Question Paper

Exam Date & Time: 05-Dec-2023 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

SEVENTH SEMESTER B.TECH END SEMESTER EXAMINATIONS, DEC 2023

Pattern Recognition [BME 4068]

Marks: 50 **Duration: 180 mins.**

A

Answer all the questions.

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

1) Express posterior probability for an input X=[x1 x2 x3 x4]^T consisting continuous features, with a 2-class problem. Design a classification rule utilising the posterior probability. (3)

A)

B) Apply the Single linkage algorithm to find three clusters from the given samples: (10,8), (10,10) (12,15) and (15,17). Use city block distance. (4)

C) How classification model is different from a regression model? Construct the workflow for pattern recognition system for classification with details of each. (3)

2) Estimate an optimal threshold between the following two classes. The group A has peoples with "BP" measurement as follows: 110, 112, 116, 119, 124, 125, 126, 128, 132, 137. The measurement of another group B is: 138, 142, 145, 149, 151, 152, 153, 155, 157, 161, 166. Draw the histogram with a step size of five and test the given sample with sample value "141". (3)

A)

B) Apply *K-Means algorithm* on the following samples and find three clusters: (100,10), (101,12), (110,24), (119,25). **Note:** Begin clustering by considering the first, third and fourth samples as seed points. (4)

C) Design a simple neuron as OR-*gate* function using a basic McCulloch-Pitts Neuron model. Draw the neuron diagram and test it with an input vector X= [1 1]^T. (3)

3) Differentiate a supervised model from other models considering a suitable example. (3)

A)

B) Design a perceptron network to classify the two-dimensional input patterns "**F**" and "**T**" . The character "*" indicates the data representation to be " 1 ", and " -" indicate data to be " -1 ". Consider a target of "+1 " for pattern **F** and "-1" for pattern **T**. (4)

F = * * * / * * * / * - -

T = * * * / - * - / - * -

C) Apply knowledge of machine learning design cycle for detailing the workflow of the malaria classification system. (3)

4) Find optimal boundary equation for the two classes when feature x is normally distributed for class (4)

A) A, with a mean of 2 and a standard deviation of 1 and for class B, it is also normal with mean of 7 and standard deviation of 3. Note: P(A)=0.6, P(B)=0.4

B) Breakdown the training algorithm of multilayer perceptron into feed *forward* and *error propagation* using sigmoidal activation function at hidden and output layers. Discuss the approach of training to generate a desired output. (3)

C) Identify True positive, True negative, False positive and False negative values from the confusion matrix given in the table 4 (c), which is built for the machine learning model developed for screening patients having diabetic. The model is tested with a group of 2500 peoples. Calculate the values of Sensitivity and Specificity. (3)

Table 4 (c) Confusion matrix

		Predicted classes by ML model	
		Positive	**Negative**
Actual Class	**Positive**	1150	150
	Negative	100	1100

5) Illustrate a digital approach for arrhythmia classification system. Identify five important features from the input pattern. Discuss the associated difficulties. (3)

A)

B) Explain the role of an activation function in an artificial neuron. Calculate the net input and response of a neuron Y for the artificial neuron as shown in figure 5(B). Use linear activation at Xin1 & Xin2, and binary sigmoidal activation function at y_o. (3)

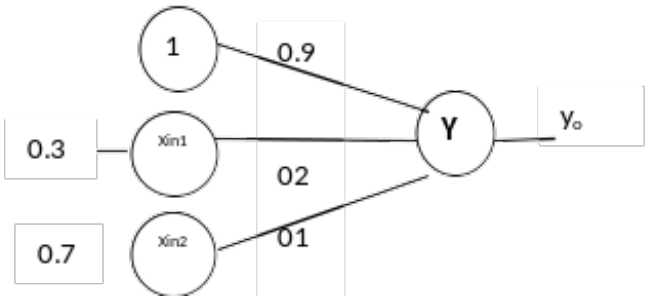

Figure 5(B): Artificial neuron

C) Determine the value of posterior probability P(YES/Shortness of breath) using Naive Bayesian theorem from the given table 5 (c) consisting symptoms of patients listed for various COVID-19 conditions. Interpret the answer. (4)

Table 5 (c) Attribute table

Body_temperature (Higher than 100.4 degree)	Shortness of breath	Muscle pain	Loss of taste	Covid 19 Present
Yes	No	Yes	Yes	YES
Yes	No	Yes	No	NO
Yes	Yes	No	Yes	YES
No	No	Yes	Yes	NO

Yes	No	No	No	NO
Yes	No	Yes	Yes	YES
No	Yes	Yes	No	NO
No	No	Yes	No	NO
Yes	Yes	No	Yes	YES
Yes	Yes	Yes	Yes	YES

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