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17CS73

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

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions.

1 a. Explain the designing of a learning system in detail. **(10 Marks)**

b. Define learning. Specify the learning problem for handwriting recognition and robot driving. **(05 Marks)**

c. Explain the issues in machine learning. **(05 Marks)**

2 a. Write the steps involved in find-S algorithm. **(05 Marks)**

b. Apply candidate elimination algorithm to obtain final version space for the training set shown in Table.Q2(b) to infer which books or articles the user reads based on keywords supplied in the article. **(10 Marks)**

Article	Crime	Academes	Local	Music	Reads
a_1	True	False	False	True	True
a_2	True	False	False	False	True
a_3	False	True	False	False	False
a_4	False	False	True	False	False
a_5	True	True	False	False	True

Table.Q2(b)

c. State the inductive bias rote-learner, candidate-elimination and Find-S algorithm. **(05 Marks)**

3 a. Define the following terms with an example for each:
(i) Decision tree (ii) Entropy (iii) Information gain
(iv) Restriction Bias (v) Preference Bias **(10 Marks)**

b. Construct decision tree for the data set shown in Table.Q3(b) to find whether a seed is poisonous or not. **(10 Marks)**

Example	Colour	Toughness	Fungus	Appearance	Poisonous
1	Green	Soft	Yes	Wrinkled	Yes
2	Green	Hard	Yes	Smooth	No
3	Brown	Soft	No	Wrinkled	No
4	Brown	Soft	Yes	Wrinkled	Yes
5	Green	Soft	Yes	Smooth	Yes
6	Green	Hard	No	Wrinkled	No
7	Orange	Soft	Yes	Wrinkled	Yes

Table.Q3(b)

4 a. Explain ID3 algorithm. Give an example. **(10 Marks)**

b. Explain the issues and solutions to those issues in decision tree learning. **(10 Marks)**

5 a. Derive an expression for gradient descent rule to minimize the error. Using the same, write the gradient descent algorithm for training a linear unit. **(10 Marks)**

b. Write back propagation algorithm that uses stochastic gradient descent method. What is the effect of adding momentum to the network? **(10 Marks)**

6 a. List the characteristics of the problems which can be solved using back propagation algorithm. **(05 Marks)**

b. Design a perceptron to implement two input AND function. **(05 Marks)**

c. Derive expressions for training rule of output and hidden unit weights for back propagation algorithm. **(10 Marks)**

7 a. Define Maximum a Posteriori (MAP) hypothesis. Derive an equation for MAP hypothesis using Baye's theorem. **(04 Marks)**

b. Given P(A = True) = 0.3, P(A = False) = 0.7, P(B = True | A = True) = 0.4, P(B = False | A = True) = 0.6, P(B = True | A = False) = 0.6, P(B = False | A = False) = 0.4. Calculate P(A = False/ B = False) using Baye's rule. **(06 Marks)**

c. Given the previous patient's data in the Table.Q7(c). Use Naïve Baye's classifies to classify the new data (Chills = Y, Runny nose = N, Headache = Mild, Fever = Y) to find whether the patient has flue or not. **(10 Marks)**

Chills	Runny nose	Headache	Fever	Flue
Y	N	Mild	Y	N
Y	Y	No	N	Y
Y	N	Strong	Y	Y
N	Y	Mild	Y	Y
N	N	No	N	N
N	Y	Strong	Y	Y
N	Y	Strong	N	N
Y	Y	Mild	Y	Y

Table.Q7(c)

8 a. Describe the features of Bayesian learning methods. **(05 Marks)**

b. A patient takes a lab test and the result comes back positive. It is known that the test returns a correct positive result in only 98% of the cases and a correct negative result is only 97% of the cases. Furthermore only 0.008 of the entire population has this disease.

(i) What is the probability that this patient has cancer?

(ii) What is the probability that he does not have cancer? **(05 Marks)**

c. The Table.Q8(c) provides a set of 14 training examples of the target concept 'Play Tennis' where each day is described by the attributes, outlook, temperature, humidity and wind.

Day	Outlook	Temperature	Humidity	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	Cool	Normal	Weak	Yes
D6	Rain	Cool	Normal	Strong	No
D7	Overcast	Cool	Normal	Strong	Yes
D8	Sunny	Mild	High	Weak	No
D9	Sunny	Cool	Normal	Weak	Yes
D10	Rain	Mild	Normal	Weak	Yes
D11	Sunny	Mild	Normal	Strong	Yes
D12	Overcast	Mild	High	Strong	Yes
D13	Overcast	Hot	Normal	Weak	Yes
D14	Rain	Mild	High	Strong	No

Table.Q8(c)

Use the Naïve Bayes classifier and the training data from this table to classify the following novel instance: <Outlook = Sunny, Temperature = Cool, Humidity = High, Wind = Strong> **(10 Marks)**

9 a. Explain binomial distribution and write the expressions for its probability distribution, mean, variance and standard deviation. **(04 Marks)**

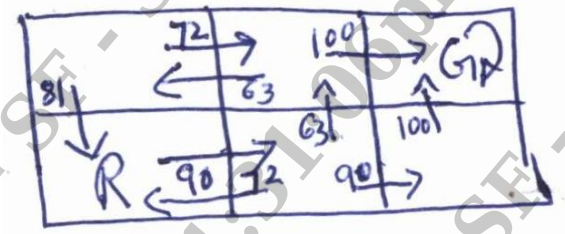
b. Define the following terms:
   (i) Sample error
   (ii) True error
   (iii) N% confidence interval
   (iv) Random variable
   (v) Expected value
   (vi) Variance **(06 Marks)**

c. Write K-Nearest Neighbour algorithm for approximating a discrete values target function. Apply the same for the following three-dimensional training data instances along with one-dimensional output.
   $x_1 = 5, x_2 = 7, x_3 = 3, y = 4$
   $x_1 = 2, x_2 = 4, x_3 = 9, y = 8$
   $x_1 = 3, x_2 = 8, x_3 = 1, y = 2$
   $x_1 = 7, x_2 = 7, x_3 = 2, y = 4$
   $x_1 = 1, x_2 = 9, x_3 = 7, y = 8$
   Consider the query point ($x_1 = 5, x_2 = 3, x_3 = 4$) and K = 3. **(10 Marks)**

10 a. List the steps used for deriving confidence intervals. **(04 Marks)**

b. Explain CADIT system using case based reasoning. **(06 Marks)**

c. Write Q learning algorithm. Consider the following state s_1. Find $\hat{Q}(s_1, a_{right})$ for R given immediate reward as 0 and $\gamma = 0.9$. **(10 Marks)**



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