SRM VALLIAMMAI ENGEINEERING COLLEGE

(An Autonomous Institution)

DEPARTMENT OF COMPUTER APPLICATIONS

QUESTION BANK

II SEMESTER

PMC301 MACHINE LEARNING FOR DATA SCIENCE

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SUBJECT : PMC301 MACHINE LEARNING FOR DATA SCIENCE
SEM / YEAR : III / II year MCA

UNIT I- INTRODUCTION TO MACHINE LEARNING

Machine Learning – Basic concepts – Types of Machine learning – Examples & Applications – Data Pre-processing – Noise Removal – Normalization – Bias & Variance, Review on Probability – Conditional probability – Bayesian conditional probability.

Q.No.	Question	Bloom's Taxonomy Level	Competence	Course Outcome
	PART – A			
1.	What is Machine Learning?	BTL -1	Remembering	CO 1
2	Compare Machine Learning and Traditional Programming.	BTL -2	Understanding	CO 1
3	How does machine learning works.	BTL -2	Understanding	CO 1
4	When do we use Machine Learning?	BTL -1	Remembering	CO 1
5	List different types of learning algorithms.	BTL -2	Understanding	CO 1
6	List the Applications of Machine Learning.	BTL -1	Remembering	CO 1
7.	Define Bayesian conditional probability.	BTL -2	Understanding	CO 1
8.	Why do we need data pre-processing?	BTL -1	Remembering	CO 1
9.	What do you mean by a well –posed learning problem?	BTL -2	Understanding	CO 1
10	Differentiate between Training data and Testing Data.	BTL -1	Remembering	CO 1
11	What are the issues in Machine Learning?	BTL -1	Remembering	CO 1
12	Define Noise.	BTL -1	Remembering	CO 1
13	What is the difference between a preference bias and a representation bias?	BTL -2	Understanding	CO 1
14.	What is Bias?	BTL -1	Remembering	CO 1
15.	What happens when our model has a high variance?	BTL -2	Understanding	CO 1
16.	What is data normalization?	BTL -2	Understanding	CO 1
17.	Differentiate between Supervised, Unsupervised and Reinforcement Learning	BTL -2	Understanding	CO 1
18.	Explain the steps required for selecting the right machine learning algorithm.	BTL -1	Remembering	CO 1
19.	What are the Key elements of Machine Learning	BTL -1	Remembering	CO 1
20.	Define Restriction Bias	BTL -1	Remembering	CO 1
21.	Define Conditional probability.	BTL -2	Understanding	CO 1

22.	In a class, there are 70% of the students who like English and 40% of the students who likes English and mathematics, and then what is the percent of students those who like English also like mathematics?	BTL -1	Apply	CO 1
23.	Write down Bayes Rule.	BTL -2	Understanding	CO 1
24.	What is the probability that a patient has diseases with a stiff neck? Given Data: meningitis A doctor is aware that disease meningitis causes a patient to have a stiff neck, and it occurs 80% of the time. He is also aware of some more facts, which are given as follows: The Known probability that a patient has meningitis disease is 1/30,000. The Known probability that a patient has a stiff neck is 2%.	BTL -1	Remembering	CO 1
25.	Define Probability and the probability of occurrence.	BTL -2	Understanding	CO 1
	PART – B			
1.	Discuss the techniques to deal with Noisy Data.	BTL -3	Applying	CO 1
2.	Discuss the methods to handle Missing Data and Outliers.	BTL -3	Applying	CO 1
3.	(i) Suppose in a city, 1% of people have a particular disease (Event A). There's a test for the disease, but it's not perfect. If you have the disease, the test will correctly identify it 99% of the time. However, if you don't have the disease, the test will still say you do 2% of the time. If someone tests positive (Event B), what's the probability they actually have the disease? (ii) Suppose in a city, on any given day, there's a 20% chance of rain (Event A). If it rains, there's an 80% chance of traffic jams (Event B). On days without rain, there's a 30% chance of traffic jams due to other factors. If there's a traffic jam, what's the probability it rained?	BTL -3	Applying	CO 1
4.	Explain the fundamental concepts of Machine Learning and its types with suitable examples.	BTL -4	Analyzing	CO 1
6.	Compare and contrast the different normalization techniques used in data preprocessing. How do they influence ML model performance?	BTL5	Evaluating	CO 1
7.	Differentiate between Bias and Variance. How does it affect model performance? Suggest techniques to handle both.	BTL -4	Analyzing	CO 1
8.	Explain the concept of conditional probability and apply Bayes' Theorem to a real-world classification problem.	BTL -4	Analyzing	CO 1
9.	What is noise in data? Explain the methods to identify and remove noise from datasets. Why is it important in ML models?	BTL -3	Applying	CO 1

10.	Explain the impact of data quality on machine learning performance. How does preprocessing help mitigate data-related issues?	BTL -2	Understanding	CO 1
11.	Discuss the various stages of data preprocessing in Machine Learning with appropriate techniques. Illustrate with an example dataset.	BTL -3	Applying	CO 1
12.	Classify the different types of machine learning with examples and discuss their typical use cases.	BTL -3	Applying	CO 1
13.	What is meant by overfitting and underfitting in ML models? How does the bias-variance tradeoff explain this phenomenon?	BTL5	Evaluating	CO 1
14.	Design a machine learning pipeline from raw data to model evaluation. Justify the role of each component.	BTL6	Creating	CO 1
15.	Apply Bayes' Theorem to a binary classification problem. Derive the formula and explain its significance in probabilistic models.	BTL -3	Applying	CO 1
16.	Illustrate how normalization improves model accuracy and convergence. Compare different normalization methods.	BTL -4	Analyzing	CO 1
17.	Describe the differences between probability, conditional probability, and Bayesian probability with real-world examples.	BTL6	Creating	CO 1
18.	Evaluate the role of noise detection and removal techniques in improving machine learning model robustness.	BTL3	Applying	CO 1

UNIT II SUPERVISED LEARNING

Linear Regression Models: Multiple regression – Logistic regression, Naïve Bayes classifier, Nearest Neighbor and KNN Algorithm, Decision Trees, Support Vector Machines, Kernel functions.

Q.No.	Question	Bloom's Taxonomy Level	Competence	Course Outcome
	PART – A			
1.	What is Supervised Learning?	BTL-2	Understanding	CO 2
2.	List some examples of Regression Analysis	BTL-2	Understanding	CO 2
3.	List the Terminologies Related to the Regression Analysis.	BTL-2	Understanding	CO 2
4.	What is Regression Analysis in Machine learning ?	BTL-1	Remembering	CO 2
5.	Define Multicollinearity	BTL-2	Understanding	CO 2
6.	Define overfitting.	BTL-1	Remembering	CO 2
7.	Define Underfitting.	BTL-1	Remembering	CO 2
8.	Why do we use Regression Analysis?	BTL-2	Understanding	CO 2
9.	What are the various types of Regression?	BTL-2	Understanding	CO 2
10.	What is linear regression?	BTL-2	Understanding	CO 2
11.	What are the types of linear regression?	BTL-2	Understanding	CO 2
12.	Compare Simple Linear Regression and Multi Linear Regression.	BTL-5	Evaluating	CO 2
13.	What are the two categories of classification algorithms?	BTL-1	Remembering	CO 2
14.	Define entropy.	BTL-2	Understanding	CO 2
15.	Compare classification and regression models.	BTL-5	Evaluating	CO 2

16.	What is the principle of ordinary least square in linear regression?	BTL-1	Remembering	CO 2
17.	Enumerate the advantages of Support Vector Machine.	BTL-2	Understanding	CO 2
18.	Why do we need data preprocessing before applying K-NN?	BTL-1	Remembering	CO 2
19.	Explain about Soft margin support vector machines.	BTL-1	Remembering	CO 2
20.	What are the Metrics used to validate the result of regression? Explain each of them.	BTL-1	Remembering	CO 2
21.	What is decision tree?	BTL-2	Understanding	CO 2
22.	Distinguish clustering and classification.	BTL-1	Remembering	CO 2
23.	Relate entropy and information gain	BTL-1	Remembering	CO 2
24.	How does CART solve the regression problems?	BTL-1	Remembering	CO 2
25.	What are the ways to secure that a machine learning model is generalized?	BTL-2	Understanding	CO 2
	PART –B			
1.	(i) What are the assumptions of multiple linear regression ? (ii) List the regression model evaluation metrics.	BTL5	Evaluating	CO 2
2.	Support Vector Machine Algorithm. Give an example.	BTL -3	Applying	CO 2
3.	Explain logistic regression with suitable example	BTL -2	Understanding	CO 2
4.	Explain the difference between linear and logistic regression with example.	BTL -5	Evaluating	CO 2
5.	What are Regression trees? Write the procedure to construct regression trees and explain with example	BTL-4	Analyzing	CO 2
6.	What is the role of kernels? Classify the different type of Kernel.	BTL-4	Analyzing	CO 2
7.	Write short notes on (i) Regression and Correlation (ii) Limitation of Regression model	BTL-3	Applying	CO 2
8.	List the advantages of SVM and how optimal hyperplane differs from hyperplane	BTL-3	Applying	CO 2
9.	Consider a boy who has a volleyball tournament the next day but feels sick today. Usually, there is only a 40% chance he would fall sick since he is a healthy boy. Now, find the probability of the boy participating in the tournament. The boy is very interested in volleyball, so there is a 90% probability that he will participate in tournaments and 20% fall sick, given that he particiapates in the tournament.	BTL -3	Applying	CO 2
10.	Explicate the weighted K-nearest Neighbour algorithm with a suitable sketch.	BTL-4	Analyzing	CO 2
11.	Mention the methods of measuring Classifier performance with suitable examples.	BTL -3	Applying	CO 2
12.	Explain in detail about Naive Bayes Classifier Algorithm.	BTL -3	Applying	CO 2
13.	Write in detail about Decision tree.	BTL-3	Applying	CO 2
14.	Explain the working of multiple linear regression. Derive the normal equation for multiple variables.	BTL-3	Applying	CO 2

15.	Given a dataset with three independent variables and one dependent variable, compute the regression coefficients using the least squares method.	BTL-4	Analyzing	CO 2
16.	Given a dataset of patient symptoms, fit a logistic regression model and interpret the model output (odds, log-odds).	BTL3	Applying	CO 2
17.	Explain how to evaluate classification models using confusion matrix, accuracy, precision, recall, and F1 score.	BTL5	Evaluating	CO 2
18.	Explain how decision trees are constructed using entropy and information gain. Build a decision tree for a sample dataset.	BTL6	Creating	CO 2

UNIT – III NEURAL NETWORKS, ENSEMBLE TECHNIQUES 9

Artificial Neural Network(ANN), perceptron, multilayer perceptron, Back propagation network(BPN) activation functions, gradient descent optimization, error back propagation, Unit saturation (vanishing gradient problem) - ReLU, hyper parameter tuning, batch normalization, regularization, Ensemble Methods – Bagging, Boosting.

Q.No.	Question	Bloom's Taxonomy Level	Competence	Course Outcome
	PART – A			
1.	State the Perceptron rule.	BTL-2	Understanding	CO 3
2.	Write the types of Gradient descent and differentiate it.	BTL-2	Understanding	CO 3
3.	How to minimize the error in back backpropagation algorithm?	BTL-2	Understanding	CO 3
4.	What is the use of Stochastic Gradient Descent?	BTL-1	Remembering	CO 3
5.	Define Artificial Neural Network.	BTL-2	Understanding	CO 3
6.	What are the type of problems in which Artificial Neural Network can be applied?	BTL-1	Remembering	CO 3
7.	What are the difficulties in applying Gradient Descent?	BTL-1	Remembering	CO 3
8.	What are the conditions in which Gradient Descent is applied?	BTL-1	Remembering	CO 3
9.	What do you mean by Gradient Descent?	BTL-2	Understanding	CO 3
10.	Distinguish between Bagging and Boosting	BTL-1	Remembering	CO 3
11.	List out significant parts of biological neuron	BTL-2	Understanding	CO 3
12.	Give the types of artificial neural networks	BTL-1	Remembering	CO 3
13.	Discuss on ReLU.	BTL-2	Understanding	CO 3
14.	Clarify how to train a neural network.	BTL-1	Remembering	CO 3
15.	List any two types of activation functions used in neural networks.	BTL-2	Understanding	CO 3
16.	What is the vanishing gradient problem?	BTL-1	Remembering	CO 3
17.	Define batch normalization.	BTL-1	Remembering	CO 3
18.	Name two ensemble techniques used in machine learning.	BTL-2	Understanding	CO 3
19.	What is the main idea behind boosting?	BTL-1	Remembering	CO 3

20.	State the function of an activation function in neural networks.	BTL-2	Understanding	CO 3
21.	List the difference between bagging and boosting in ensemble learning	BTL-1	Remembering	CO 3
22.	What is the role of gradient descent in training neural networks?	BTL-2	Understanding	CO 3
23.	Define regularization. Why is it important in deep learning models?	BTL-1	Remembering	CO 3
24.	Differentiate between supervised learning and reinforcement learning.	BTL-1	Remembering	CO 3
25.	State two issues caused by the vanishing gradient problem.	BTL-2	Understanding	CO 3
	PART –B			
1.	Discuss the steps involved in the backpropagation algorithm	BTL-3	Applying	CO 3
2.	Explain hyper parameter tuning with example	BTL-3	Applying	CO 3
3.	Elaborate Activation functions in detail.	BTL-3	Applying	CO 3
4.	What is back propagation? How Backpropagation Algorithm Works?	BTL-3	Applying	CO 3
5.	Demonstrate the strategies for Hyperparameter tuning.	BTL-4	Analyzing	CO 3
6.	Write in detail the vanishing gradient problem.	BTL-3	Applying	CO 3
7.	Explain the architecture and functioning of an Artificial Neural Network. Illustrate with a simple example.	BTL-3	Applying	CO 3
8.	Compare and contrast Perceptron and Multilayer Perceptron (MLP). Why is MLP more powerful?	BTL-4	Analyzing	CO 3
9.	Describe the working of a single-layer perceptron with a mathematical formulation and an example.	BTL-3	Applying	CO 3
10.	Explain the Backpropagation algorithm used for training Multilayer Perceptrons. Derive the weight update rule.	BTL-3	Applying	CO 3
11.	Given a small dataset, demonstrate one epoch of feedforward and backpropagation computations for a simple neural network.	BTL-3	Applying	CO 3
12.	Discuss gradient descent optimization in detail. Compare it with stochastic and mini-batch gradient descent.	BTL-5	Evaluating	CO 3
13.	Describe commonly used activation functions (Sigmoid, Tanh, ReLU, Leaky ReLU). Compare their characteristics.	BTL-4	Analyzing	CO 3
14.	Explain various hyperparameters in neural networks. How do they affect learning and performance?	BTL4	Analyzing	CO 3
15.	Discuss strategies for hyperparameter tuning. Compare grid search, random search, and Bayesian optimization.	BTL6	Creating	CO 3
16.	Explain batch normalization. Derive its computation and discuss its role in training deep networks.	BTL3	Applying	CO 3
17.	Describe L1 and L2 regularization. How do they help in preventing overfitting in neural networks?	BTL2	Understanding	CO 3
18.	Evaluate the advantages of ensemble learning over individual models. Give real-world applications.	BTL5	Evaluating	CO 3

UNIT – IV UNSUPERVISORY & REINFORCEMENT LEARNING

Clustering – Distance Function, Minimum, maximum & average connection, Hierarchical Clustering, agglomerative – K Means clustering, Self-organizing Map, Reinforcement Learning overview.

Q.No.	Question	Bloom's Taxonomy Level	Competence	Course Outcome
	PART – A			
1.	What is Reinforcement Learning?	BTL-1	Remembering	CO 4
2.	Discuss the major drawbacks of K-nearest Neighbour learning Algorithm and how it can be corrected	BTL-1	Remembering	CO 4
3.	Identify challenges of the clustering algorithm.	BTL-1	Remembering	CO 4
4.	Define clustering in machine learning.	BTL-1	Remembering	CO 4
5.	Name any two distance functions used in clustering.	BTL-1	Remembering	CO 4
6.	Write the formula for Euclidean distance between two points.	BTL-3	Applying	CO 4
7.	What is Manhattan distance?	BTL-1	Remembering	CO 4
8.	What is the main goal of clustering algorithms?	BTL-2	Understanding	CO 4
9.	Differentiate between minimum and maximum linkage in hierarchical clustering.	BTL-2	Understanding	CO 4
10.	What is average linkage in hierarchical clustering?	BTL-2	Understanding	CO 4
11.	Mention the two main types of hierarchical clustering.	BTL-1	Remembering	CO 4
12.	What is agglomerative clustering?	BTL-2	Understanding	CO 4
13.	List the steps in agglomerative clustering.	BTL-2	Understanding	CO 4
14.	What is a dendrogram?	BTL-2	Understanding	CO 4
15.	How does hierarchical clustering differ from K-Means?	BTL-4	Analysing	CO 4
16.	Define centroid in the context of K-Means clustering.	BTL-1	Remembering	CO 4
17.	How are centroids updated in K-Means clustering?	BTL-3	Applying	CO 4
18.	Name any two limitations of K-Means clustering.	BTL-1	Remembering	CO 4
19.	What is meant by the number of clusters (k) in K-Means?	BTL-2	Understanding	CO 4
20.	What is the objective of the K-Means algorithm?	BTL-2	Understanding	CO 4
21.	What is initialization sensitivity in K-Means?	BTL-1	Remembering	CO 4
22.	What is a Self-Organizing Map (SOM)?	BTL-2	Understanding	CO 4
23.	Mention any one application of Self-Organizing Maps.	BTL1	Remembering	CO 4
24.	What is the structure of a Self-Organizing Map?	BTL2	Understanding	CO 4
25.	What are the key elements of reinforcement learning?	BTL2	Understanding	CO 4
	PART –B			
1.	Define clustering. Describe the types of clustering and their real-world applications.	BTL3	Applying	CO 4
2.	Compare and contrast minimum, maximum, and average linkage methods in hierarchical clustering. Illustrate with diagrams.	BTL5	Evaluating	CO 4

3.	Given a small dataset, perform agglomerative hierarchical clustering using Euclidean distance and complete linkage. Show all steps.	BTL4	Analyzing	CO 4
4.	Discuss the advantages and limitations of hierarchical clustering. How does linkage choice affect results?	BTL4	Analyzing	CO 4
5.	Explain how the number of clusters (K) affects K-Means. How can we determine the optimal K value?	BTL4	Analyzing	CO 4
6.	Explain various distance metrics used in clustering: Euclidean, Manhattan, and cosine distance. Provide examples.	BTL3	Applying	CO 4
7.	Explain hierarchical clustering with a step-by-step procedure for agglomerative clustering. Draw a dendrogram for a sample dataset.	BTL3	Applying	CO 4
8.	Describe the K-Means clustering algorithm with its working steps. Apply it to a small dataset and show cluster formation.	BTL3	Applying	CO 4
9.	Compare K-Means and Hierarchical Clustering in terms of efficiency, interpretability, and scalability.	BTL4	Analyzing	CO 4
10.		BTL3	Applying	CO 4
11.	Compare K-Means and Hierarchical Clustering in terms of efficiency, interpretability, and scalability.	BTL4	Analyzing	CO 4
12.	Describe the architecture and learning algorithm of a Self-Organizing Map (SOM). Include a labeled diagram.	BTL3	Applying	CO 4
13.	Explain how the number of clusters (K) affects K-Means. How can we determine the optimal K value?	BTL5	Evaluating	CO 4
14.	Apply SOM to a small numerical dataset. Show how the map is formed and weights are updated.	BTL4	Analyzing	CO 4
15.	Discuss the advantages and limitations of Self-Organizing Maps in clustering and visualization.	BTL5	Evaluating	CO 4
16.	Define reinforcement learning. Explain the key components: agent, environment, state, action, reward.	BTL2	Understanding	CO 4
17.	Explain the exploration vs. exploitation dilemma in reinforcement learning. Why is it important?	BTL5	Evaluating	CO 4
18.	Explain the structure of a basic Markov Decision Process (MDP). How is it used in reinforcement learning?	BTL3	Applying	CO 4

UNIT – V GRAPHICAL MODELS & DIMENSION REDUCTION 9
Directed Graphical Models, Bayesian Networks, Markov Models, Hidden Markov Models, Inference-Learning Generalization, Dimension reduction-Curse of Dimensionality, PCA

Q.No.	Question	Bloom's Taxonomy Level	Competence	Course Outcome
	PART – A			
1.	Define a Directed Graphical Model.	BTL-1	Remembering	CO 5
2.	What is the primary function of a Bayesian Network?	BTL-1	Remembering	CO 5

3.	State the difference between probabilistic graphical models and decision trees.	BTL-2	Understanding	CO 5
4.	What is meant by cross-validation and resampling?	BTL-1	Remembering	CO 5
5.	Define conditional independence in Bayesian networks.	BTL-1	Remembering	CO 5
6.	What is the Markov assumption in Markov Models?	BTL-2	Understanding	CO 5
7.	Differentiate between Markov Models and Bayesian Networks.	BTL-4	Analyzing	CO 5
8.	What are transition and emission probabilities in Hidden Markov Models (HMMs)?	BTL-2	Understanding	CO 5
9.	Define Hidden Markov Model (HMM).	BTL-2	Understanding	CO 5
10.	State one application of Hidden Markov Models in real life.	BTL-2	Understanding	CO 5
11.	What is inference in the context of probabilistic models?	BTL-1	Remembering	CO 5
12.	Name any two inference methods used in graphical models.	BTL-1	Remembering	CO 5
13.	What is learning in graphical models?	BTL-1	Remembering	CO 5
14.	What is generalization in machine learning?	BTL-2	Understanding	CO 5
15.	Define curse of dimensionality.	BTL-1	Remembering	CO 5
16.	What is meant by dimensionality reduction?	BTL-2	Understanding	CO 5
17.	Mention any two techniques for dimensionality reduction.	BTL-1	Remembering	CO 5
18.	Differentiate between feature selection and feature extraction.	BTL-2	Understanding	CO 5
19.	State one disadvantage of high-dimensional data in ML models.	BTL-2	Understanding	CO 5
20.	What is the purpose of Principal Component Analysis (PCA)?	BTL-2	Understanding	CO 5
21.	Mention the steps involved in PCA.	BTL-2	Understanding	CO 5
22.	What is an eigenvector in the context of PCA?	BTL-2	Understanding	CO 5
23.	Write the mathematical expression for PCA transformation.	BTL-1	Remembering	CO 5
24.	What is the significance of eigenvalues in PCA?	BTL-2	Understanding	CO 5
25.	.State one key limitation of PCA	BTL-1	Remembering	CO 5
	PART –B			
1.	Explain Directed Graphical Models with examples. How are they used to represent joint probability distributions?	BTL-3	Applying	CO 5
2.	Describe the components of Hidden Markov Models (HMMs). How are they different from observable Markov models?	BTL2	Understanding	CO 5
3.	Construct a Bayesian Network for a real-world scenario (e.g., medical diagnosis or spam detection). Justify the dependencies.	BTL-3	Applying	CO 5
4.	Describe the structure and semantics of Bayesian Networks. How do they model conditional independence?	BTL-4	Analyzing	CO 5
5.	Compare Bayesian Networks with Markov Networks. Discuss their strengths and limitations.	BTL-4	Analyzing	CO 5

6.	Given a simple observation sequence and HMM parameters, compute the likelihood using the Forward Algorithm.	BTL-4	Analyzing	CO 5
7.	Describe the Viterbi algorithm for decoding in HMMs. Show its working with a small example.	BTL-4	Analyzing	CO 5
8.	Define Markov Models and explain their properties. How are they applied in temporal data modeling?	BTL-3	Applying	CO 5
9.	Explain the three fundamental problems of HMMs (Evaluation, Decoding, Learning). Mention algorithms used.	BTL-3	Applying	CO 5
10.	What is probabilistic inference in graphical models? Explain exact and approximate inference techniques.	BTL-3	Applying	CO 5
11.	Discuss the learning process in Bayesian Networks. How are parameters learned from complete data?	BTL-3	Applying	CO 5
12.	Define generalization in machine learning. How is it affected by model complexity and overfitting?	BTL-5	Evaluating	CO 5
13.	Compare inference and learning in Markov and Bayesian models. When is each used?	BTL-3	Applying	CO 5
14.	Explain the concept of the Curse of Dimensionality. What challenges does it create in machine learning models?	BTL-4	Analyzing	CO 5
15.	Discuss the impact of high-dimensional data on clustering and classification algorithms. Provide examples.	BTL-3	Applying	CO 5
16.	Differentiate between feature selection and feature extraction. How do they help reduce dimensionality?	BTL-4	Analyzing	CO 5
17.	Explain the steps involved in Principal Component Analysis (PCA) for dimensionality reduction.	BTL-3	Applying	CO 5
18.	Evaluate the applications of HMMs in real-time systems like speech recognition, bioinformatics, and finance.	BTL5	Evaluating	CO 5

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