Paper / Subject Code: 37816 / Digital Image Processing and Machine Vision (DLOC - II)

TE (ELEX) DIP& MV Gem VI R/13 clscheme 26.05.2015

Duration: 3hrs Max Marks: 80

N.B.: (1) Question No 1 is Compulsory.

- (2) Attempt any three questions out of the remaining five.
- (3) All questions carry equal marks.
- (4) Assume suitable data, if required and state it clearly.



[20]

- 1 Attempt any FOUR
 - a Define and differentiate between two-dimensional sampling and quantization.
 How do they affect image quality?
 - b Describe a practical application of image subtraction in medical imaging.
 - c Describe the role of redundancy in image compression and explain how image compression techniques utilize redundancy to reduce file size.
 - d What factors should be considered when choosing a feature extraction method for a machine vision application?
 - e Explain the role of the structuring element in both dilation and erosion. How does its shape and size influence the outcome of these operations?
- 2 a Describe the split-and-merge approach for image segmentation. Provide an example where an image is recursively split into smaller regions and then merged based on homogeneity.
 - b Given the following 4×4 image matrix.

[10]

	2	3	5	7		
1	4	6	8	10		
S	1	20	4	8		
1	5	~7	9	12		

Apply 2D DFT to the above image using separability property.

3 a Consider the following 5x5 grayscale image.

[10]

The Personnel of the Personnel	17	24	I	8	15
-	23	5	ी	14	16
	4	6	13	20	22
	10	12	19	21	3
	11	18	25	2	9

- 1. Apply 3x3 averaging (mean) filter to the image matrix and generate new image matrix.
- 2. Describe the effect of this filter on the image appearance.
- b Given the following sequence of 8-pixel values from an 8-bit grayscale image: [10] [100, 120, 130, 140, 150, 160, 170, 180]. Outline the process of generating their IGS codes when quantizing to 4 bits per pixel. Show the intermediate steps for all pixels.

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- 4 a How does Huffman coding achieve optimal lossless compression for a given set of symbol probabilities? Construct the Huffman code for the symbol set {A:0.4, B:0.3, C:0.2, D:0.1}.
 - b Suppose you have a binary image representing a handwritten numeral '1' that is several pixels wide. Describe how the thinning operation would process this image. What is the resulting image, and why is thinning useful for character recognition?
- 5 a What is an active vision system, and how does it differ from a passive vision system? Give an example where an active vision system would be preferred over a passive system. How can active vision systems improve depth perception or handle occlusions in a scene?
 - b Describe the steps in histogram equalization. Using the histogram data below, calculate the cumulative distribution function (CDF) and use it to find the new intensity levels after equalization. Illustrate the original and equalized histograms.

Intensity Level rk	0	1	2	3	4	5	6	7
Number of Pixels nk	55	45	20	25	50	60	70	75

- 6 a How can machine vision algorithms be trained or calibrated to handle variations in paint color and glossiness when grading slates for quality?
 - b Given a 4-bit image, consider the intensity transformation function s = 15 r, where r is the original intensity. [10]
 - a. What type of transformation is this?
 - b. Draw the transformation curve.
 - c. Apply this transformation to the intensity levels r (0 to 15).
 - d. Explain the visual effect this transformation would have on an image.


