

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION-2022

B.Tech- VII Semester (ECE)

COURSE CODE (CREDITS): 19B1WEC732 (3)

MAX. MARKS: 35

COURSE NAME: Pattern Analysis in Machine Intelligence

COURSE INSTRUCTORS: Dr. Alok Kumar

MAX. TIME: 2 Hours

*Note: All questions are compulsory. Marks are indicated against each question in square brackets.*

**Q.1.** As we increase the number of features in feature vector, then discriminating power of separability between the classes increases. What are the problems that arises when the size of features in feature vector is increased and how we can overcome this issue while maintaining the performance of classification? How we can select the best suitable features from feature vector for classification? Justify your answer with suitable explanation. [CO1, CO2] [5 Marks]

**Q.2** What is the Fisher linear discriminant method? How Multiple Discriminant Analysis (MDA) is different from Principal Component Analysis (PCA)? Which technique is better for classification and why? [CO3, CO4] [5 Marks]

**Q.3** Consider the given datasets belong to the two feature vectors namely  $\omega_1$  and  $\omega_2$ . Find the best projection direction using PCA and MDA. After finding the projection direction, represent the datasets graphically. What is your observation on the basis of separability between the two classes while using PCA and MDA. [CO4, CO5] [6 Marks]

$$\left\{ \begin{pmatrix} 1 \\ 2 \end{pmatrix}, \begin{pmatrix} 3 \\ 5 \end{pmatrix}, \begin{pmatrix} 4 \\ 3 \end{pmatrix}, \begin{pmatrix} 5 \\ 6 \end{pmatrix}, \begin{pmatrix} 7 \\ 5 \end{pmatrix} \right\} \in \omega_1$$

$$\left\{ \begin{pmatrix} 6 \\ 2 \end{pmatrix}, \begin{pmatrix} 9 \\ 4 \end{pmatrix}, \begin{pmatrix} 10 \\ 1 \end{pmatrix}, \begin{pmatrix} 12 \\ 3 \end{pmatrix}, \begin{pmatrix} 13 \\ 6 \end{pmatrix} \right\} \in \omega_2 .$$

**Q.4** What is Support Vector Machine? How do Support Vector Machine Works? What are Hard-Margin and Soft-Margin SVMs? What are the factors that affect the decision boundary in SVMs? For N dimensional data set, what is the minimum possible number of Support Vectors? [CO4] [5 Marks]

**Q.5** What is the information gain of  $a_1$  and  $a_2$  in the given datasets. Draw the decision tree for the given dataset. [CO3, CO4] [4 Marks]

Instance	Classification	$a_1$	$a_2$
1	+	T	T
2	-	T	F
3	+	F	F
4	-	F	T

**Q.6** Write algorithm to apply the Agglomerative clustering approach? Consider the five feature vectors and each vector has two dimensions as follows:

	x	y
1	4	4
2	8	4
3	15	8
4	24	4
5	24	12

Show the Agglomerative clustering approach while employing:

- single linkage algorithm
- complete linkage algorithm.

[CO4] [5 Marks]

**Q.7** What is the role of classifier in machine learning? What are the different types of classifier used in pattern recognition? Derive the expression for minimum risk classifier while considering that, given samples may belong to either class  $\omega_1$  or class  $\omega_2$ . [CO5] [5 Marks]