

IEE/M.TECH(IEE)/SEM-2/ PG / IEE / T/ 128C/2019

2019

Pattern Recognition

Time Allotted : 3 Hours

Full Marks : 100

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Short Answer Type Questions)

Answer any four of the following. 4×5 = 20

1. What do you mean by linear and quadratic discriminant functions explain with example. 5
2. Explain k-mean Clustering Algorithm with example. 5
3. What is Pattern Recognition. What do you mean by features and decision boundaries in Pattern Recognition.
4. Explain some applications of Pattern Recognition in real life. What is clustering. 3+2
5. What is multilayer perceptron. What are the significance of multilayer perceptron. 5
6. Explain the process of pattern recognition systems. What are the characteristics of pattern recognition systems. 3+2

GROUP B

(Long Answer Type Questions)

Answer any five of the following. 16×5 = 80

7. Write down the advantages and disadvantages of Decision Tree Classifier. Differentiate between clustering and classification. Explain different clustering technique.

Name	Gender
Preet	Male
Harmanpreet	Female
Preet	Female
Preet	Female
Sunit	Male
Sunny	Female

Nina	Female
Gomez	Male

What is the probability of being called "Preet" given that you are a male or female? $3+3+4+6$

8. What is K-Nearest Neighbour Classifier explain with example. What do you mean by supervised and unsupervised learning. Differentiate between them.

The Speed and Agility ratings for 20 colleges athletes are given and whether they are drafted as professional team. Find out If the speed is 6.75 and Agility 3.00 what will be the distance between query distances. Also find If the speed is 5.52 and Agility 5.00 what will be the distance between query distances. $3+3+2+8$

ID	SPEED	AGILITY	DRAFT	Dist.	ID	SPEED	AGILITY	DRAFT	Dist.
18	7.00	4.25	yes	1.27	11	2.00	2.00	no	4.85
12	5.00	2.50	no	1.82	19	7.50	8.00	yes	5.06
10	4.25	3.75	no	2.61	3	2.25	5.50	no	5.15
20	7.25	5.75	yes	2.80	1	2.50	6.00	no	5.20
9	4.00	4.00	no	2.93	13	8.25	8.50	no	5.70
6	4.50	5.00	no	3.01	2	3.75	8.00	no	5.83
8	3.00	3.25	no	3.76	14	5.75	8.75	yes	5.84
15	4.75	6.25	yes	3.82	5	2.75	7.50	no	6.02
7	3.50	5.25	no	3.95	4	3.25	8.25	no	6.31
16	5.50	6.75	yes	3.95	17	5.25	9.50	yes	6.67

9. a) Explain Fuzzy Sets and Crisp Sets. What are the properties of fuzzy sets.

b) For steel design, the cross-sectional area to column-height ratio largely determines the susceptibility of the columns to buckling under axial loads. The normalized ratios are on the universe, $X = \{1, 2, 3, 4, 5\}$. These ratios are characterized as "small" to "large":

$$\text{"Small"} = \{.3/1+.4/2+.5/3+.02/4+.04/5\}$$

$$\text{"Large"} = \{.5/1+.1/2+.7/3+.8/4+.03/5\}$$

Calculate the membership functions for the following phrases:

- very small, very large
- very, very large
- very, very Small
- "not very small and not very large,"

c) Show that λ -cut relation of the following fuzzy equivalence relation results in a crisp equivalence relation :

$$R = \begin{bmatrix} 1 & 0.8 & 0.4 & 0.5 & 0.8 \\ 0.8 & 1 & 0.4 & 0.5 & 0.9 \\ 0.4 & 0.4 & 1 & 0.4 & 0.4 \\ 0.5 & 0.5 & 0.4 & 1 & 0.5 \\ 0.8 & 0.9 & 0.4 & 0.5 & 1 \end{bmatrix}$$

5+6+5

10. What is Fuzzy Inference System. What is Fuzzy Rule Based System explain it. Explain Fuzzy Inference System with two process Mamdani and Sugeno Based System. 3+5+8

11. Describe different types of activation functions in ANN ? What is the role of hidden layer, Weight and learning rate in the training process in ANN ? What do you mean by Hebian Learning? Design network of McCulloch-Pitts neurons that implement logical AND gate. Draw the network and label all the weight and threshold values?

5+3+2+6

12. What do you mean by perceptron learning rule. Explain a single layer perceptron network with suitable diagram. State the perceptron learning rule and apply that rule to find a perceptron network for OR function with bipolar inputs and targets (Take initial weights including bias and learning rate to be 0). Find out the final weights and bias. Explain Hopfield networks with proper diagram.

3+3+6+4

13. What is SVM classifier. What are the significance of SVM classifier. What are different kernels of SVM. What is fuzzification and defuzzification. Given two fuzzy sets

$$N1 = \{.52/A+.86/B+.9/C+.75/D+.77/E\}$$

2+4+3+2+5

$$N2 = \{.43/A+.07/B+.75/C+.33/D+.83/E\}$$

Find out i) Algebraic Sum ii) Algebraic Product iii) Bounded Sum iv) Bounded Product