Code No: RR411103 **Set No.1**

IV B.Tech. I Semester Regular Examinations, November -2005
IMAGE PROCESSING AND PATTERN RECOGNITION
(Bio-Medical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain one of the bio-medical applications of pattern recognition system in detail.
   (b) Classify the pattern x=(4,3) into any one of the three classes characterized by the following decision function. $d_{12}(x) = -x_1 - x_2 + 5$, $d_{13}(x) = -x_1 + 3$, $d_{23}(x) = -x_1 + -x_2$ [6+10]

2. (a) Write a short note on cluster analysis.
   (b) Explain a cluster-seeking algorithm in detail. [8+8]

3. Apply the perceptron algorithm to find the solution vector for the following pattern classes: ω_1: $\{(0,0)^1, (1,0)^1\}$andω_2: $\{(0,1)^1, (1,1)^1\}$. Sketch the decision surface obtained, and indicate the positive side of the separating surface. [10+6]

4. Discuss Robbins-monro algorithm for pattern classification and extend the algorithm to multi - dimensional case. [16]

5. (a) With the help of a block diagram explain the different stages of image processing and analysis schemes along with the information flow from each block.
   (b) Differentiate the spatial image enhancement and image enhancement in frequency domain? [8+8]

6. (a) What is the main aim of an image pre-processing and explain why smoothing typically blurs the image edges? [6+2]
   (b) Name and explain different smoothing methods that try to avoid image blurring. [8]

7. (a) Write short notes on
      i. Inter pixel redundancy.
      ii. Psychovisual Redundancy
   (b) What do you mean by run length coding? Explain with an example. [4+4+8]

8. (a) A binary image contains straight lines oriented horizontally, vertically diagonally at 45^0 and - 45^0. Give a set of 3 x 3 masks that can be used to detect one -pixel-long breaks in these lines. Assume that the gray level of the lines is 1 and that the gray level of the background is 0.
   (b) Prove that the average value of the Laplacian operator $\nabla^2 h = \left(\frac{r^2-\sigma^2}{\sigma^4}\right) \exp\left(-\frac{r^2}{2\sigma^2}\right)$ is zero. [8+8]

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Code No: RR411103 **Set No.2**

IV B.Tech. I Semester Regular Examinations, November -2005
IMAGE PROCESSING AND PATTERN RECOGNITION
(Bio-Medical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain in brief about the pattern classes.
   (b) Discuss a simple pattern recognition model to recognize chineese characters. [8+8]
2. (a) What is the difference between single prototype and multi-prototype patterns.
   (b) Explain why patterns are not easily classifiable by proximity concept. [8+8]
3. (a) State and prove LMSE convergence algorithm.
   (b) Explain the limitation of percepron training algorithm. [8+8]
4. (a) Explain the least-mean square-error algorithm with an example.
   (b) Explain the convergence proof of the LMSE algorithm. [8+8]
5. (a) Discuss the various geometrical transformations of the image function.
   (b) Suppose the sequence [2 3 2 1] represents a discrete function. Compute Discrete Fourier transform of the function. [8+8]
6. (a) Write a note on the following:
      i. image subtraction
      ii. image averaging [4+4]
   (b) Show that a high pass filtered image can be obtained in the frequency domain as High pass = original - low pass (assume 3x3 filters) [8]
7. (a) How do you measure information?
   (b) Describe the compression of image by eliminating coding redundancy [4+12]
8. (a) A binary image contains straight lines oriented horizontally, vertically diagonally at 45^0 and - 45^0. Give a set of 3 x 3 masks that can be used to detect one -pixel-long breaks in these lines. Assume that the gray level of the lines is 1 and that the gray level of the background is 0.
   (b) Prove that the average value of the Laplacian operator $\nabla^2 h = \left(\frac{r^2-\sigma^2}{\sigma^4}\right) \exp\left(-\frac{r^2}{2\sigma^2}\right)$ is zero. [8+8]

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Code No: RR411103 **Set No.3**

IV B.Tech. I Semester Regular Examinations, November -2005
IMAGE PROCESSING AND PATTERN RECOGNITION
(Bio-Medical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain one of the bio-medical applications of pattern recognition system in detail.
   (b) Classify the pattern x=(4,3) into any one of the three classes characterized by the following decision function. $d_{12}(x) = -x_1 - x_2 + 5$, $d_{13}(x) = -x_1 + 3$, $d_{23}(x) = -x_1 + -x_2$ [6+10]

2. Derive the Byes decision rule for a multiclass problem? [16]

3. Find the solution vector ω using reward punishment algorithm to separate the two classes, where the patterns in each class are given by $\omega_1 : \{(0,0,1),(0,1,1)^1\}$ and $\omega_2 : \{(1,0,1)^1,(1,1,1)^1\}$ [16]

4. Discuss Robbins-monro algorithm for pattern classification and extend the algorithm to multi - dimensional case. [16]

5. (a) Discuss the various geometrical transformations of the image function.
   (b) Suppose the sequence [2 3 2 1] represents a discrete function. Compute Discrete Fourier transform of the function. [8+8]

6. (a) Write a note on the following:
      i. image subtraction
      ii. image averaging [4+4]
   (b) Show that a high pass filtered image can be obtained in the frequency domain as High pass = original - low pass (assume 3x3 filters) [8]

7. (a) How do you measure information?
   (b) Describe the compression of image by eliminating coding redundancy [4+12]

8. (a) A binary image contains straight lines oriented horizontally, vertically diagonally at 45^0 and - 45^0. Give a set of 3 x 3 masks that can be used to detect one -pixel-long breaks in these lines. Assume that the gray level of the lines is 1 and that the gray level of the background is 0.
   (b) Prove that the average value of the Laplacian operator $\nabla^2 h = \left(\frac{r^2-\sigma^2}{\sigma^4}\right) \exp\left(-\frac{r^2}{2\sigma^2}\right)$ is zero. [8+8]

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Code No: RR411103 **Set No.4**

IV B.Tech. I Semester Regular Examinations, November -2005
IMAGE PROCESSING AND PATTERN RECOGNITION
(Bio-Medical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Mention the conditions of case1, case2, and case3 of linear decision functions to classify the pattern?
   (b) Classify the pattern X = (6,5) into any one of the three classes characterized by the following decision function.
   $d_1(x) = -x_1 + x_2$, $d_2(x) = x_1 + x_2$ -5, $d_3(x) = -x_2 + 1$. [8+8]

2. (a) Explain how minimum distance classification is useful for classifying different pattern classes.
   (b) Explain the maximin distance algorithm for pattern classification. [8+8]

3. Find the solution vector ω using reward punishment algorithm to separate the two classes, where the patterns in each class are given by $\omega_1 : \{(0,0,1),(0,1,1)^1\}$ and $\omega_2 : \{(1,0,1)^1,(1,1,1)^1\}$ [16]

4. (a) Explain what do you mean by syntactic pattern recognition.
   (b) Give the productions used in the generation of the sentence "THE BOY RUNS" and draw the corresponding semantic tree. [8+8]

5. (a) Prove the following properties of one-dimensional Fourier transform
      i. Shift invariance
      ii. Convolution [4+4]
   (b) State and prove Parseval's theorem. [8]

6. (a) Write a note on the following:
      i. image subtraction
      ii. image averaging [4+4]
   (b) Show that a high pass filtered image can be obtained in the frequency domain as High pass = original - low pass (assume 3x3 filters) [8]

7. (a) Write short notes on
      i. Inter pixel redundancy.
      ii. Psychovisual Redundancy
   (b) What do you mean by run length coding? Explain with an example. [4+4+8]

8. (a) What is meant by image segmentation? Mention the applications of image segmentation. [4+4]

(b) Explain about detection of discontinuities. [8]

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