Reg. No.



ANIPAL INSTITUTE OF TECHNOLOGY

VII SEMESTER B.TECH. (BME) DEGREE END SEMESTER EXAMINATIONS NOV 2017

SUBJECT: PATTERN RECOGNITION (BME 4008)

(REVISED CREDIT SYSTEM)

Thursday, 23rd November 2017: 2 PM to 5 PM

TIME: 3 HOURS

MAX. MARKS: 100

Instructions to Candidates:

Answer FIVE full questions. 1.

2. Draw labeled diagram wherever necessary

- Explain the estimation of posterior probability for an i^{th} class C_i , when "i" varies from 1. (a) 1 to K and "d" is the size of the training vector. Describe the significance of the above 06 conditional probability.
 - (b) Birth in a hospital occur randomly at an average rate of 1.8 births per hour. What is the probability of observing more than or equal to 2 births in a given hour at the 06 hospital? Plot the nature of the class in terms of probability density.
 - The training vectors for the two classes namely Normal (N) and Hypertension (H) are (c) given in the table 1(C). Mark the optimal region associated with each of the class on the histogram plot, and define an appropriate rule for classification. $\overline{T_{a}}$ ble 1(C)

		1 able 1(C)	
Members of Normal(N)	systolic pressure (mm Hg)	Members of Hypertension(H)	systolic pressure (mm Hg)
1	99	1	145
2	101	2	147
3	111	3	143
4	115	4	151
5	119	5	141

- 2. (a) Explain the significance of the following, in the context of the performance of a
 - classifier:
 - a. True positive rate and True negative rate
 - b. ROC
 - (b) The classifier designed for screening cardiac patients is tested with a group of 1000, and the results obtained are provided in the Table-2(b). Calculate the sensitivity and specificity.

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08

04

Table-2(b)						
		Test results				
		positive	Negative			
Actual status	positive	71 (TP)	5 (FN)			
siains	negative	9 (FP)	915 (TN)			

- (c) With an example narrate the agglomerative algorithm, to find the clusters with a similarity measure of "squared error" or "minimum variance".
- 3. (a) *Class-A* has a prior probability of 0.65 and is bivariate normal. Another *class-B* is also normally distributed with its class prior probability value of 0.35. The extracted class features are x and y, and the parameters of the classes are:

$$classA: \mu_{1} = 28, \mu_{2} = 87, \sigma_{1} = 2, \sigma_{2} = 5, \rho_{12} = 0.6$$

$$classB: \mu_{1} = 15, \mu_{2} = 61, \sigma_{1} = 3, \sigma_{2} = 8, \rho_{12} = 0.5$$
Given test input vector $X = \begin{bmatrix} 30 & 70 \end{bmatrix}^{T}$, find $P(A|X)$.

- (b) Describe the estimation of error in *Back propagation neural network* (BPNN) and state its significance. Further, elaborate the procedure involved in updating the 10 weights.
- 4. (a) The diagnosis of a group of people suspected to having a cardiac disorder are listed with the diagnostic details, as shown in the Table-4(a). Discover the two groups of patients from the given details. Use the divisive-type of clustering algorithm.

1 able-4(a)							
Patients	Heart Rate	Weight	Age				
		in KG					
1	72	65	48				
2	105	68	52				
3	99	71	49				
4	75	67	51				
5	108	72	55				

06

(b) What is the significance of an activation function in a neural network? Explain.
(c) Explain the important stages of a classifier design in the case of a problem involving segmentation using K-Means algorithm.
(a) Realize the given function f = A + BC using McCulloch-Pitts neuron model, and test the designed model.
(b) What are anatomical and behavioral biometrics? Explain the elements of a behavioral biometric analysis system.
(c) Write an appropriate rule for the estimation of an *average linkage cluster distance*.

What is the significance of an activation function in a neural network? Explain.

Find the inert cluster distance between two clusters C_1 and C_2 : $Cluster C_1 = \{(72, 42), (75, 45)\}$ and $Cluster C_2 = \{(100, 52), (102, 57)\}$ *Note:* Use city-block distance for the calculation of sample distance.

(b)

5.