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17EC834

Eighth Semester B.E. Degree Examination, July/August 2021
Machine Learning

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions.***

1 a. Mention five applications of machine learning. **(05 Marks)**

b. Explain List-Then-Eliminate algorithm. **(05 Marks)**

c. Analyze the given instances in Table Q.1(c) and find the version space using candidate-elimination algorithm. **(10 Marks)**

Instances	Citations	Size	In library	Price	Editions	Buy
1	Some	Small	No	Affordable	One	No
2	Many	Big	No	Expensive	Many	Yes
3	Many	Medium	No	Expensive	Few	Yes
4	Many	Small	No	Affordable	Many	Yes

Table Q.1(c)

2 a. Explain different perspectives and issues in machine learning. **(05 Marks)**

b. Enumerate the steps in designing a learning system. **(05 Marks)**

c. Write the Find-S algorithm. Analyze the given instances in Table Q.2(c) and find maximally specific hypothesis using Find-S. **(10 Marks)**

Instances	Citations	Size	In Library	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	Medium	No	Expensive	Many	Yes
5	Many	Small	No	Affordable	Many	Yes

Table Q.2(c)

3 a. Given $W_1 = W_2 = 0.5$, show that how a single-layer perceptron can solve the following linearly separable problem.

i) A AND B with bias = -0.75

ii) A OR B with bias = -0.25 **(08 Marks)**

b. Construct decision tree using ID3 algorithm considering the training examples given in Table Q.3(b). **(12 Marks)**

Instance	a1	a2	a3	Classification
1	True	Hot	High	No
2	True	Hot	High	No
3	False	Hot	High	Yes
4	False	Cool	Normal	Yes
5	False	Cool	Normal	Yes
6	True	Cool	High	No
7	True	Hot	High	No
8	True	Hot	Normal	Yes
9	False	Cool	Normal	Yes
10	False	Cool	High	Yes

Table Q.3(b)

4 a. List the appropriate problems for neural network learning. **(05 Marks)**

b. Define perceptron and discuss its training rule. **(05 Marks)**

c. Define entropy and information gain. For the transactions shown in the Table Q.4(c) compute the following:

i) Entropy of the collection of transaction records of the table with respect to classification.

ii) What are the information gain of a1 and a2 relative to the transactions of the table?

Instance	1	2	3	4	5	6	7	8	9
a1	T	T	T	F	F	F	F	T	F
a2	T	T	F	F	T	T	F	F	T
Target class	+	+	-	+	-	-	-	+	-

Table Q.4(c)

(10 Marks)

5 a. Explain Baye's theorem, MAP hypothesis and ML hypothesis. **(09 Marks)**

b. Classify the dataset: <sunny, cool, high, strong> using Naïve Bayes classifier for the dataset shown in Table Q.5(b). Also find conditional probabilities of each attribute. **(11 Marks)**

Day	Outlook	Temperature	Humidity	Wind	Play Tennis
1	Sunny	Hot	High	Weak	No
2	Sunny	Hot	High	Strong	No
3	Overcast	Hot	High	Weak	Yes
4	Rain	Mild	High	Weak	Yes
5	Rain	Cool	Normal	Weak	Yes
6	Rain	Cool	Normal	Strong	No
7	Overcast	Cool	Normal	Strong	Yes
8	Sunny	Mild	High	Weak	No
9	Sunny	Cool	Normal	Weak	Yes
10	Rain	Mild	Normal	Weak	Yes
11	Sunny	Mild	Normal	Strong	Yes
12	Overcast	Mild	High	Strong	Yes
13	Overcast	Hot	Normal	Weak	Yes
14	Rain	Mild	High	Strong	No

Table Q.5(b)

6 a. Prove that minimizing the squared error between the output hypothesis predictions and the training data will output a maximum likelihood hypothesis. **(07 Marks)**

b. Consider a football game between two rival teams, say team A and team B. Suppose team A wins 65% of the time and team B coins the remaining matches. Among the games won by team A, only 35% of them comes from playing at team B's foot ball field. On the otherhand, 75% of the victories for team B are obtained while playing at home. If team B is to host the next match between the two teams, who will emerge as the winner? **(07 Marks)**

c. Given that 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. Also, 0.008 of the entire population have this cancer. Suppose a new patient is observed for whom the lab test returns a negative (-) result. Should we diagnose the patient as having cancer or not? **(06 Marks)**

7 a. Explain K-nearest neighbor algorithm with example plots. List out its advantages and disadvantages. **(10 Marks)**

b. Explain locally-weighted linear regression with example plots. List out its advantages and disadvantages. **(10 Marks)**

8 a. Explain sequential covering algorithm for learning disjunctive set of rules with example. **(06 Marks)**

b. Define literal, ground literal, negative literal and positive literal. **(04 Marks)**

c. Explain the basic FOIL algorithm with example and describe how to handle noisy data. **(10 Marks)**

9 a. Explain an analytical learning problem with example. **(10 Marks)**

b. Discuss the explanation based learning algorithm P_{ROLOG} = EBG. **(10 Marks)**

10 a. Discuss inductive learning versus analytical learning. **(08 Marks)**

b. Explain the FOCL algorithm with example. **(12 Marks)**

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