Printed Pages : 7

ECS-074

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 110754

Roll No.

B. Tech.

(SEM. VII) (ODD SEM.) THEORY EXAMINATION, 2014-15

PATTERN RECOGNITION

Time : **3** Hours] [Total Marks : **100**

Note : Attempt all Questions.

1 Attempt any **four** of the following : **(4×5=20)**

a) Define Pattern, feature, feature vector, feature space and feature extraction.

b) Consider a two-class problem, where the training patterns are:

Class1 : (2, 2), (4, 3), and (5, 1)

Class2 : (1, 3), (5, 5), and (3, 6)

Obtain the within class scatter matrix.

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c) What is statistical pattern recognition ? Explain.

d) What is K-Near Neighbours classifier ?

e) Consider the two class problem class 1 and class 2. Test pattern is P. Five Nearest Neighbours patterns to test pattern P is X1, X2, X3, X4 and X5. X1 and X4 belong to Class 1 and X2, X3 and X5 belong to Class 2. Distances from P, d(X1, P) = 1, d(X2, P) = 2, d(X3, P) = 2.5, d(X4, P) = 4 and d(X5, P) = 5. Classify the test pattern P using modified k-Nearest Neighbour algorithm.

f) What is learning and adaption ? Explain.

2 Attempt any **four** of the following : **(4×5=20)**

a) Explain Bayesian decision theory. Explain two category classifications.

b) Let blue, green, and red be three classes of objects with prior probabilities given by P(blue) = 1/4, P(green) = 1/2, P(red) = 1/4. Let there be three types of objects : pencils, pens, and paper. Let the class-conditional probabilities of these objects be

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given as follows. Use Bayes classifier to classify pencil, pen, and paper.

P(pencil|green) = 1/3 P(pen|green) =1/2 P(paper|green) = 1/6

P(pencil|blue) = 1/2 P(pen|blue) =1/6 P(paper|blue) = 1/3

P(pencil|red) = 1/6 P(pen|red) =1/3 P(paper|red) = 1/2

c) Explain Parametric and Non parametric pattern recognition methods.

d) Ram is a student. He loves going to the movies. He will go to the theatre in the evening if he has money in his pocket. On the other hand, if it rains, he will not go the theatre. When ram does not go to the movies, he stays home and watches the television. He also dedicates some time to his studies. Draw the belief network for this situation.

e) What is linear discriminant function ? Explain.

f) Write short note on "Maximum likelihood estimation" and "Bayesian estimation".

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3 Attempt any **two** of the following : **(2×10=20)**

a) Consider the example given in decision trees given in the Table 1. We have a new pattern money = 90, has-exams=yes, and weather=fine.

Use Naive Bayes classifier to classify this pattern as either belonging to goes-to-movie=yes or goes-to-movie=no.

Table 1: Two class problem (Yes and No)

Money	Has-exams	weather	Goes-to-movie
25	no	fine	no
200	no	hot	yes
100	no	rainy	no
125	yes	rainy	no
30	yes	rainy	no
300	yes	fine	yes
55	yes	hot	no
140	no	hot	no
20	yes	fine	no
175	yes	fine	yes
110	no	fine	yes

b) Explain following i) Hidden Markov Model (HMM) ii) Fisher's Linear Discriminant?

c) What do you mean by dimension reduction? Discuss principal component analysis (PCA) algorithm for dimension reduction.

Let us consider two patterns of class 1. The patterns are (2,2) and (3,1). Let us consider two patterns of class 2. The patterns are (5,4) and (7,4). Obtain the sample covariance matrix.

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4 Attempt any **two** of the following : **(2×10=20)**

a) Consider the two class problem shown in Figure 1. There are four patterns in Class 1 marked as 'X' and there are five patterns in Class 2 marked as '+'. The test pattern is P. The closest points to P are X1, X6, X7, X2 and X5. If the distances from P to X1, X6, X7, X2 and X5 are 0.3, 1.0, 1.1, 1.5 and 1.6. Classify the test pattern P using following

i) Nearest Neighbour algorithm

ii) k-Nearest Neighbour (kNN) algorithm with k=5

iii) Modified k-Nearest Neighbour (mkNN) classifier

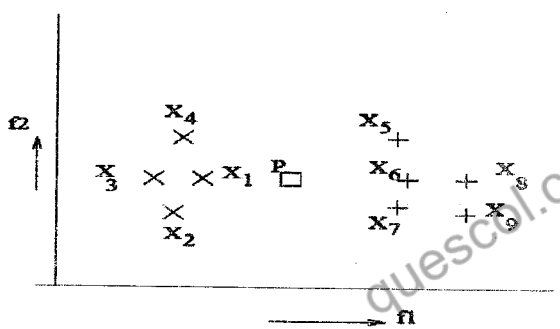


Figure 1: Two class problem

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b) What is Parzon window? Explain. Derive the conditions for (i) convergence of mean (ii) convergence of variance.

c) What is χ^2 test ? Write the significance of hypothesis testing in pattern recognition. Write the uses of χ^2 Test. The following table gives the number of accident that occurs during the various days of the week. Find whether the accidents are uniformly distributed over the week.

Days	Sun	Mon	Tue	Wed	Thu	Fri	Sat
No of accident	14	16	8	12	11	9	14

Given: the values of chi square significance at 5,6,7 degrees of freedom are respectively 11.07, 12.59, 14.07 at 5% level of significance.

5 Attempt any **two** of the following : **(2×10=20)**

a) Differentiate between clustering and classification. Explain criteria function for clustering.

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b) Write and explain K-means clustering algorithm. Illustrate K-means algorithm with the help of the three-dimensional data set of 10 points given below :

(1, 1, 1), (1, 1, 2), (1, 3, 2), (2, 1, 1), (6, 3, 1), (6, 4, 1), (6, 6, 6), (6, 6, 7), (6, 7, 6), (7, 7, 7)

Consider the initial seeds to be (1, 1, 1), (6, 3, 1), (6, 6, 6).

c) What is clustering? Explain. What are different clustering techniques? Why is clustering important? What is an agglomerative clustering algorithm? Explain.

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