GIET UNIVERSITY, GUNUPUR – 765022

Ph.D. (First Semester) Examinations, January – 2024

23SPPECA1011 / 23SPPECS1013 / PPECS1024 – Machine Learning

(CSE)

Time: 3 hrs   Maximum: 70 Marks

The figures in the right hand margin indicate marks.

Answer ANY FIVE Questions   (14 x 5 = 70 Marks)

Marks

1.a. Elaborate on the distinctions between supervised and unsupervised machine learning, providing concrete examples to illustrate the applications and use cases of each approach.   7

b. Write candidate elimination algorithm. Apply the algorithm to obtain the final version space for training example.   7

Sl. No.	Sky	Air Temp	Humidity	Wind	Water	Forecast	Enjoy sport
1	Sunny	Warm	Normal	Strong	Warm	Same	Yes
2	Sunny	Warm	High	Strong	Warm	Same	Yes
3	Rainy	Cold	High	Strong	Warm	Change	No
4	Sunny	Warm	High	Strong	Cool	Change	Yes

2.a. Define the term simple linear regression. Evaluate the regression from the given data and evaluate the standard error.   7

X	1	3	10	16	26	36
Y	42	50	75	100	150	200

b. Define Artificial Intelligence (AI), Machine Learning (ML), Deep Learning, and Data Science, elucidating their distinctions and providing practical examples to illustrate their applications.   7

3.a.   7

Weather	Temperature	Humidity	Sports
Sunny	Hot	High	No
Sunny	Hot	High	No
Overcast	Hot	High	Yes
Rainy	Mild	High	Yes
Rainy	Cool	Normal	Yes
Rainy	Cool	Normal	No
Overcast	Cool	Normal	Yes
Sunny	Mild	High	No

Using the given dataset, calculate the entropy for the target class (Sports: Yes/No). Then, determine which attribute (Weather, Temperature, or Humidity) would be the better choice for the initial split in a decision tree based on information gain, and compute the information gain value for the chosen attribute.

b. Utilizing the provided dataset, compute the Gini index for the target class (Sports: Yes/No). Then, determine which attribute (Weather, Temperature, or Humidity) would be the optimal choice for the initial split in a decision tree based on Gini impurity, and calculate the Gini gain for the selected attribute.

7

4.a. Write and explain decision tree for the following transactions.

Tid	Refund	Marital Status	Total income	Cheat
1.	Yes	Single	125K	No
2.	No	Married	100K	No
3.	No	Single	70K	No
4.	Yes	Married	120K	No
5.	No	Divorced	95K	Yes
6.	No	Married	60K	No
7.	Yes	Divorced	220K	No
8.	No	Single	85K	Yes
9.	No	Married	75K	No
10.	No	Single	90K	Yes

7

7b. For the following set of training samples, find which attribute can be chosen as the root for decision tree classification.

Instance	Classification	A1	A2
1	+	T	T
2	+	T	T
3	-	T	F
4	+	F	F
5	-	F	T
6	-	F	T

7

5.a. What are the fundamental differences between Bagging, Boosting, and AdaBoost in ensemble learning, and how do they contribute to improving predictive models?

7

b. Could you explain the reasoning behind Random Forest being labeled as an Ensemble Method? Also, given the presence of Decision Trees, what advantages or circumstances lead to the utilization of Random Forest as a method?   7

6.a. Artificial Neural Networks (ANNs) are inspired by biological neurons. How do neurons function in the context of ANNs, and what are the key motivations drawn from biology in designing these networks?   7

b. Explain gradient descent and delta rule? Why stochastic approximation to gradient descent is needed?   7

7.a. Describe the multilayer neural network. Explain why back propagation algorithm is required.   7

b. How do kernels enable SVMs to learn non-linear functions? Provide examples of commonly used kernels and their applications.   7

8.a. Compare and contrast the Naive Bayes learning algorithm with other probabilistic classifiers. What are its strengths and limitations?   7

b. The following data set contains factors that determine whether tennis is played or not. Using Naive Bayes classifier, find the play prediction for the day **<Sunny, Cool, High, Strong>**

DAY	OUTLOOK	TEMP	HUMIDITY	WIND	PLAY
Day 1	Sunny	Hot	High	Weak	NO
Day 2	Sunny	Hot	High	Strong	NO
Day 3	Overcast	Hot	High	Weak	YES
Day 4	Rain	Mild	High	Weak	YES
Day 5	Rain	Cool	Normal	Weak	YES
Day 6	Rain	Cool	Normal	Strong	NO
Day 7	Overcast	Cool	Normal	Strong	YES
Day 8	Sunny	Mild	High	Weak	NO
Day 9	Sunny	Cool	Normal	Weak	YES
Day 10	Rain	Mild	Normal	Weak	YES
Day 11	Sunny	Mild	Normal	Strong	YES
Day 12	Overcast	Mild	High	Strong	YES
Day 13	Overcast	Hot	Normal	Weak	YES
Day 14	Rain	Mild	High	Strong	NO

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