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B.Tech DEGREE EXAMINATION, NOVEMBER 2023

Seventh Semester

18BME471T - MACHINE LEARNING AND DEEP LEARNING TECHNIQUES IN MEDICINE

(For the candidates admitted during the academic year 2020 - 2021 & 2021 - 2022)

Note:

i. **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.

ii. **Part - B** and **Part - C** should be answered in answer booklet.

Time: 3 Hours **Max. Marks: 100**

PART - A (20 × 1 = 20 Marks)

Answer **all** Questions

		Marks	BL	CO
1.	Which of the following is an example of unsupervised learning? (A) Image classification (B) Sentiment analysis (C) Clustering customer data (D) Predicting house prices	1	2	1
2.	The VC dimension measures: (A) The complexity of a hypothesis space (B) The capacity of a model to fit random noise (C) The amount of bias in a model (D) The number of data points in a dataset	1	1	1
3.	Increasing the complexity of a model typically leads to: (A) Increased bias and decreased variance (B) Increased bias and increased variance (C) Decreased bias and decreased variance (D) Decreased bias and increased variance	1	2	1
4.	What is the primary goal of Maximum Likelihood Estimation (MLE) in statistical modeling? (A) To minimize the bias of the model (B) To maximize the variance of the model (C) To find the parameter values that maximize the likelihood of the observed data (D) To minimize the variance of the model	1	3	2
5.	What is the name of the model that uses a set of fixed parameters to determine a probability model that is used in Machine Learning (A) Clustering (B) Parametric (C) Non-Parametric (D) Regression	1	1	2
6.	What is the primary objective of Linear Discriminant Analysis (LDA) in dimensionality reduction? (A) To maximize the within-class variance and minimize the between-class variance (B) To maximize the between-class variance and minimize the within-class variance (C) To preserve all features without dimensionality reduction (D) To minimize the reconstruction error of the original data	1	3	2
7.	In K-Means clustering, how is the "centroid" of a cluster typically defined? (A) It is the data point with the highest density in the cluster. (B) It is the mean of all data points in the cluster. (C) It is the data point farthest from all other points in the cluster. (D) It is the median of all data points in the cluster.	1	3	3

8. What is a key advantage of hierarchical clustering over K-Means clustering? 1 4 3

(A) Hierarchical clustering is faster and more scalable.
(B) Hierarchical clustering does not require specifying the number of clusters in advance.
(C) Hierarchical clustering always produces the same results regardless of the initial conditions.
(D) Hierarchical clustering is less sensitive to outliers.

9. In nonparametric classification, what is the primary advantage of using the k-Nearest Neighbor (k-NN) algorithm? 1 4 3

(A) It assumes a specific parametric distribution for the data.
(B) It requires no assumptions about the data distribution.
(C) It is computationally efficient for large datasets.
(D) It is robust to outliers.

10. In a factorial design experiment, if you have two factors, each with three levels, how many treatment combinations are there? 1 5 4

(A) 3
(B) 6
(C) 9
(D) 12

11. In machine learning, what is the primary purpose of K-Fold Cross-Validation? 1 3 4

(A) To increase the computational efficiency of training models
(B) To split the data into train and test sets randomly
(C) To assess a model's performance by partitioning the data into K subsets and using each as a test set
(D) To perform feature selection on the data

12. Dendrogram is used in which clustering technique? 1 1 3

(A) k-means
(B) kNN
(C) Expectation-maximization
(D) Hierarchial clustering

13. Which type of learning algorithm uses unlabeled training data 1 1 1

(A) Semi supervised learning
(B) supervised learning
(C) unsupervised learning
(D) Reinforcement learning

14. In deep neural networks, why is proper weight initialization important? 1 4 6

(A) It reduces the training time required to converge.
(B) It prevents gradient vanishing during training.
(C) It helps prevent the model from getting stuck in local minima.
(D) It ensures that the model starts with all weights equal to zero.

15. What is the main advantage of using mini-batch gradient descent over batch gradient descent? 1 3 5

(A) It guarantees a smaller learning rate.
(B) It converges to the global minimum faster.
(C) It consumes less memory and can be faster for large datasets.
(D) It avoids local minima.

16. Name the method that enhances the generalization by preventing overfitting. 1 1 5

(A) Normalization
(B) Regularization
(C) Numerical approximation
(D) Denoising

17. Which among the following is not an error function 1 1 5

(A) Mean square error
(B) Softmax
(C) Cost
(D) Cross Entropy

18. Which among the following is not an activation function? 1 1 6

(A) Sigmoid
(B) tanh
(C) Cost
(D) Relu

19.	Which method is used for measuring carotid thickness (A) CIMT Ultrasound (B) PET CT (C) DEXA (D) MRI	1	1	5
20.	Which of the following statements is correct (i) On average, neural networks have higher computational rates than conventional computers. (ii) Neural networks learn by example. (iii) Neural networks mimic the way the human brain works. (A) (a) all of them are true (B) (b) (ii) and (iii) are true (C) (c) (i), (ii) and (iii) are true (D) (d)none are true	1	5	6

PART - B (5 × 4 = 20 Marks)

Answer **any 5** Questions

		Marks	BL	CO
21.	Differentiate supervised from unsupervised learning with one example for each.	4	2	1
22.	Explain four different methods used for model selection procedures in machine learning and statistics	4	3	2
23.	Discuss the key differences between the K-Means clustering algorithm and the K-Nearest Neighbors (KNN) classification algorithm. And what types of applications are they commonly used?	4	4	4
24.	Suppose 10,000 patients get tested for flu; out of them, 9,000 are actually healthy and 1,000 are actually sick. For the sick people, a test was positive for 620 and negative for 380. For the healthy people, the same test was positive for 180 and negative for 8,820. Construct a confusion matrix for the data and compute the accuracy, specificity and recall for the data.	4	5	4
25.	Explain the concept of randomization in experimental design. How does it help reduce bias and increase the reliability of experimental results?	4	3	5
26.	Write note on some image denoising techniques	4	3	6
27.	Discuss about the need Regularization and Normalizing in deep learning	4	3	6

PART - C (5 × 12 = 60 Marks)

Answer **all** Questions

		Marks	BL	CO
28.	(a) In a neighborhood, 90% of children were falling sick due flu and 10% due to measles and no other disease. The probability of observing rashes for measles is 0.95 and for flu is 0.08. If a child develops rashes, find the child's probability of having flu.Note: use Bayes theorem	12	3	1
	(OR)			
	(b) Describe the method of classification using Bayes' Theorem along with the relevant terms. Additionally, provide detailed notes on the concepts of loss and risks.			
29.	(a) Write down the step-by-step procedure for performing Principal Component Analysis (PCA) as a method for feature selection in a dataset. Explain each step and the rationale behind it.	12	2	2
	(OR)			
	(b) Describe the method of Linear discriminant analysis along with the discriminant solution. Explain the concepts of within/between class scatter.			
30.	(a) Narrate the procedure to implement KNN algorithm with example problem	12	3	4
	(OR)			
	(b) Describe any four methods of Hierarchical clustering techniques			

31.	(a) Discuss in detail about factorial design and response surface design.	12	4	5
	(OR)			
	(b) Compare and contrast different resampling methods used in machine learning, including K-Fold Cross-Validation, 5x2 Cross-Validation, and Bootstrapping. Discuss their advantages and limitations.			
32.	(a) Describe in detail about any two methods of optimization techniques in deep learning	12	3	6
	(OR)			
	(b) Illustrate the basic CNN architecture with schematic and its application for image registration.			

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