Code No: RR410507 **Set No. 1**

IV B.Tech I Semester Regular Examinations, November 2005
DIGITAL SPEECH & IMAGE PROCESSING
SPEECH & IMAGE PROCESSING
(Common to Computer Science & Engineering, Information Technology and Electronics & Computer Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Derive expressions for image plane co-ordinates, assuming that camera and world co-ordinate systems are not coincident. [16]
2. Give a note about the techniques followed in grey-level transformations. [16]
3. Discuss the limiting effect of repeatedly applying a 3x3 low pass filter to a digital image. Ignore the border effects. [16]
4. Explain various discontinuity detection methods in detail with suitable examples. [16]
5. Discuss about the following edge detection techniques
   (a) Laplacean
   (b) Laplacean of Gaussian (LOG) and
   (c) Zero crossing. [5+6+5]
6. (a) What is granulometry? Explain the different morphological operations used in granulometry?
   (b) A gray scale image, f(x,y), is corrupted by overlapping noise spikes that can be modeled as small, cylindrical artifacts of radii $R_{min} \leq r \leq R_{\max}$ and amplitude $A_{\min} \leq a \leq A_{\max}$ Develop a morphological filtering approach for cleaning up the image. [8+8]
7. (a) With a neat block diagram, describe the image compression system model
   (b) What do you mean by mapper in source encoder?
   (c) Compare the statistical Compression and spatial Compression. [6+4+6]
8. How statistical coding is differentiated from spatial coding? Give one example for both the coding. Explain. [16]

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Time: 3 hours **Max Marks: 80**

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1. What are the elements required to acquire digital images? Explain in detail about various imaging systems. [16]

2. Two images f(x,y) and g(x,y) have histograms hf and hg.Give the condition under which you can determine the histogram of

   (a) f(x,y) + g(x,y)

   (b) f(x,y) - g(x,y)

   (c) f(x,y) * g(x,y)

   (d) f(x,y) ÷ g(x,y)

   interms of hf and hg. Explain how to obtain histogram in each case. [4+4+4+4]

3. (a) What is the expression for performing convolution of images. Explain the terms involved in it.

   (b) If the template T is defined as

$$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

   and the image I is defined as

$$\begin{bmatrix} 1 & 1 & 3 & 3 \\ 1 & 1 & 4 & 4 \\ 2 & 1 & 3 & 3 \\ 1 & 1 & 1 & 4 \end{bmatrix}$$

   find the resulting convolved image T * I. [6+10]

4. Write short notes on the following:

   (a) Global thresholding

   (b) Adaptive thresholding. [8+8]

5. A sample image of 5× 5 is shown below.

$$\begin{bmatrix} 3 & 2 & 3 & 4 & 1 \\ 0 & 2 & 4 & 3 & 7 \\ 3 & 4 & 2 & 1 & 0 \\ 4 & 1 & 3 & 3 & 7 \\ 5 & 4 & 5 & 4 & 6 \end{bmatrix}$$

Apply the Sobel's diagonal operators in both the directions and show the turncated output image of size 3×3. [8+8]

6. (a) What is granulometry? Explain the different morphological operations used in granulometry?

   (b) A gray scale image, f(x,y), is corrupted by overlapping noise spikes that can be modeled as small, cylindrical artifacts of radii $R_{min} \leq r \leq R_{\max}$ and amplitude $A_{\min} \leq$ a $\leq$ $A_{\max}$ Develop a morphological filtering approach for cleaning up the image. [8+8]

7. (a) Describe about Transform coding.

   (b) Write notes on optimal quantization. [8+8]

8. (a) Write about the Huffman coding.

   (b) What do you mean by error free compression.

   (c) Explain about near optimal variable length coding. [8+4+4]

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Code No: RR410507 **Set No. 3**

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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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1. (a) Write a short note on image model.
   (b) Explain in detail about different types of CCD sensors used for image acquisition. [6+10]

2. (a) Prove or disprove that the histogram equalization is an invertible function.
   (b) What would be the effect on the histogram if we set to zero the higher order bits. [10+6]

3. (a) Explain the characteristics of the following smoothing filters.
      i. Thresholding
      ii. averaging filters
      iii. median filters.
   (b) Discuss their relative advantages and disadvantages. [8+8]

4. Write short notes on the following:
   (a) Optimal thresholding
   (b) Role of Illumination in thresholding. [8+8]

5. A sample image of 5× 5 is shown below.

$$\begin{bmatrix} 3 & 2 & 3 & 4 & 1 \\ 0 & 2 & 4 & 3 & 7 \\ 3 & 4 & 2 & 1 & 0 \\ 4 & 1 & 3 & 3 & 7 \\ 5 & 4 & 5 & 4 & 6 \end{bmatrix}$$

   Apply the Sobel's diagonal operators in both the directions and show the turncated output image of size 3×3. [8+8]

6. Explain how the following morphological operations can be extended to gray scale images
   (a) erosion
   (b) opening. [10+6]

7. (a) What do you mean by compression? Briefly explain its requirement.

(b) Differentiate lossy compression and lossless compression. Mention their applications.

(c) What do you mean by improved Gray Scale Quantization?

(d) Explain the fidelity criteria in image compression. [3+5+4+4]

8. (a) Explain about

   i. slope overload

   ii. granular noise.

   (b) List out the advandages and drawbacks of different types of lossy compression techniques. [8+8]

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Code No: RR410507 **Set No. 4**

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Answer any FIVE Questions
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1. With a brief note on satellite imagery technique, explain in detail about various methods of acquiring images from satellite. [16]

2. (a) What are the transformation functions and properties of the following gray level transformations:
   i. Contrast strctching
   ii. thresholding
   iii. log transformations
   iv. power law transformations. [4+4+4+4]

3. (a) Explain how the directional smoothing is performed.
   (b) Explain the steps involved in median filtering. [8+8]

4. (a) Enumerate the basic formulation of the region-based segmentation.
   (b) Explain the concept of region growing procedure with suitable example. [6+10]

5. Distinguish first-order derivative and second -order derivative of a 2-D function. Give the example operators for each of the derivatives. [16]

6. (a) Explain with an example the boundary extraction using morphology operations.
   (b) Write short notes on opening and closing. [8+8]

7. (a) Define
   i. Compression ratio
   ii. Relative data redundancy
   iii. Mappings
   iv. Quantization in Psychovisual redundancy.
   (b) How the interpixel redundancy is differentiated from the coding redundancy and psychovisual redundancy? [8+8]

8. (a) Explain about
   i. slope overload
   ii. granular noise.

(b) List out the advandages and drawbacks of different types of lossy compression techniques. [8+8]

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