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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

July / August 2019 Supplementary Examinations

Programme: B.E. **Semester : VI**
Branch : Information Science and Engineering **Duration: 3 hrs.**
Course Code: 16IS6DEMLG **Max Marks: 100**
Course: Machine Learning **Date: 31.07.2019**

Instructions: 1. Answer any FIVE full questions, There is no internal choice in unit 1, 2 and 5. Whereas there is internal choice in unit 3 (Question 3 **OR** 4) and unit 4 (Question 5 **OR** 6).

UNIT - I

1 a) Illustrate the steps required for designing a learning system with an example. **07**

b) Explain candidate elimination learning algorithm. Apply the algorithm for the example given in Table-1. **08**

Example	Sky	Air temp	Humidity	Wind	Water	Forecast	Enjoy Sport
1.	Sunny	Warm	Normal	Strong	Warm	Same	Yes
2.	Sunny	Warm	High	Strong	Warm	Same	Yes
3.	Rainy	Cold	High	Strong	Warm	Change	No
4.	Sunny	Warm	High	Strong	Cold	Change	Yes

Table-1

c) Explain why the size of the hypothesis space in the EnjoySport learning task above is 973. How would the number of possible instances and possible hypotheses increase with the addition of the attribute WaterCurrent, which can take the values Light, Moderate, or Strong? **05**

UNIT - II

2 a) Explain rule – post pruning with an example. **06**

b) Consider the following set of training examples: **08**

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

(i) What is the entropy of this collection of training examples with respect to the target function classification?

(ii) What is the information gain of a2 relative to these training examples?

(iii) Create the decision tree for these training examples using ID3.

c) Write decision trees to represent the following Boolean functions: **06**
(i) $A \vee [B \wedge C]$ (ii) $[A \wedge B] \vee [C \wedge D]$

UNIT - III

3 a) Describe the concept of perceptrons and explain perceptron training rule. **07**

b) Write and explain Gradient descent algorithm for training a linear unit. **08**

c) Consider two perceptrons A and B defined by the threshold expression $0+w_1x_1+w_2x_2>0$. Perceptron A has weight values $w_0=1$, $w_1=2$, $w_2=1$ and perceptron B has weight values $w_0=0$, $w_1=2$, $w_2=1$. Is perceptron A more_general_than perceptron B? Justify. **05**

OR

4 a) Explain Gradient descent and Delta rule. **07**

b) Write and explain the stochastic gradient descent version of the backpropagation algorithm for feed forward networks containing two layers of sigmoid units. **08**

c) Design a two-input perceptron that implements the Boolean function **A∧¬B**. **05**

UNIT - IV

5 a) Differentiate between sample error and true error. **06**

b) Define Naive Bayes classifier. Classify the following using Naive Bayes classifier. Suppose we are building a classifier that says whether a text is about sports or not. The training data has 5 sentences as given below **08**

Text	Tag
"A great game"	Sports
"The election was over"	Not sports
"Very clean match"	Sports
"A clean but forgettable game"	Sports
"It was a close election"	Not sports

Now, which tag does the sentence **A very close game** belong to?

c) Suppose you test a hypothesis h and find that it commits r = 300 errors on a sample S of n = 1000 randomly drawn test examples. What is the standard deviation in error s (h)? **06**

OR

6 a) Define estimation bias. Is $error_S(h)$ an unbiased estimator for $error_D(h)$? **06**

b) Describe Bayes optimal classifier. Solve the following problem. **08**
Consider a medical diagnosis problem in which there are two alternative hypotheses: (1) that the patient has a particular form of cancer, and (2) that the patient does not. The available data is from a particular laboratory test with two possible outcomes: "+" (positive) or "-" (negative). We have prior knowledge that over the entire population of people, only .008 have this

disease. Furthermore, the lab test is only an imperfect indicator of the disease. 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. The above situation can be summarized by the following probabilities:

P(cancer) , P(~cancer) , P(+|cancer) , (-|cancer) , P(-|~cancer) , P(+|~cancer)

Suppose the doctor decides to order a second laboratory test for the same patient, and suppose the second test returns a positive result as well. What are the probabilities of cancer and ~cancer following these two tests. Assume the two tests are independent.

c) Suppose hypothesis h commits r = 10 errors over a sample of n = 65 independently drawn examples. What is the 90% confidence interval (two-sided) for the true error rate? What is the 95% one-sided interval (i.e., what is the upper bound U such that errorD(h) <= U with 95% confidence)? What is the 90% one-sided interval? **06**

UNIT - V

7 a) Differentiate between inductive and analytical learning problems. **06**

b) Write KNN algorithm and apply the same for the following data. **08**

Name	Acid durability	Strength	class
Type -1	7	7	Bad
Type -2	7	4	Bad
Type -3	3	4	Good
Type - 4	1	4	Good

Classify the given test data. Acid durability = 3 and Strength = 7

c) Explain the concept of Reinforcement learning with example. **06**

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