Question Paper

Exam Date & Time: 23-Nov-2022 (02:00 PM - 05:00 PM)



MANIPAL ACADEMY OF HIGHER EDUCATION

MANIPAL INSTITUTE OF TECHNOLOGY DEPARTMENT OF BIOMEDICAL ENGINEERING SEVENTH SEMESTER B.TECH END SEMESTER EXAMINATIONS, NOV 2022

Pattern Recognition [BME 4068]

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Marks: 50

Duration: 180 mins.

Answer all the questions.

Instructions to Candidates: Answer ALL questions Missing data may be suitably assumed

1)	A)	State the Bayesian Theorem for a <i>K</i> -class problem with <i>d</i> -features when the features are discrete type and independent within each class. Discuss how to design a rule for classification based on the posterior probability.	(3)
	B)	The values of "heart rate" for the group ECG_Normal has are: 69, 70, 71, 72,74, 75, 75,77,78,80,85,89,88,92. The samples from ECG_Trachycardia had x values of 97, 98,100, 104, 105, 107, 108, 111,114, 117, 118, 120. Draw histogram with a step size of five. Find an optimal decision boundary between classes and test the following sample having heart rate 99.	(4)
	C)	The feature " x" is normally distributed for class A, with a mean of 10 and a standard deviation of 3. The class-2 is seen uniformly distributed between15 to 20. Test the given sample with $x=14$, by estimating P(A x=14). The prior probability of both class A and class B are 0.5.	(3)
2)		The feature "x" is normally distributed for class-A and class-B. If the classes are described as:	(4)
	A)	class-A : Mean value of x is 90, and standard deviation of 2, with $P(A)=0.4$	
	,	<i>class-B</i> : Mean value of x is 60, and standard deviation of 3, with P(B)=0.6	
		Find the equation of the optimal decision boundary between the two classes for test sample " x=72".	
	B)	Given 150 samples, design an agglomerative algorithm for discovering 3 clusters finding the average cluster distance as an measure.	(3)
	C)	Consider the given clusters: Cluster C1= $\{(10,35), (12, 18)\}$ Cluster C2= $\{(22,20), (24,24)\}$. Calculate the total squared error value in above case. Note: For the estimation of the sample distance use city block distance.	(3)
3)		How supervised and unsupervised machine learning methods are different? Explain.	(3)
	A)		
	B)	Realise as AND gate function using a basic McCulloch-Pitts Neuron model Draw the neuron diagram and test it with an input vector $X = [0 \ 1]^T$	(3)
	C)	Explain the training algorithm of a single perceptron with appropriate weight updating rules when the inputs are I and J.	(4)
4)		Apply K-Means algorithm on the following samples to discover three clusters. The samples are:	(4)

- A) (77,20), (86,22), (91,24) ,(99,25). **Note:** Give details of each step used during the discover of the clusters.
- B) Consider the given input vector $(X) = [1 \ 1]^T$, weight $(W) = [w1 \ w2] = [0.4 \ 0.7]$. The Bias weight is (3) 0.5. Find the artificial neuron response by using sigmodal activation function.
- C) Highlight the importance of digitisation of a pathology lab for improving healthcare service and (3) discuss the associated challenges.
- 5) Develop block diagram for describing the ECG system for identifying abnormality class utilising the (4) cardiac signal. Explain the importance of each element. Identify the challenges associated with the feature extraction stage.
 - B) Explain the significance of Sensitivity and Specificity in the context of analysis of performance of a (3) classifier.
 - C) A group of 1000 cardiac patients is tested with a prediction algorithm, and the results obtained are (3) provided in the Table-5(c). Calculate the Accuracy, sensitivity, and specificity.

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140.46

		Test algorithm results	
		Positive	Negative
Actual	Positive	490(TP)	20 <u>(FN</u>)
status	Negative	10 (FP)	480(TN)

<u>table-5(</u>c)

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