Code No. : 42522

VASAVI COLLEGE OF ENGINEERING (Autonomous), HYDERABAD
B.E. (I.T.) IV Year II-Semester Main Examinations, May-2019
Machine Learning

Time: 3 hours   Max. Marks: 70

Note: Answer ALL questions in Part-A and any FIVE from Part-B

Q.No.	Stem of the question	M	L	CO	PO
	Part-A (10 × 2 = 20 Marks)				
1.	Write multivariate normal density function and describe each parameter?	2	2	1	1
2.	Differentiate logistic and linear regressions?	2	3	1	2
3.	Explain rule post-pruning?	2	2	2	1
4.	Define the following measures. i) Gain ii) Gain-Ratio iii) Split-Information	2	2	2	1
5.	What are the derivatives of *tanh* and *logistic* activation functions?	2	2	3	1
6.	What is Gaussian kernel? What is the role of kernel in support vector machines?	2	2	3	1
7.	Differentiate Boosting and Bagging learning algorithms?	2	2	4	2
8.	What are the basic assumptions made in naive Bayes model?	2	2	4	1
9.	What are the advantages and disadvantages of K-means clustering?	2	2	5	2
10.	Write the following distance functions to measure the distance between two data points? i) Euclidean distance function ii) Minkowski distance function.	2	2	5	1
	Part-B (5 × 10 = 50 Marks)				
11. a)	What is L2-Regularized Regression Objective? Derive the solution for the same.	5	4	1	2
b)	Derive the gradient of logistic regression objective with respect to the model parameters	5	3	1	3
12. a)	What is Collaborative Filtering? How does it help a recommendation system?	5	2	2	1
b)	List different criteria for designing decision trees. Identify the critical differences between them?	5	2	2	2
13. a)	Describe the various aspects of SVM optimization objective.	5	2	3	1
b)	What is Deep Neural Network? What is Vanishing gradient problem observed in Deep Neural Networks? How is it addressed?	5	2	3	1

		M	L		
14. a)	Derive the parameters of Naive Bayes model for the following example. Here F1, F2, F3, and F4 are features and Y is label which takes values 1 and 2 indicating class 1 and 2 respectively. The training data to be used is upto example 6 while example 7 is test sample.	6	3	4	3

	F1	F2	F3	F4	Y
1	2	1	0	0	1
2	5	0	3	4	2
3	1	4	1	2	1
4	2	2	1	1	1
5	1	1	4	3	2
6	2	1	6	4	2
7	4	6	2	3	??

Predict the label of the test example in example 7 (whose label is??).

b)	What is VC dimension? How is VC dimension related to modeling complexity?	4	2	4	1
15. a)	Write Expectation Maximization algorithm to compute the parameters of Gaussian mixtures?	6	2	5	2
b)	What is clustering and explain spectral clustering with an example?	4	2	5	1
16. a)	Explain reinforcement learning through an example? Explain the objective function used in reinforcement learning?	5	2	1	1
b)	How Decision Tree handle the issue of *attributes with different costs*? Explain it with an example.	5	2	2	1
17.	Answer any *two* of the following:				
a)	Differentiate deep neural network with multilayer perception? Explain convolutional operation with an example? What is the main objective of CNN?	5	3	3	2
b)	On an airport all passengers are checked carefully. Let T with $t \in \{0, 1\}$ be the random variable indicating whether somebody is a terrorist $(t = 1)$ or not $(t = 0)$ and A with $a \in \{0, 1\}$ be the variable indicating arrest. A terrorist shall be arrested with probability $P(A = 1|T = 1) = 0.98$, a non-terrorist with probability $P(A = 1|T = 0) = 0.001$. One in hundred thousand passengers is a terrorist, $P(T = 1) = 0.00001$. What is the probability that an arrested person actually is a terrorist? Solve it using Bayes theorem?	5	3	4	3
c)	Write K-means clustering algorithm? Apply K-means algorithm to group the visitors to a website in to two clusters using just their age (one-dimensional space) values. Age values of the few visitors are 15, 15, 16, 19, 19, 20, 20, 21, 22, 28, 35, 40, 41, 42, 43, 44, 60, 61, 65. Consider the initial centroid values of clusters as $c1=16.0$ and $c2=22$. Consider Euclidean distance function to measure the distance. Compute upto 1 iteration.	5	3	5	4

M: Marks; L: Bloom's Taxonomy Level.

S. No.	Criteria for questions	Percentage
1	Fundamental knowledge (Level-1 & 2)	65
2	Knowledge on application and analysis (Level-3 & 4)	35
3	*Critical thinking and ability to design (Level-5 & 6) (*wherever applicable)	00

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