SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES (AUTONOMOUS)

QUESTION BANK

Year / Semester: III B.Tech VI Semester **Regulation: R23**

Subject and Code: Machine Learning & **23CSM241**

SYLLABUS

UNIT I: INTRODUCTION TO MACHINE LEARNING (9)

Evolution of Machine Learning, Paradigms for ML, Learning by Rote, Learning by Induction, Reinforcement Learning, Types of Data, Matching, Stages in Machine Learning, Data Acquisition, Feature Engineering, Data Representation, Model Selection, Model Learning, Model Evaluation, Model Prediction, Search and Learning, Data Sets.

UNIT 2: NEAREST NEIGHBOUR-BASED MODELS (9)

Introduction to Proximity Measures, Distance Measures, Non-Metric Similarity Functions, Proximity Between Binary Patterns, Different Classification Algorithms Based on the Distance Measures ,K-Nearest Neighbor Classifier, Radius Distance Nearest Neighbor Algorithm, KNN Regression, Performance of Classifiers, Performance of Regression Algorithms.

UNIT 3: MODELS BASED ON DECISION TREES (9)

Decision Trees for Classification, Impurity Measures, Properties, Regression Based on Decision Trees, Bias–Variance Trade-off, Random Forests for Classification and Regression.

The Bayes Classifier: **Introduction to the Bayes Classifier, Bayes‟ Rule and Inference, The Bayes Classifier and its Optimality, Multi-Class Classification | Class Conditional Independence and Naive Bayes Classifier (NBC)**

UNIT 4: LINEAR DISCRIMINANTS FOR MACHINE LEARNING (9)

Introduction to Linear Discriminants, Linear Discriminants for Classification, Perceptron Classifier, Perceptron Learning Algorithm, Support Vector Machines, Linearly Non-Separable Case, Non-linear SVM, Kernel Trick, Logistic Regression, Linear Regression, Multi-Layer Perceptrons (MLPs), Backpropagation for Training an MLP.

UNIT 5: CLUSTERING (9)

Introduction to Clustering, Partitioning of Data, Matrix Factorization |Clustering of Patterns, Divisive Clustering, Agglomerative Clustering, Partitional Clustering, K-Means Clustering, Soft Partitioning, Soft Clustering, Fuzzy C-Means Clustering, Rough Clustering, Rough K-Means Clustering Algorithm, Expectation Maximization-Based Clustering, Spectral Clustering.

Prepared by J. Shaik Mohammed & Dr Rajani Kanth. VELURU

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Max Marks: 10

S.No.	CO	Questions	BT
Unit I: (INTRODUCTION TO MACHINE LEARNING)			
1	**1**	**a.** Explain the evolution of Machine Learning and its major milestones. (5M) **b.** Analyze the paradigms of Machine Learning with suitable examples. (5M)	**L4**
2	**1**	Apply the stages of Machine Learning to design a predictive model for house price estimation.	**L3**
3	**1**	Analyze the importance of Feature Engineering and Data Representation in model performance.	**L4**
4	**1**	Illustrate Learning by Rote, Learning by Induction, and Reinforcement Learning with examples.	**L3**
5	**1**	Evaluate different model evaluation metrics and justify their suitability for classification problems.	**L5**
6	**1**	Analyze the role of Search strategies in Machine Learning hypothesis space exploration.	**L4**
7	**1**	Apply preprocessing techniques to handle missing values and noisy data.	**L3**
8	**1**	Evaluate model selection strategies to avoid overfitting and underfitting.	**L5**
9	**1**	Analyze different types of datasets (structured, unstructured, labeled, unlabeled) and their impact on ML algorithms.	**L4**
10	**1**	Apply Machine Learning concepts to solve a real-world problem of spam email detection.	**L3**
11	**1**	Apply the stages of Machine Learning to design a predictive model for house price estimation.	**L3**

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S.No.	CO	Questions	BT
Unit II: (NEAREST NEIGHBOUR-BASED MODELS)			
1	**2**	**a.** Explain various distance measures used in proximity-based learning. (5M) **b.** Analyze their effect on classification performance. (5M)	**L4**
2	**2**	Apply K-Nearest Neighbor (KNN) algorithm for classification on a sample dataset.	**L3**
3	**2**	Analyze the Radius Distance Nearest Neighbor algorithm and compare it with KNN.	**L4**
4	**2**	Demonstrate KNN Regression with suitable example.	**L3**
5	**2**	Evaluate the performance of KNN in high-dimensional feature space.	**L5**
6	**2**	Analyze similarity functions for binary patterns and compute proximity.	**L4**
7	**2**	Apply appropriate performance metrics for evaluating regression models.	**L3**
8	**2**	Evaluate advantages and limitations of nearest neighbor-based models.	**L5**
9	**2**	Analyze the impact of 'K' on bias–variance trade-off in KNN.	**L4**
10	**2**	Apply normalization techniques before distance-based classification and justify their necessity.	**L3**
11	**2**	Apply K-Nearest Neighbor (KNN) algorithm for classification on a sample dataset.	**L4**

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S.No.	CO	Questions	BT
Unit III: (MODELS BASED ON DECISION TREES)			
1	3	**a.** Explain impurity measures (Entropy, Gini Index). (5M) **b.** Analyze their influence in decision tree construction. (5M)	L4
2	3	Apply Decision Tree algorithm to classify a given dataset.	L3
3	3	Analyze the Bias–Variance Trade-off in Decision Trees.	L4
4	3	Demonstrate regression using Decision Trees with suitable example.	L3
5	3	Evaluate Random Forests in comparison with individual Decision Trees.	L5
6	3	Analyze Bayes' Rule and derive the Bayes Classifier.	L4
7	3	Apply Naive Bayes Classifier for multi-class classification.	L3
8	3	Evaluate the optimality property of Bayes Classifier.	L5
9	3	Analyze the assumption of class conditional independence in Naive Bayes.	L4
10	3	Apply Bayesian inference to compute posterior probabilities for a given dataset.	L3
11	3	Explain Decision Tree algorithm to classify a given dataset.	L3

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S.No.	CO	Questions	BT
Unit IV: (LINEAR DISCRIMINANTS FOR MACHINE LEARNING)			
1	**4**	**a.** Explain the Perceptron Learning Algorithm. (5M) **b.** Analyze its convergence theorem. (5M)	**L4**
2	**4**	Apply Logistic Regression for binary classification and derive its cost function.	**L3**
3	**4**	Analyze Support Vector Machines (SVM) for linearly separable case.	**L4**
4	**4**	Demonstrate Linear Regression using gradient descent method.	**L3**
5	**4**	Evaluate the importance of Kernel Trick in non-linear SVM.	**L5**
6	**4**	Analyze hard-margin and soft-margin SVM formulations.	**L4**
7	**4**	Apply Backpropagation algorithm for training a Multi-Layer Perceptron.	**L3**
8	**4**	Evaluate performance differences between Logistic Regression and SVM.	**L5**
9	**4**	Analyze the mathematical formulation of linear discriminant functions.	**L4**
10	**4**	Apply perceptron learning rule to update weights for a given dataset.	**L3**
11	**4**	Analyze the performance between FFNN & BPNN.	**L3**

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S.No.	CO	Questions	BT
Unit V: (CLUSTERING)			
1	5	**a.** Compare Agglomerative and Divisive Clustering methods. (5M) **b.** Analyze their computational complexity. (5M)	L4
2	5	Apply K-Means Clustering algorithm to compute centroids for a given dataset.	L3
3	5	Analyze Fuzzy C-Means Clustering algorithm and its objective function.	L4
4	5	Demonstrate Expectation Maximization (EM) algorithm for clustering.	L3
5	5	Evaluate Spectral Clustering and justify its advantages over K-Means.	L5
6	5	Analyze Soft Partitioning and differentiate it from Hard Clustering.	L4
7	5	Apply Rough K-Means Clustering algorithm to a dataset.	L3
8	5	Evaluate EM-based clustering models in probabilistic framework.	L5
9	5	Analyze similarity matrix and graph Laplacian in Spectral Clustering.	L4
10	5	Apply Hierarchical Clustering and construct a dendrogram.	L3
11	5	Differentiate between Fuzzy K-Means Clustering & Fuzzy C means.	L3

Note: L1-Remembering, L2-Understanding, L3-Applying, L4-Analyzing, L5-Evaluating, and L6-Creating

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The Six Levels of Bloom's Taxonomy:

1. **Remembering:** Retrieving, recognizing, and recalling relevant knowledge from long-term memory (e.g., list, define, name, locate).
2. **Understanding:** Constructing meaning, explaining ideas, or concepts (e.g., summarize, interpret, classify, compare).
3. **Applying:** Using information in new situations or implementing procedures to solve problems (e.g., solve, use, demonstrate, implement).
4. **Analyzing:** Breaking material into constituent parts, determining how the parts relate to one another and to an overall structure (e.g., contrast, categorize, distinguish, diagram).
5. **Evaluating:** Making judgments based on criteria and standards through checking and critiquing (e.g., judge, critique, justify, defend, argue).
6. **Creating:** Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure (e.g., design, construct, develop, formulate).

Instruction to Faculty Members:

- **Strictly follow the prescribed question paper template without deviation.**
- **Text book reference to quoted end of the fifth unit**
- **Set a** minimum of ten (11) **and a** maximum of fifteen (15) **subjective questions per unit. Each question shall carry** ten (10) marks**.**
- **Questions may include sub-questions as per the prescribed pattern: B.Tech: 10M** or **5M + 5M** or **6M + 4M**
- **For** M.Tech**, questions shall be set as per the following pattern only: 12M** or **6M + 6M**