Nirma University

Institute of Technology

Semester End Examination (IR), December - 2023

B. Tech. in CL / CH / ME / EE, Semester-V

2CSOE51-O Machine Learning

Roll/ Exam No: | **Supervisor's Initial**

Time: 3 Hrs | Max. Marks: 100

Instructions:
1. Attempt all questions.
2. Figures to right indicate full marks.
3. Draw neat sketches wherever necessary.
4. Make suitable assumptions wherever necessary and specify them.
5. Section-wise separate answer book should be used

SECTION - I

Q.1 **Do as directed** **[20]**

A. [CO1, BL2]
(i) Describe the empirical, theoretical, and joint probability concepts with an example. [10]
(ii) Differentiate between
(1) Classification and regression
(2) Gradient descent and normal equation

B. [CO2, BL2] Explain the working of decision trees in terms of entropy, information gain, and Gini index with a suitable example. [10]

Q.2. **Do as directed** **[20]**

A. [CO1, BL2] Illustrate the use of regularization with a suitable example. Explain L1 and L2 regularizations. [10]

B. [CO3, BL3] Discuss three types of Naïve Bayes model with examples. For the dataset given below, predict whether golf will be played or not, given that the outlook is sunny, the temperature is mild, the humidity is normal, and the day is windy using Naïve Bayes algorithm. [10]

SNo.	Outlook	Temperature	Humidity	Windy	Play Golf
1	Rainy	Hot	High	False	No
2	Rainy	Hot	High	True	No
3	Overcast	Hot	High	False	Yes
4	Sunny	Mild	High	False	Yes
5	Sunny	Cool	Normal	False	Yes
6	Sunny	Cool	Normal	True	No
7	Overcast	Cool	Normal	True	Yes
8	Rainy	Mild	High	False	No
9	Rainy	Cool	Normal	False	Yes
10	Sunny	Mild	Normal	False	Yes
11	Rainy	Mild	Normal	True	Yes
12	Overcast	Mild	High	True	Yes
13	Overcast	Hot	Normal	False	Yes
14	Sunny	Mild	High	True	No

OR

B. [CO3, BL3] Discuss the logic behind choosing the optimal value of K in the KNN algorithm. For the dataset below, determine the weight for ID 11 using the KNN regressor algorithm. Consider the value of K = 3. [10]

ID	Height	Age	Weight
1	5	45	77
2	5.11	26	47
3	5.6	30	55
4	5.9	34	59
5	4.8	40	72
6	5.8	36	60
7	5.3	19	40
8	5.8	28	60
9	5.5	23	45
10	5.6	32	58
11	5.5	38	?

Q.3 [CO3, BL3] Use linear SVM model to determine hyperplane equation using support vectors - **[10]**

S1 = (3,1), S2 = (3,-1), S3 = (6,1), S4 = (6,-1)
S5 = (1,0), S6 = (0,1), S7 = (0,-1), S8 = (-1,0)
Here S1, S2, S3, S4 represent positive class and S5, S6, S7, S8 represent a negative class.

SECTION II

Q.4 **Do as directed** **[20]**

A. [CO1, BL2] Explain any four non-linear activation functions with a proper example. [10]

B. [CO2, BL3] Consider a simple perceptron network. Suppose the weights corresponding to the two inputs have the following initial values: w1 = 1.2, w2 = 0.6. Design perceptron to learn AND GATE and determine the final values of weights if the threshold = 1 and [10]

learning rate n = 0.5 are given. Show the updated values of weights in each step.

OR

B. [CO2, BL3] Perceptron can't learn XOR GATE; justify your answer. Demonstrate the backpropagation concept for an artificial neural network with a proper example. [10]

Q.5 **Do as directed** **[20]**

A. [CO1, BL2] Discuss various metrics on which classification methods can be evaluated. [10]

B. [CO2, BL3] List the steps required for the K-means clustering algorithm. Apply the K-means clustering algorithm and Euclidean distance to cluster the following 8 examples into 3 clusters: [10]
A1=(2,10), A2=(2,5), A3=(8,4), A4=(5,8), A5=(7,5), A6=(6,4), A7=(1,2), A8=(4,9).

Q.6 [CO1, BL2] Differentiate between the following (any 4). **[10]**

1. Clustering and classification
2. Bias and variance
3. Overfitting and underfitting
4. Bagging and boosting
5. Soft margin SVM and hard margin SVM
6. Decision tree and random forest

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