Reg. No. :

Question Paper Code : X10305

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020
Seventh Semester
Computer Science and Engineering
CS8082 – MACHINE LEARNING TECHNIQUES
(Common to Information Technology, Electronics and Communication Engineering and Computer Communication Engineering)
(Regulations 2017)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. Define Machine Learning with suitable example.

2. Assume S is a collection containing 14 examples, [9+, 5–]. Of these 14 examples, suppose 6 of the positive and 2 of the negative examples have Wind = Weak, and the remainder have Wind = Strong. What will be the information gain on attribute wind ?

3. What is perceptron ? When does the perceptron fails to converge ?

4. According to Gabil algorithm if the hypothesis consist of the rules if A1 =T&&A2=F then C=T. What will be the string representation of the given rule ?

5. How Bayes theorem calculates posterior probability ?

6. What is probability learning ?

7. Is KNN algorithm is a Lazy learning algorithm ? Justify your answer.

8. Suppose the data sample S contains N = 40 examples and the hypothesis H commits 10 errors over the examples, what will be the sample error ?

9. What is the entropy of a group in which :
   a) All samples belong to the same class ?
   b) Each group having equal number of samples.

10. What is explanation based learning ? Give an example.

PART – B **(5×13=65 Marks)**

11. a) Explain version spaces and candidate – elimination algorithm in detail with suitable example.

(OR)

b) NASA wants to be able to discriminate between Martians (M) and Humans (H) based on the following characteristics: Green $\in$ {N, Y}, Legs $\in$ {2, 3}, Height $\in$ {S, T}, Smelly $\in$ {N, Y}.
The available training data is given in table below :

i) Construct a decision tree using the ID3 algorithm. **(6)**

ii) Write the learned concept for Martian as a set of conjunctive rules (e.g., if (green = Y and legs = 2 and height = T and smelly = N), then Martian; else if ... then Martian; ... ; else Human). **(7)**

	Species	**Green**	**Legs**	**Height**	**Smelly**
1	M	N	3	S	Y
2	M	Y	2	T	N
3	M	Y	3	T	N
4	M	N	2	S	Y
5	M	Y	3	T	N
6	H	N	2	T	Y
7	H	N	2	S	N
8	H	N	2	T	N
9	H	Y	2	S	N
10	H	N	2	T	Y

12. a) Explain Multilayer Neural Network with back propagation in detail with gradient descent optimization.

(OR)

b) Explain Genetic Learning in detail with a suitable example.

13. a) We have prior knowledge over entire population of people only 0.008 have Cancer. The test returns a correct positive result in only 98% of the cases in which the disease is actually present, and a correct negative result in only 97% of the cases in which the disease is not present. In other cases, the test returns the opposite result. A patient takes a lab test and the result comes back positive. Evaluate whether the patient have cancer or not using Bayes learning ?

(OR)

b) Given 14 training examples of the target concert play tennis with attributes outlook, temperature, humidity and wind. The frequency of play tennis = 9 Frequency of not play tennis = 5 Conditional probabilities are given as

P(outlook = rainy | Play = Yes) = 2/9

P(temp = cool | Play = Yes) = 3/9

P(humidity = High | Play = Yes) = 3/9

P(Windy = true | Play = Yes) = 3/9

P(Outlook = rainy | Play = No) = 3/5

P(temp = cool | Play = No) = 1/5

P(humidity = High | Play = No) = 4/5

P(Windy = true | Play=No) = 3/5

Classify the new instance whether play = yes or No (Outlook = sunny, Temp = cool, Humidity = high, wind = strong) using Naive Bayes Classifier.

14. a) Write K-Means algorithm.

Suppose that the data mining task is to cluster the following eight points (with (x, y) representing location) into three clusters.

A1(2, 10), A2(2, 5), A3(8, 4), B1(5, 8), B2(7, 5), B3(6, 4), C1(1, 2), C2(4, 9).

The distance function is Euclidean distance. Suppose initially we assign A1, B1, and C1 as the center of each cluster, respectively.

Use the k-means algorithm to show only

i) The three cluster centers after the first round of execution and

ii) The final three clusters.

(OR)

b) i) Write short note on Radial Basis Functions. **(5)**

ii) Explain Case based learning in detail. **(8)**

15. a) i) Explain how Sequential Covering algorithm learns rule sets ? **(7)**

ii) Illustrate FOIL algorithm of learning First-order rules. **(6)**

(OR)

b) Briefly describe Reinforcement learning with suitable example.

PART – C **(1×15=15 Marks)**

16. a) i) Differentiate between generative and discriminative learning models. In a multinational company, there are people speaking different languages of their own mother tongue. The auto teller engine hosted by the company has a task of determining the language that someone is speaking by determining the linguistic differences without learning any language. Which learning model it has to follow ? Why ? **(5)**

ii) For the application of your choice, explain the machine learning process indicating

1) Type of machine learning model
2) Dataset needed and how much ?
3) input parameters and expected outcome
4) Possible evaluation strategy. **(10)**

(OR)

b) i) If S is a collection of 14 examples with 9 YES and 5 NO examples in which one of the attributes is wind speed. The values of Wind can be Weak or Strong. The classification of these 14 examples are 9 YES and 5 NO. For attribute Wind, suppose there are 8 occurrences of Wind = Weak and 6 occurrences of Wind = Strong. For Wind = Weak, 6 of the examples are YES and 2 are NO. For Wind = Strong, 3 are YES and 3 are NO. Find the Entropy(weak) and Entropy(strong). **(8)**

ii) Imagine what would happen if our agent were in state 1. It has 2 possible actions : go to state 3 or 5. Assume Gamma value is 0.8. What will be the Q(1, 5) ? **(7)**

$$
\begin{array}{c} \\ \\ \\ Q = \\ \\ \\ \end{array}
\begin{array}{c} \\ 0 \\ 1 \\ 2 \\ 3 \\ 4 \\ 5 \end{array}
\begin{array}{c} \begin{array}{cccccc} 0 & 1 & 2 & 3 & 4 & 5 \end{array} \\
\begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 100 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix} \end{array}
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