1T01036 - T.E.(Electronics and Telecommunication )(SEM-VI)(Choice Base Credit Grading System ) (R-20-21) (C Scheme) / 89343 - Image Processing and Machine Vision

QP CODE: 10012285                                              DATE: 13/12/2022.

**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.**

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|---|---|---|
| **1** | Attempt **any FOUR.** | **[20]** |
| a | Specify formulas for computing Euclidian distance, City-block distance and Chess-board distance in digital images. Draw the locus of each them. | |
| b | Justify/contradict: Salt-pepper noise in a digital image can be better removed by a median filter rather than an averaging filter. | |
| c | State what is the cause of the 'Ringing effect' when a digital image is filtered in frequency domain. How can the effect be minimized? | |
| d | Explain with a diagram what are support vectors in a SVM.  Do they affect the classification process? If yes, how? | |
| e | Illustrate with an example what is grey level co-occurrence matrix in texture analysis. | |
| **2** a | Given a grey scale image as follows: | **[10]** |

| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| 2 | 1 | 2 | 1 | 7 | 4 | 1 | 2 |
| 1 | 1 | 0 | 1 | 5 | 4 | 0 | 1 |
| 1 | 1 | 6 | 6 | 6 | 5 | 1 | 0 |
| 1 | 1 | 5 | 4 | 6 | 7 | 1 | 0 |
| 1 | 1 | 3 | 2 | 2 | 2 | 0 | 0 |
| 1 | 1 | 2 | 1 | 1 | 1 | 0 | 0 |

    i.      Draw Histogram of the image.
    ii.    Perform histogram equalization on the image.
    iii.   Draw transformation function.
    iv.   Draw output image histogram.

    b    Describe the Canny Edge Detection method step-by-step. Support your answer with **[10]**
appropriate diagrams.

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**3**  a  For the 2x2 transform matrix  **[10]**

$$A = \frac{1}{\sqrt{2}}\begin{bmatrix} \sqrt{3} & 1 \\ -1 & \sqrt{3} \end{bmatrix}$$ and a sub-image $U = \begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix}$ compute the image transform and the basis images.

  b  Write an expression for a two-dimensional DCT. Form a 4x4 DCT matrix and compute  **[10]**
     the DCT of the following sub-image.

$$I = \begin{bmatrix} 1 & 2 & 2 & 1 \\ 2 & 1 & 2 & 1 \\ 1 & 2 & 2 & 1 \\ 2 & 1 & 2 & 1 \end{bmatrix}$$

**4**  a  Explain the Hit-and-Miss transform in Morphology. Explain how morphology can be used  **[10]**
     for boundary detection.

  b  Differentiate between shape and region descriptors. State their examples. Explain  **[10]**
     signatures in detail.

**5**  a  For the given image, perform region based segmentation by split and merge technique.  **[10]**
     Illustrate the splitting technique with a quad tree graph. Use the Predicate P>=10 for
     splitting and merging.

| 13 | 12 | 13 | 12 | 11 | 12 | 11 | 12 |
|----|----|----|----|----|----|----|----|
| 13 | 13 | 63 | 63 | 61 | 11 | 12 | 11 |
| 11 | 12 | 63 | 62 | 61 | 62 | 12 | 12 |
| 13 | 13 | 62 | 63 | 62 | 61 | 13 | 13 |
| 12 | 11 | 62 | 63 | 62 | 11 | 12 | 11 |
| 62 | 62 | 63 | 61 | 61 | 62 | 13 | 13 |
| 62 | 61 | 61 | 62 | 13 | 12 | 13 | 11 |
| 61 | 62 | 63 | 11 | 12 | 11 | 12 | 12 |

  b  Explain smoothening and sharpening filters in frequency domain.  **[10]**

**6**  a  Explain the need of good classifiers in object recognition. List different classifiers.  **[10]**
     Explain the Bayesian classifier in detail.
  b  Explain the K-means clustering algorithm with a suitable example.  **[10]**

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