

Q.6

Attempt any two:

- i. Define semi-supervised learning and explain its advantages over supervised and unsupervised learning. Discuss common algorithms used in semi-supervised learning.
- ii. What is reinforcement learning? Explain the difference between value-based and policy-based approaches. Describe the components of a reinforcement learning system.
- iii. Describe the architecture of a CNN. Explain the roles of convolutional layers, pooling layers, and fully connected layers.

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Total No. of Questions: 6

Total No. of Printed Pages: 4

Enrollment No.....



Programme: B.Tech.

Branch/Specialisation: EC

Faculty of Engineering

End Sem Examination Dec 2024

EC3ET05 Introduction to Machine Learning

Duration: 3 Hrs.**Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

Marks	BL	PO	CO	PSO
1	1	2,5	1	1
Q.1 i. Supervised learning requires-				
(a) A labeled dataset for training				
(b) An unlabeled dataset for training				
(c) Both labeled and unlabeled data				
(d) No dataset for training				
ii. The hypothesis space in machine learning refers to-	1	1	2,5	1
(a) The input data provided for training				
(b) The set of all possible functions the model can represent				
(c) The error term in the model				
(d) The test dataset				
iii. What part of a biological neuron is analogous to the activation function in artificial neurons?	1	1	2,5	1
(a) Axon				
(b) Synapse				
(c) Cell body				
(d) Dendrites				
iv. A feedforward neural network-	1	1	2,5	1
(a) Allows connections only in one direction				
(b) Has cycles in the connections				
(c) Uses recurrent connections				
(d) Requires labeled data for training				

	[2]		[3]
v.	Which of the following is NOT an example of a GLM? (a) Logistic regression (b) Poisson regression (c) Ridge regression (d) Linear regression	1 1 2,5 1 1	Q.2 i. Define machine learning. Explain its importance in solving real-world problems with examples. ii. Explain the difference between supervised, unsupervised, and reinforcement learning. Provide examples of each. iii. Derive the cost function for linear regression and explain the gradient descent algorithm for optimizing it.
vi.	In multi-class classification, "One-vs-One" approach involves- (a) Comparing one class against all others (b) Creating models for every possible pair of classes (c) Combining predictions from multiple models (d) Using only one model for all classes	1 2 2,5 2 1	OR iv. Why is evaluation important in machine learning? Describe common evaluation metrics for classification and regression models.
vii.	PCA works by- (a) Rotating the data to align with the axes (b) Finding a set of orthogonal directions that capture the maximum variance in the data (c) Grouping similar data points together (d) Eliminating features with zero variance	1 2 2,5 2 1	Q.3 i. What are activation functions? Write their importance and commonly used types. ii. What is a feedforward neural network? Describe its architecture and working with a suitable example.
viii.	Recommender systems primarily use which of the following approaches? (a) Collaborative filtering and content-based filtering (b) Logistic regression and decision trees (c) Clustering and anomaly detection (d) Dimensionality reduction and PCA	1 2 2,5 2 1	OR iii. Explain the backpropagation algorithm in detail. How does it update the weights in a neural network?
ix.	Which of the following is a common use case for semi-supervised learning? (a) Predicting stock prices (b) Image classification with limited labeled data (c) Detecting anomalies in network traffic (d) Recommender systems	1 1 2,5 1 1	Q.4 i. Compare linear regression and GLMs. Discuss the role of the link function in GLMs. ii. Describe the difference between underfitting and overfitting with examples. How can these issues be addressed?
x.	What is the primary purpose of convolutional layers in a CNN? (a) To connect every neuron to every other neuron (b) To extract features from the input data (c) To reduce the dimensionality of data (d) To compute classification probabilities	1 1 2,5 1 1	OR iii. Discuss the One-vs-All (OvA) and One-vs-One (OvO) approaches for multi-class classification. Highlight their pros and cons.
			Q.5 i. What is anomaly detection, and why is it important? Provide examples of real-world applications. ii. Define clustering. Explain the working of the K-Means algorithm with an example and diagram.
			OR iii. Explain the working of PCA. Derive the mathematical formula for principal components.

Marking Scheme

EC3ET05 (T) Introduction to Machine Learning (T)

Q.1	i) a) A labeled dataset for training (Ans)	1				Q.4	i. Compare linear regression and GLMs. Discuss the role of the link function in GLMs. (1.5+1.5)	3
	ii) b) The set of all possible functions the model can represent (Ans)	1				ii.	difference between underfitting and overfitting with examples.	7
	iii) a) Axon	1				OR	iii. issues be addressed? (4+3) One-vs-All (OvA) and One-vs-One (OvO) approaches. pros and cons. (2+2+3)	7
	iv) a) Allows connections only in one direction (Ans)	1				Q.5	i. anomaly detection, important, examples applications. (1+1+2)	4
	v) c) Ridge Regression (Ans)	1				ii.	Define clustering. working of the K-Means algorithm with an example and diagram. (2+2+1+1)	6
	vi) b) Creating models for every possible pair of classes (Ans)	1				OR	iii. working of PCA. mathematical formula for principal components. (3+3)	
	vii) b) Finding a set of orthogonal directions that capture the maximum variance in the data (Ans)	1				Q.6	Attempt any two:	
	viii) a) Collaborative filtering and content-based filtering (Ans)	1				i.	Define semi-supervised learning, advantages over supervised and unsupervised learning. Discuss common algorithms used in semi-supervised learning (1+2+2)	5
	ix) b) Image classification with limited labeled data (Ans)	1				ii.	reinforcement learning, difference between value-based and policy-based approaches, components. (1+2+2)	5
	x) b) To extract features from the input data (Ans)	1				iii.	architecture of a CNN. roles of convolutional layers, pooling layers, and fully connected layers. (2+1+1+1)	5
Q.2	i. Define Machine Learning. examples. (1+1)	2					*****	
	ii. difference between supervised, unsupervised, and reinforcement learning. examples of each. (1+1+1)	3						
	iii. cost function. gradient descent algorithm. (2+3)	5						
OR	iv. evaluation important. common evaluation metrics. (1+2+2)	5						
Q.3	i. activation functions. importance and commonly used types. (1+1)	2						
	ii. feedforward neural network. Architecture. working with a suitable example. (3+2+3)	8						
OR	iii. backpropagation algorithm in detail. update the weights in a neural network? (4+4)	8						