M.Tech. Computer Technology - Second Year - Second Semester Exam -2024

Sub: MACHINE LEARNING Time: 3 hours Full marks: 100

Answer any 5 questions

1. Consider the following set of training examples and show the decision tree that would be learned by ID3 algorithm. Clearly show the value of information gain for each candidate attribute at each step in growing the tree. 20

id	Age	Has_Job	Has_House	Credit_ Rating	Class
1	young	FALSE	FALSE	fair	No
2	young	TRUE	FALSE	good	Yes
3	young	TRUE	TRUE	fair	Yes
4	young	FALSE	FALSE	fair	No
5	middle	FALSE	FALSE	fair	No
6	middle	FALSE	FALSE	good	No
7	middle	TRUE	TRUE	good	Yes
8	middle	FALSE	TRUE	excellent	Yes
9	old	FALSE	TRUE	excellent	Yes
10	old	TRUE	FALSE	good	Yes
11	old	TRUE	FALSE	excellent	Yes
12	old	FALSE	FALSE	fair	No

Show what would be classification output if the following test instance is submitted to the learned decision tree for classification <old, FALSE, TRUE, excellent > .

2. a. What are the basic principle of the Support Vector Machines? How does SVM handle multiclass classification problems? 5+5

   b. "Support vector machine can be viewed as a Kernel machine" –justify your answer with necessary mathematics. 10

3. a. Establish the relationship between curve fitting and linear regression. 5

   b. How does the Naïve classifier address the Zero Conditional Probability? 5

   c. The following table is given 10

Day	*Outlook*	*Temperature*	*Humanity*	*Wind*	*Play Tennis*
D1	*Sunny*	*Hot*	*High*	*Weak*	*No*
D2	*Sunny*	*Hot*	*High*	*Strong*	*No*
D3	*Overcast*	*Hot*	*High*	*Weak*	*Yes*
D4	*Rain*	*Mild*	*High*	*Weak*	*Yes*
D5	*Rain*	*Cold*	*Normal*	*Weak*	*Yes*

   What will be the condition to play tennis if Outlook=Overcast, Temperature= Mild, Humanity=High and Wind=Strong (use Naïve classifier?

4. a. Is it possible to obtain desired number of clusters using Hierarchical clustering algorithm? If yes, how? if no, why not? –Explain properly. 10

   b. What is cluster validity index? Suppose a dataset has six points, each of which has two features F1 and F2. The data set is listed below. Use K-Means algorithm to partition the dataset into two clusters and the initial values are C1 = (5,5) and C2 = (10,10) for cluster 1 and 2 respectively. 10

	F1	F2
X1	2	12
X2	4	9
X3	7	13
X4	11	5
X5	12	7
X6	14	4

5. a. "Bagging and Boosting may improve accuracy"- Justify the argument with your own words. 5

   b. Among Bagging and Boosting which one will you prefer and when? Write the pseudocode for the selected algorithm. 5+5

   c. What are the Sensitivity and Specificity? Is there any releation between them? 5

6. a. What are the differences between Perceptron Learning Rule and Gradient Descent Learning Rule? 5

   b. What is the utility of Backpropagation algorithm in MLP? 5

   c. Construct a neural network that computes the XOR function of two input values. Use perceptron learning to demonstrate that your designed network really acts as an XOR function of two inputs. 10

7. a. Why KNN method is called as lazy learning method? Explain briefly 5

   b. Explain the differences between Generative Models and Discriminative Models. 5

   c. What are the differences among regression, classification and clustering? 5

   d. What are differences between ANN and SVM? 5

8. a. Explain Fisher's Linear Discriminant Analysis for dimensionality reduction with proper eample 10

   b. What are the fundamental differences between PCA and FLDA ? Explain with appropriate diagram. 5

   c. Discuss a method for selection of desired numbers of eigen vectors in PCA with its advantage and disadvantages. 5