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

Autonomous Institute Affiliated to VTU

September / October 2023 Supplementary Examinations

Programme: B.E. **Semester: VI**
Branch: Computer Science and Engineering **Duration: 3 hrs.**
Course Code: 20CS6PCMAL **Max Marks: 100**
Course: Machine Learning

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

UNIT - I

1 a) Define and explain WELL-POSED LEARNING PROBLEMS. Give any two examples. **4**

b) Illustrate Find-s algorithm by taking Enjoy Sport as target concept and training instances given below also write the algorithm. **6**

Time	Weather	Temperature	Company	Humidity	Wind	Enjoy Sports
Morning	Sunny	Warm	Yes	Mild	Strong	Yes
Evening	Rainy	Cold	No	Mild	Normal	No
Morning	Sunny	Moderate	Yes	Normal	Normal	Yes
Evening	Sunny	Cold	Yes	High	Strong	Yes

c) List and explain the steps to design a learning system in detail with a suitable example. **10**

OR

2 a) For the following instance examples where buy is target value and find **3**

Example	citations	size	inLibrary	price	editions	buy
1	some	small	no	affordable	many	no
2	many	big	no	expensive	one	yes
3	some	big	always	expensive	few	no
4	many	mediu m	no	expensive	many	yes
5	many	small	no	affordable	many	yes

i. How many concepts are possible for this instance space?
ii. How many hypotheses can be expressed by the hypothesis language?
iii. How many Hypothesis are Semantically Distinct?

b) Write the candidate elimination algorithm and apply to the sequence of training examples and show the contents of the sets S (specific boundary) and G (general boundary) after each step. **7**

Training	running nose	coughing	reddened skin	Classification
D1	+	+	+	positive (ill)
D2	+	+	-	positive (ill)
D3	+	-	+	negative (healthy)
D4	-	+	+	negative (healthy)

c) Consider the below Student Exam Performance dataset and perform the following **10**

No.	Student	First last year?	Male?	Works hard?	Drinks?	First this year?
1	Richard	yes	yes	no	yes	yes
2	Alan	yes	yes	yes	no	yes
3	Alison	no	no	yes	no	yes
4	Jeff	no	yes	no	yes	no
5	Gail	yes	no	yes	yes	yes
6	Simon	no	yes	yes	yes	no

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

(ii) Construct a minimal decision tree for this dataset. Show your work.

UNIT - II

3 a) Explain the difference between true error and sample error. **6**

b) 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 $error_D(h) \leq U$ with 95% confidence)? What is the 90% one-sided interval? **6**

c) Estimate the difference between the true errors of two hypothesis h1 and h2. Use the general approach for deriving the confidence interval for d. What is the probability distribution governing the random variables? Obtain the approximate variance of each distribution. **8**

UNIT - III

4 a) Assume the learner considers some finite hypothesis space H defined over the instance space X, in which the task is to learn some target concept $c : X \rightarrow \{0,1\}$. Explain a learning algorithm to output the maximum a posteriori hypothesis. **10**

b) Consider below given dataset and classify the new example into mammals or non-mammals using Naïve Bayes classifier. **10**

Name	Give Birth	Can Fly	Live in Water	Have Legs	Class
human	yes	no	no	yes	mammals
python	no	no	no	no	non-mammals
salmon	no	no	yes	no	non-mammals
whale	yes	no	yes	no	mammals
frog	no	no	sometimes	yes	non-mammals
komodo	no	no	no	yes	non-mammals
bat yes		yes	no	yes	mammals
pigeon	no	yes	no	yes	non-mammals
cat	yes	no	no	yes	mammals
leopard shark	yes	no	yes	no	non-mammals
turtle	no	no	sometimes	yes	non-mammals
penguin	no	no	sometimes	yes	non-mammals
porcupine	yes	no	no	yes	mammals
eel	no	no	yes	no	non-mammals
salamander	no	no	sometimes	yes	non-mammals
gila monster	no	no	no	yes	non-mammals
platypus	no	no	no	yes	mammals
owl	no	yes	no	yes	non-mammals
dolphin	yes	no	yes	no	mammals
eagle	no	yes	no	yes	non-mammals

Give Birth	Can Fly	Live in Water	Have Legs	Class
yes	no	yes	no	?

OR

5 a) Analyze the difference between Gibbs algorithm and Bayesian optimal classifier. **5**

b) Explain Bayesian belief network with an example. **5**

c) Assume that we have two coins, C1 and C2 and 5 times one of the coins are tossed. toss the chosen coin 10 times. following are the results. **10**

{ H T T T H H T H T H }
{ H H H H T H H H H H }
{ H T H H H H H T H H }
{ H T H T T T H H T T }
{ T H H H T H H H T H }

Assume the bias of C1 is $\theta 1$ (i.e., probability of getting heads with C1), Assume the bias of C2 is $\theta 2$ (i.e., probability of getting heads with C2). Use EM algorithm to find $\theta 1$, $\theta 2$ after 2 iteration. Initialize $\theta 1$=0.6 and $\theta 2$=0.5. Determine coin parameters without knowing the identity of each data set's coin, work out for 2 iterations

UNIT - IV

6 a) Discuss how radial basis function transforms non-linear problem into linear problem with an example **6**

b) Consider any prototypical example and discuss case-based reasoning system **6**

c) Suppose we have height, weight and T-shirt size of some customers and we need to predict the T-shirt size of a new customer given only height = 161 Cm and weight = 61 Kg. Data including height, weight and T-shirt size information is shown below, assume k=5. Write the algorithm for the same. **8**

Height (in cms)	Weight (in kgs)	T Shirt Size
158	58	M
158	59	M
158	63	M
160	59	M
160	60	M
163	60	M
163	61	M
160	64	L
163	64	L
165	61	L
165	62	L
165	65	L
168	62	L
168	66	L
170	64	L

UNIT - V

7	a)	Explain the various common rule performance evaluation functions used to guide the search in LEARN-ONE-RULE.	**3**
	b)	Write the FOIL algorithm and discuss how first order rules are learnt for a given concept.	**8**
	c)	Write the implementation for LEARN-ONE-RULE method for performing a general-to-specific beam search.	**9**

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