SRM VALLIAMMAI ENGINEERING COLLEGE

(An autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF

ELECTRONICS AND INSTRUMENTATION ENGINEERING

QUESTION BANK

III SEMESTER(M.E.C&I)

1912105 MACHINE LEARNING

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Unit -I

SYLLABUS

INTRODUCTION

Machine learning: What and why? - Examples of Machine Learning Applications - Types Of Machine Learning Supervised Learning - Machine Learning Process- The Curse of Dimensionality, Overfitting - Training, Testing, and Validation Sets-The Confusion Matrix & Basic Statistics-Bias-Variance Tradeoff.

PART – A

Q.No	Questions	Competence	BT Level
1	What is machine learning?	Remember	BTL1
2	Point out few examples of machine learning applications.	Analyze	BTL 4
3	Distinguish between supervised and unsupervised learning.	Understand	BTL 2
4	List the types of machine learning.	Remember	BTL 1
5	Discuss about the supervised learning.	Understand	BTL 2
6	Discover one useful perspective on machine language.	Apply	BTL3
7	Point out the issues in machine learning.	Analyze	BTL 4
8	Assess the role of the curse of dimensionality in machine learning.	Evaluate	BTL 5
9	Define the regression problem in statistics.	Remember	BTL 1
10	Assess about training of the machine learning process.	Evaluate	BTL 5
11	Define activation function.	Remember	BTL 1
12	Develop Euclidean distance input and neuron of neural network.	Create	BTL 6
13	Define confusion matrix.	Remember	BTL 1
14	Label the Receiver operator curve. .	Remember	BTL1
15	Illustrate about turning data into probabilities.	Apply	BTL 3
16	Express the Matthew's correlation coefficient.	Understand	BTL 2
17	Illustrate about Covariance matrix.	Apply	BTL 3
18	Design the Mahalanobis distance in terms of mean of the process.	Create	BTL 6
19	Analyze the Gaussian probability distribution model for higher dimension.	Analyze	BTL 4
20	Interpret about the bias variance tradeoff.	Understand	BTL 2

PART-B (13 MARKS)			
1	(i) What is machine learning? Discuss about learning and machine learning. (5) (ii) Discuss the various types of machine learning. (8)	Analyze	BTL 4
2	(i) Summarize in detail about supervised learning. (6) (ii) Discuss about the Classification problem in machine learning techniques. (7)	Understand	BTL 2
3	(i) Summarize the Issues in Machine Learning. (5) (ii) Explain about learning a class from examples in supervised learning. (8)	Evaluate	BTL 5
4	Summarize about the model selection procedure to fine tune model complexity. (13)	Remember	BTL 1
5	Apply the Naïve Bayes classifier to the problem of dilemma on watching TV or having assignment with in a deadline. (13)	Apply	BTL 3
6	Illustrate about the following used in testing machine learning algorithms. (i) Accuracy Metrics (7) (ii) The receiver operator (ROC) curve (6)	Apply	BTL 3
7	Formulate over fitting, Training, Testing and validation sets in machine learning algorithm. (13)	Create	BTL 6
8	(i) Describe about the basic statistic properties used in Machine learning algorithmic perspective. (8) (ii) Explain about Gaussian distribution with its probability density function. (5)	Remember	BTL 1
9	(i) Summarize about the first and second regression function used in supervised problems. (6) (ii) Discuss about the three decision needed to make to build a good approximation in Supervised machine learning algorithm. (7)	Understand	BTL 2
10	Explain about any four examples of Machine learning applications. (13)	Remember	BTL 1
11	(i) Describe about the curse of dimensionality in machine learning techniques. (6)	Remember	BTL 1

	(ii) Explain about the confusion matrix and its use in testing of machine learning algorithm. (7)		
12	Summarize in detail about the machine learning process. (13)	Understand	BTL 2
13	(i) Analyze about the regression problem in statistics for supervised learning. (7) (ii) Analyze about the classification problem for supervised learning. (6)	Analyze	BTL 4
14	Explain about the bias variance trade off with necessary equation. (13)	Analyze	BTL 4
	PART - C (15 MARKS)		
1	Design the Naïve Bayes classifier model for the assignment dead line problem. (15)	Create	BTL 6
2	(i) Evaluate the regression and classification of supervised learning. (8) (ii) Evaluate the machine learning process and the curse of dimensionality. (7)	Evaluate	BTL 5
3	Evaluate Accuracy metrics in machine learning and turning data into probabilities. (15)	Evaluate	BTL 5
4	Design the covariance matrix and the expectation of the sum of squares of error using the bias variance trade off. (15)	Create	BTL 6

Unit -II

SYLLABUS

NEURONS,NEURAL NETWORKS,AND LINEAR DISCRIMINANTS

Hebb's Rule - Neural Networks - The Perceptron - Linear Separability & Linear Regression. The Multi-layer Perceptron: Biases, Algorithm - Local minima and Stochastic gradient Descent Examples Of Using The MLP : Regression Problem & Classification Example - Deriving Back-Propagation.

PART - A

Q.No	QUESTIONS	Competence	BT Level
1	Analyze about McCulloh and Pitts neuron.	Analyzing	BTL4
2	Define Hebb rule.	Remembering	BTL1
3	List out different output activation functions.	Remembering	BTL1
4	What is meant by perceptron?	Understanding	BTL2

5	Define linear separability.	Remembering	BTL1
6	Interpret about linear regression in two and three dimension.	Understanding	BTL2
7	Label the multilayer perceptron with neat diagram.	Remembering	BTL1
8	Name the two parts of MLP.	Understanding	BTL2
9	Explain hybrid learning.	Understanding	BTL2
10	Write the error function used for the perceptron.	Remembering	BTL1
11	Illustrate about sequential and batch training	Applying	BTL 3
12	Demonstrate briefly the various steps of deriving Back Propagation.	Applying	BTL 3
13	Illustrate about local minima	Applying	BTL 3
14	Summarize briefly about the principles of gradient descent.	Evaluating	BTL 5
15	Define Biases.	Remembering	BTL 1
16	Differentiate optimal separating hyperplane and soft margin hyperplane.	Analyzing	BTL 4
17	Analyze about auto association Network.	Analyzing	BTL 4
18	Summarize Back propagation of error	Evaluating	BTL5
19	Design the mathematical expression for back propagation of error	Creating	BTL6
20	Develop the cross entropy error function from entropy	Creating	BTL6

PART-B (13 MARKS)

1	(i) Describe about Hebb's rule with an example. (5) (ii) Examine about McCulloch and Pitts Neuron Model with neat diagram and also give its limitation. (8)	Remembering	BTL 1
2	Describe about the Perceptron network with neat diagram and equation. (13)	Remembering	BTL 1
3	(i) Recall the following terms used in Perceptron learning algorithm a) The learning rate (3) b) The bias Input (3) (ii) Examine the Perceptron learning algorithm with its steps and also explain with an example. (7)	Remembering	BTL 1
4	Describe about the linear regression with necessary equations and also explain any one example. (13)	Remembering	BTL 1
5	(i) Summarize about linear separability necessary equation and diagram. (7)	Understanding	BTL 2

	(ii) Discuss about decision boundary solving the XOR problem in linear separability with truth table and diagram. (6)		
6	(i) Illustrate about multilayer perceptron network with neat diagram. (7) (ii) Discuss about the back propagation of error with necessary equation and diagram. (6)	Understanding	BTL 2
7	Interpret about the multilayer perceptron algorithm with necessary assumption. (13)	Understanding	BTL 2
8	(i) Apply Perceptron algorithm to write its implementation in any programming language. (7) (ii) Demonstrate about the Perceptron convergence theorem. (6)	Applying	BTL 3
9	(i) Apply multilayer perceptron network for solving XOR problem. (6) (ii) Demonstrate about going forwards and backwards in multilayer perceptron network. (7)	Applying	BTL 3
10	(i) Point out the different output activation function used in multilayer perceptron with necessary equations. (7) (ii) Explain about the amount of training data and number of hidden layers used in practical multilayer perceptron. (6)	Analyzing	BTL 4
11	Explain about auto association network with necessary diagram. (13)	Analyzing	BTL 4
12	(i) Explain about Sequential and batch training and local minima in multi layer perceptron with necessary diagram. (6) (ii) Point out the features needed to remind while using MLP. (7)	Analyzing	BTL 4
13	Summarize about the deriving back propagation in MLP with necessary diagram. (13)	Evaluating	BTL 5
14	Design the back propagation error for the linear, sigmoidal and Soft-max output activation function. (13)	Creating	BTL 6
PART - C (15 MARKS)			
1	Evaluate perceptron learning algorithm and also implement it for logical OR operation. (15)	Evaluating	BTL5
2	Develop the multilayer perceptron algorithm with neat sketch and necessary equations. (15)	Creating	BTL6
3	(i) Evaluate Mcculloch and Pitts neurons network with necessary	Evaluating	BTL5

	equations. (7) (ii) Evaluate the various output activation functions used in multilayer perceptron. (8)		
4	Design the back propagation network with necessary equation and assumption. (15)	Creating	BTL 6

Unit -III			
SYLLABUS **DIMENSIONALITY REDUCTION AND EVOLUTIONARY MODELS** . Linear Discriminant Analysis (LDA) - PRINCIPAL COMPONENTS ANALYSIS (PCA), Factor Analysis - Independent Components Analysis -PROBABILISTIC MODEL - Gaussian Mixture Models : EM Algorithm - Nearest Neighbour Methods - Support Vector Machines.			
PART - A			
Q.No	**Questions**	**Competence**	**BT Level**
1	Define dimensionality reduction.	Remembering	BTL1
2	When will you apply LDA for dimensionality reduction?	Remembering	BTL1
3	Identify the relation of PCA with multi layer perceptron.	Remembering	BTL1
4	Illustrate briefly about principle component analysis.	Applying	BTL3
5	What is meant by dimensionality reduction?	Understanding	BTL2
6	Define the kernel PCA algorithm.	Remembering	BTL1
7	Demonstrate briefly about multi dimensional scaling algorithm.	Applying	BTL3
8	Write the equation of reconstruction error in locally linear embedding.	Remembering	BTL1
9	Discuss briefly about principle component algorithm.	Understanding	BTL2
10	Illustrate about the Gaussian mixture models.	Applying	BTL3
11	Analyze about the efficient distance computation of the KD tree.	Analyzing	BTL4
12	Point out the significance of nearest neighbor smoothing.	Analyzing	BTL4
13	Summarize briefly about Expectation and maximization algorithm.	Evaluating	BTL5
14	What is meant by kernel?	Remembering	BTL1
15	Discuss about choosing of kernels	Understanding	BTL2
16	Assess the significance of support vector machine.	Evaluating	BTL5

17	Design the k-nearest neighbours algorithm bias variance decomposition equation.	Creating	BTL6
18	Develop the SVM regression expression for the test point.	Creating	BTL6
19	Discuss briefly about multiclass classification.	Understanding	BTL2
20	Point out the significance of SVM regression.	Analyzing	BTL4
	PART-B (13 MARKS)		
1	Describe about linear discriminant analysis (LDA) with necessary equation and possible projection lines. (13)	Remembering	BTL1
2	Describe about principal component analysis (PCA) with necessary equation and possible projection lines. (13)	Remembering	BTL1
3	(i) Analyze the relation of principal component analysis with multilayer Perceptron. (4) (ii) Explain about Factor analysis of dimensionality reduction with necessary equation. (9)	Analyzing	BTL4
4	(i) Interpret about the principal component analysis algorithm. (5) (ii) Summarize about kernel PCA and its algorithm with necessary equations. (8)	Understanding	BTL2
5	Illustrate about independent component analysis with necessary equations. (13)	Applying	BTL3
6	(i) Describe about local linear embedding of dimensionality reduction with its algorithm and equation. (10) (ii) Define Iso map algorithm. (3)	Remembering	BTL1
7	(i) Illustrate about multidimensional scaling and also give its algorithm. (7) (ii) Demonstrate about Gaussian mixture models with an example. (6)	Applying	BTL3
8	Describe about the Expectation-Maximization algorithm and also give the general EM algorithm. (13)	Remembering	BTL1
9	(i) Explain about the Gaussian mixture model EM algorithm. (7) (ii) Analyze about the nearest neighbor method in probabilistic learning. (6)	Analyzing	BTL4
10	(i) Summarize about nearest neighbor smoothing in probabilistic learning. (5)	Understanding	BTL2

	(ii) Discuss about efficient distance computation in probabilistic learning. (8)		
11	(i) Summarize about optimal separation and constrained optimization problem. (6) (ii) Discuss about Kernels and choosing of kernels in SVM. (7)	Understanding	BTL2
12	(i) Summarize about multiclass classification of SVM. (7) (ii) Explain about SVM regression with necessary equation. (6)	Evaluating	BTL5
13	Explain about the support vector machine with its algorithm and example. (13)	Analyzing	BTL4
14	Design the KD tree for the problem of finding nearest neighbor data structure and also develop it in programming language. (13)	Creating	BTL6
PART - C (15 MARKS)			
1	Develop the linear discriminant analysis and principle component analysis with necessary equation. (15)	Creating	BTL6
2	Evaluate independent components analysis and locally linear embedding with necessary equation. (15)	Evaluating	BTL 5
3	Evaluate kernel and choosing of kernels with necessary equations. (15)	Evaluating	BTL 5
4	Design the support vector machine for training data and develop its implementation. (15)	Creating	BTL6

Unit -IV

SYLLABUS

LEARNING

Evolutionary Learning - The Genetic Algorithms (GA)- Reinforcement Learning -Decision Trees - CLASSIFICATION AND REGRESSION TREES (CART) - Ensemble Learning :Boosting, Bagging, Random Forests - Unsupervised Learning : K-Means – Algorithm - Vector Quantisation.

PART - A

Q.No	Questions	Competence	BT Level
1	Point out the significance of evolutionary learning.	Analyze	BTL4
2	Define the genetic algorithm.	Remember	BTL1

3	Interpret about mutation with example.	Understand	BTL2
4	List the different ways for parent selection on genetic algorithm.	Remember	BTL1
5	Discuss about Cross over with an example.	Understand	BTL2
6	Illustrate about regression in trees.	Apply	BTL3
7	Differentiate between Sarsa and Q-learning.	Analyze	BTL4
8	Summarize about basic random forest training algorithm.	Evaluate	BTL5
9	List the genetic operators for generating off spring.	Remember	BTL1
10	Summarize about Markov property.	Evaluate	BTL5
11	List the limitations of genetic algorithm.	Remember	BTL1
12	Develop the programming code for computing entropy.	Create	BTL6
13	Label the reinforcement learning cycle with neat diagram.	Remember	BTL1
14	Define values in reinforcement learning.	Remember	BTL1
15	Demonstrate briefly about Entropy.	Apply	BTL3
16	Summarize about the regression and classification trees.	Understand	BTL2
17	Illustrate about boosting algorithm of ensemble learning.	Apply	BTL3
18	Develop the loss function for Adaboost algorithm.	Create	BTL6
19	Differentiate random forest training algorithm with boosting algorithm.	Analyze	BTL4
20	Discuss about the k-means neural networks.	Understand	BTL2
PART-B (13 MARKS)			
1	(i) Analyze about the parent selection in evolutionary learning. (7) (ii) Explain about Evaluating fitness and string representation in genetic algorithm. (6)	Analyze	BTL4
2	Describe about basic genetic algorithm in detail and also give its steps. (13)	Understand	BTL2
3	(i) Summarize about Genetic operator with examples. (6) (ii) Explain about the three basics tasks need to be performed to apply genetic algorithm. (7)	Evaluate	BTL5
4	(i) List the limitations of genetic algorithm. (4) (ii) Describe about the genetic programming with necessary diagram. (9)	Remember	BTL1
5	(i) Illustrate about combining sampling with evolutionary programming. (5)	Apply	BTL3

	(ii) Demonstrate about the getting lost problem of reinforcement learning. (8)		
6	(i) Analyze the general reinforcement learning cycle and also give its diagram. (5) (ii) Design a Markov decision process to decide on the state of your mind tomorrow given your mind of today with necessary diagram. (8)	Analyze	BTL4
7	Describe about Q-learning and Sarsa algorithm used in reinforcement learning. (13)	Remember	BTL1
8	(i) Differentiate between Sarsa algorithms with Q-learning algorithm.(5) (ii) Summarize about Classification and regression trees with necessary equations. (8)	Understand	BTL2
9	Describe about learning with trees and also give the uses of ID3 algorithm. (13)	Remember	BTL1
10	Summarize about boosting type ensemble method and Ada boost algorithm. (13)	Understand	BTL2
11	Explain about Bagging and random forest method of combining classifiers. (13)	Analyze	BTL4
12	(i) Demonstrate about the different ways to combine classifiers with neat diagram. (9) (ii) Illustrate about The mixture of Experts algorithm with necessary steps. (4)	Apply	BTL3
13	(i) Describe about the K-means Neural network with neat diagram and equation. (9) (ii) Examine the need of using vector quantization in unsupervised learning. (4)	Remember	BTL 1
14	(i) Develop the online k-means algorithm and also design the programming code. (8) (ii) Design the programming code to compute the bootstrap sample. (5)	Create	BTL 6
PART - C (15 MARKS)			
1	Design the markov decision processes and Q-learning algorithm with necessary diagram and equations. (15)	Create	BTL 6
2	Design k-means neural network and develop the online k-means	Create	BTL 6

	algorithm. (15)		
3	Evaluate the basic genetic operator and genetic programming with necessary diagram. (15)	Evaluate	BTL 5
4	Evaluate the classification and regression trees with an example. (15)	Evaluate	BTL 5

Unit -V

SYLLABUS
GRAPHICAL MODELS

Bayesian Networks - Markov Random Fields - Hidden Markov Models (HMMS) - Markov Chain Monte Carlo (MCMC) Methods - Deep Belief Networks (DBN)

PART - A

Q.No	Questions	Competence	BT Level
1	Point the algorithm that produces pseudo-random numbers.	Analyze	BTL4
2	Define MCMC.	Remember	BTL1
3	Distinguish random numbers and Gaussian Random numbers.	Understand	BTL2
4	Define Sampling.	Remember	BTL1
5	Interpret Markov Chains briefly.	Understand	BTL2
6	Illustrate the proposal distribution method.	Apply	BTL3
7	Point out the various MCMC methods.	Analyze	BTL4
8	Summarize briefly about graphical models.	Evaluate	BTL5
9	Write briefly about sampling and resampling algorithm.	Remember	BTL1
10	Assess the need of Gibbs sampler.	Evaluate	BTL5
11	How Gibbs sampler forms the basis for software package.	Remember	BTL1
12	Express Bayesian Belief network.	Create	BTL6
13	Define Directed and Undirected graphs.	Remember	BTL1
14	Identify polytrees in a graph.	Remember	BTL1
15	Illustrate about approximate inference.	Apply	BTL3
16	Discuss briefly about Making Bayesian networks.	Understand	BTL2
17	Discover the properties of HMM	Apply	BTL3
18	Develop top –down and bottom-up inference.	Create	BTL6

19	Analyze HMM Baum-Welch(forward –Backward)algorithm	Analyze	BTL4
20	Give any two Tracking methods .	Understand	BTL2
	PART-B (13 MARKS)		
1	(i) Explain about sampling from probability distribution. (5) (ii) Explain about the sampling methods in generation of random numbers. (8)	Analyze	BTL4
2	(i) Discuss about Gaussian Random numbers with necessary equations. (7) (ii) Describe about Box-Muller scheme implementation with its algorithm. (6)	Understand	BTL2
3	(i) Summarize about the Rejection Sampling Algorithm with its mathematical representation. (8) (ii) Deduce the histogram of a mixture of two Gaussians by using rejection sampling. (5)	Evaluate	BTL5
4	(i) Describe Sampling –importance resampling algorithm. (6) (ii) Describe Gibbs Sampling with necessary mathematical representation. (7)	Remember	BTL1
5	(i) Demonstrate in detail about MCMC. (8) (ii) Illustrate about the Simulated Annealing by a distribution and also give its sample sketch. (5)	Apply	BTL3
6	(i) Develop the two graphical models and show the various relationships between the nodes. (7) (ii) Develop the Gibbs sampler for Gaussian mixture. (6)	Create	BTL6
7	(i) Describe variable elimination algorithm with its algorithm and neat diagram. (6) (ii) Describe about the Approximate Inference done in Bayesian Network. (7)	Remember	BTL1
8	Describe in detail the Bayesian Network with an example. (13)	Understand	BTL2
9	Describe about the Bayesian network for an exam panic problem with necessary diagram. (13)	Remember	BTL1
10	Describe in detail Markov Random fields and Markov Random Field Image Denoising Algorithm. (13)	Remember	BTL1

11	(i)Explain about detail forward algorithm with necessary equations. (8) (ii)Infer about HMM forward algorithm with its steps. (5)	Analyze	BTL4
12	Explain about a HMM Baum-Welch forward –Backward algorithm with neat diagram and its algorithm. (13)	Analyze	BTL4
13	Summarize about Tracking methods and interpret how Kalman Filter is acting as a recursive estimator. (13)	Understand	BTL2
14	Demonstrate in detail about Kalman Filter Algorithm and the particle filter. (13)	Apply	BTL3
PART - C (15 MARKS)			
1	Design and develop the Deep belief Network algorithm. (15)	Create	BTL 6
2	(i)Create Markov chains for objective function. (8) (ii)Develop Metropolis-Hastings algorithm that rejects or accepts a sample. (7)	Create	BTL 6
3	Evaluate the Bayesian network for an exam panic problem. (15)	Evaluate	BTL 5
4	Evaluate the decoding problem by viterbi algorithm of an graphical model. (15)	Evaluate	BTL 5