obtained during its path through for FOV of the camera.

iii) Propose a segmentation procedure for automatically segment the bullet from the sequence of frames.

11. How to perform image reconstruction using radon transform? **[10]**

12. Distinguish Wavelet transform and short time Fourier Transform for time frequency representation of signals. **[10]**

Draw 2-D Multiwavelet decomposition of an image.

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