SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF INFORMATION TECHNOLOGY

QUESTION BANK

I SEMESTER – M. Tech. - Data Science

1924103– MACHINE LEARNING

Regulation – 2019

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Prepared by

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SUBJECT   : 1924103- MACHINE LEARNING

SEM/YEAR: I / I

UNIT I
UNIT – I   :   INTRODUCTION   9
Introduction- overview of machine learning-   - Generative learning- Gaussian parameter estimation- maximum likelihood estimation- MAP estimation- Bayesian estimation- bias and variance of estimators- missing and noisy features- nonparametric density estimation- applications- software tools.

PART – A			
Q.No.	Questions	BT Level	Competence
1	Define Machine Learning.	BTL 1	Remembering
2	Compare learning vs programming.	BTL 2	Understanding
3	Examine the importance of machine learning algorithms.	BTL 4	Analyzing
4	Summarize algorithm technique in ML	BTL 2	Understanding
5	What are major components involved in each machine algorithm?	BTL 1	Remembering
6	List different forms of learning.	BTL 1	Remembering
7	Build the machine learning framework.	BTL 3	Applying
8	Draw basic learning system model.	BTL 3	Applying
9	What are the factors affecting the performance of machine learning algorithm?	BTL 1	Remembering
10	Compare generic machine model and discriminate machine learning model.	BTL 2	Understanding
11	Discuss major applications of machine learning.	BTL 6	Creating
12	Define Gaussian process.	BTL 2	Understanding
13	Distinguish Joint probability vs conditional probability.	BTL 4	Analyzing
14	Point out/examine supervised learning category and technique.	BTL 4	Analyzing
15	Define maximum likelihood estimation (MLE).	BTL 2	Understanding
16	Explain semi supervised learning?	BTL 5	Evaluating
17	Explain Inductive machine learning?	BTL 5	Evaluating
18	How AI differ from Machine learning?	BTL 1	Remembering
19	Discuss the difference between training set and testing set.	BTL 6	Creating
20	List the application software tools.	BTL 1	Remembering

PART – B			
Q.No.	Questions	Marks	BT Level	Competence
1	What is machine learning? Discuss about learning and machine learning. Choose various types of machine learning.	13	BTL 1	Remembering
2	Demonstrate the supervised learning structure.	13	BTL 2	Understanding
3	Explain briefly about unsupervised learning structure?	13	BTL 2	Understanding

4	Examine in detail about machine learning process with an example.	13	BTL 4	Analyzing
5	Explain various learning techniques involved in supervised learning?	13	BTL 5	Evaluating
6	Explain various learning techniques involved in unsupervised learning?	13	BTL 5	Evaluating
7	How to develop /frame inductive learning and summarize the machine learning process?	13	BTL 1	Remembering
8	Explain generative machine learning model and analyze how it differ from discriminative machine learning model?	13	BTL 4	Analyzing
9	What is Gaussian process? And explain in detail of Gaussian parameter estimates with suitable examples.	13	BTL 1	Remembering
10	Develop procedure in parameter estimation for Bayesian parameter estimation.	13	BTL 3	Applying
11	Discuss about MLE and how it derive from MAP and extreme estimator.	13	BTL 6	Creating
12	Summarize the advantages and disadvantages of Gaussian process	13	BTL 2	Understanding
13	Explain list of application software tools used in machine learning and describe each tools in details.	13	BTL 1	Remembering
14	Short note on a) Bias and variance b) Bias and variance trade off	6 7	BTL 2	Understanding

PART – C				
Q.No.	Questions	Marks	BT Level	Competence
1	Find the covariance and correlation coefficient of data X={1,2,3,4,5} and Y={1,4,9,16,25)	15	BTL 6	Creating
2	Define SVD. Explain the procedure for decomposition matrix with suitable example	15	BTL 5	Evaluating
3	Discuss the difference and tradeoff between two factors of bias and variance. How these factor play a role in machine learning models. Explain.	15	BTL 6	Creating
4	Explain what are the various metrics used to evaluate the machine learning model performance	15	BTL 5	Evaluating

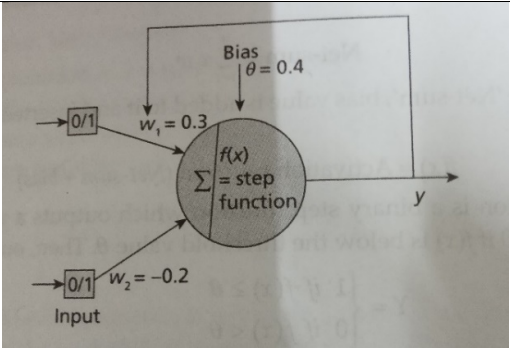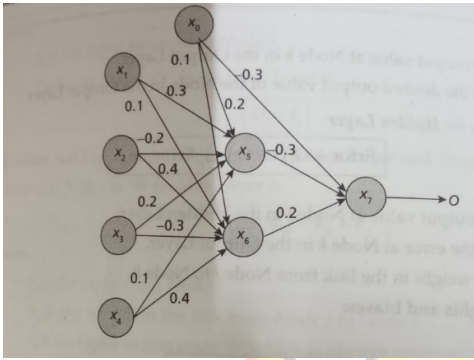| UNIT II			
Neural networks- perceptron- multilayer perceptron's - back propagation nonlinear regression - multiclass discrimination- training procedures-localized network structure- dimensionality reduction interpretation			
PART – A			
Q.No.	Questions	BT Level	Competence
1	Compare biological neuron and artificial neuron	BTL 5	Evaluating
2	Draw the structure of artificial single neuron based on biological neuron	BTL 3	Applying
3	List out major parts of biological neuron	BTL 1	Remembering
4	Discuss about types of artificial neural networks	BTL 6	Creating
5	What is the drawback of McCulloch & Pitts mathematical model of an artificial neuron?	BTL 1	Remembering
6	Define perceptron	BTL 2	Understanding
7	Draw the simple perceptron model.	BTL 3	Applying
8	Identify the parameters in a perceptron network and its significance	BTL 3	Applying
9	Why XOR problem could not be solved by simple perceptron?	BTL 1	Remembering
10	Define multilayer perceptron	BTL 2	Understanding
11	How a multilayer perceptron solve XOR problem?	BTL 4	Analyzing
12	What are activation function?	BTL 1	Remembering

13	List some linear and nonlinear activation function	BTL 1	Remembering
14	Apply the formula for sigmoidal function	BTL 3	Applying
15	Examine the delta learning rule	BTL 4	Analyzing
16	How to estimate error in the output layer?	BTL 2	Understanding
17	How to evaluate the update weight in back propagation?	BTL 2	Understanding
18	When to use the regression?	BTL 1	Remembering
19	What is dimensionality reduction?	BTL 1	Remembering
20	Justify the necessity for dimensionality reduction in the context of machine learning.	BTL 5	Evaluating

PART – B

Q.No.	Questions	Marks	BT Level	Competence
1	Explain biological Neuron.	13	BTL 2	Understanding
2	Explain simple model of an Artificial Neuron and its functions.	13	BTL 2	Understanding
3	Construct and explain Artificial Neural network structure.	13	BTL 3	Applying
4	Determine activation function and list few activation function with description.	13	BTL 5	Evaluating
5	Summarize and Explain various types of artificial neural network.	13	BTL 2	Understanding
6	a) Explain application of ANN and list the challenges of ANN. b)list Advantages and disadvantages of ANN.	6 7	BTL 1	Remembering
7	Develop simple perception model and explain learning theory.	13	BTL 3	Applying
8	Analyze the XOR is not linearly separable? Justify how it can be solved.	13	BTL 4	Analyzing
9	List the factors affecting MLP performance and explain each.	13	BTL 1	Remembering
10	What is the importance of MLP? Explain learning in MLP.	13	BTL 1	Remembering
11	a) Compare Linear Vs nonlinear regression. b) Explain back propagation nonlinear regression	6 7	BTL 4	Analyzing
12	Explain Back propagation network.	13	BTL 2	Understanding
13	Discuss the steps involved in Back propagation algorithm.	13	BTL 6	Creating
14	How dimensionality reduction is important in NN? Justify.	13	BTL 1	Remembering

PART – C

Q.No.	Questions	Marks	BT Level	Competence
1	Design single layer perceptron with two iteration. Consider the perceptron having with the initial weights w1=0.5, w2 = 0, learning rate α=0.2 and bias $^\theta$ =0.4 for AND Boolean function. The activation function is the Step function f(x) which gives the output either 0 or 1. If value of f(x) is greater than or equal to 0, it outputs 1 or else it outputs 0.	15	BTL 6	Creating
2	Consider a perception to represent the Boolean function And with the initial weights w1=0.3, w2 = -0.2, learning rate α=0.2 and bias $^\theta$ =0.4 as shown in Figure. The activation function used here is the Step function f(x) which gives the output value as binary. i.e., 0 or 1. If value of f(x) is greater than or equal to 0, it outputs 1 or else it outputs 0. Design a perceptron that performs the Boolean function AND & update the weights until the Boolean function gives the desired output	15	BTL 5	Evaluating

3	Perform a feedforward operation in a Multi-Layer Perception and conclude the result. This given MLP consists of an Input layer, one Hidden layer and an Output layer. The input layer has 4 neurons, the hidden layer has 2 neurons and the output layer has a single neuron and the Learning rate is 0.8 . | X1	X2	X3	X4	O_{Desired}
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1	1	0	1	1 | 	15		BTL 5	Evaluating
4.	Design Back propagation using Multi-Layer Perception which has three layers like the input layer has 4 neurons, the hidden layer has 2 neurons and the output layer has a single neuron. Train the MLP by updating the weights and biases in the network. Learning rate: =0.8. Refer Q.no : 3 for the structure of MLP and their weights	15		BTL 6	Creating

UNIT III
UNIT – III   :   SUPERVISED LEARNING   9
Decision Trees: ID3, Classification and Regression Trees, Regression: Linear Regression, Multiple Linear Regression, Logistic Regression, Perceptron, Support vector machines - Linear and Non-Linear, Kernel Functions, K-Nearest Neighbours.
PART – A

Q.No.	Questions	BT Level	Competence
1	Define entropy	BTL 2	Understanding
2	Relate entropy and information gain	BTL 2	Understanding
3	Define regression	BTL 2	Understanding
4	What is the role of regression model in exploratory data analysis?	BTL 1	Remembering
5	What is CART?	BTL 1	Remembering
6	How does CART solve the regression problems?	BTL 4	Analyzing
7	Compare regression and Estimations	BTL 5	Evaluating
8	Compare classification and regression models	BTL 5	Evaluating
9	What is the principle of ordinary least square in linear regression?	BTL 1	Remembering
10	Compare linear regression model and logistic regression model	BTL 4	Analyzing
11	Identify pros and cons of regression models.	BTL 3	Applying
12	Develop the concepts of K- Nearest Neighbours.	BTL 3	Applying
13	What are benefits of K- NN algorithm?	BTL 1	Remembering

14	Identify the disadvantage of K- NN algorithm	BTL 3	Applying
15	Discuss how data normalization / standardization is required in K-NN?	BTL 6	Creating
16	List out the advantages of SVM	BTL 2	Understanding
17	What do you understand by similarity based learning?	BTL 1	Remembering
18	Discuss instance based learning vs model based learning.	BTL 6	Creating
19	How does the structure of decision tree help in classifying a data instance?	BTL 4	Analyzing
20	What are the different metrics used in deciding the splitting attribute?	BTL 1	Remembering

PART – B				
Q.No.	Questions	Marks	BT Level	Competence
1	Build the structure of a decision tree.	13	BTL 3	Applying
2	Explain logistic regression with suitable example	13	BTL 2	Understanding
3	Discuss about linear regression and derive the Individual error & Minimization functions.	13	BTL 6	Creating
4	Write short notes on (i) Regression and Correlation (ii) Limitation of Regression model	6 7	BTL 1	Remembering
5	Explain the difference between linear and logistics regression with example.	13	BTL 5	Evaluating
6	What are the Metrics used to validate the result of regression and explain each.	13	BTL 1	Remembering
7	How to construct Regression tree and write procedure to construct regression tree with example.	13	BTL 1	Remembering
8	Explain CART (Classification & Regression tree) algorithm with example.	13	BTL 2	Understanding
9	a) Compare Instance based learning and Model based learning. b) List example of Instance-based learning algorithm.	6 7	BTL 4	Analyzing
10	What is the role of kernels? Classify the different type of Kernel.	13	BTL 4	Analyzing
11	List the advantages of SVM and how optimal Hyperplane differ from Hyper plane	13	BTL 1	Remembering
12	Explain Soft margin support vector machine.	13	BTL 2	Understanding
13	Explain weighted K-nearest Neighbor algorithm.	13	BTL 2	Understanding
14	Develop the following (i) Kernel based non-linear classifier. (ii) Support Vector Regression.	6 7	BTL 3	Applying

PART – C				
Q.No.	Questions	Marks	BT Level	Competence
1	How to construct ID3 and derive the procedure to construct a decision tree using ID3	15	BTL 6	Creating
2	Explain SVM classifier with suitable example	15	BTL 5	Evaluating
3	Consider the training dataset given in the following table. Use Weighted k-NN and determine the class. Test instance (7.6, 60, 8) and K=3. 	S.No.	CGPA	Assessment	Project Submitted	Result
1	9.2	85	8	Pass
2	8	80	7	Pass
3	8.5	81	8	Pass
4	6	45	5	Fail
5	6.5	50	4	Fail
6	8.2	72	7	Pass
7	5.8	38	5	Fail
8	8.9	91	9	Pass		15	BTL 6	Creating
4	Consider the training dataset shown in the Table and construct a decision tree using CART algorithm		BTL 6	Creating

S.no	CGPA	Interactive	Practical Knowledge	Communication Skills	Job Offer			
1	>=9	Yes	Very good	Good	Yes	15		
2	>=8	No	Good	Moderate	Yes			
3	>=9	No	Average	Poor	No			
4	<8	Yes	Average	Good	No			
5	>=8	Yes	Good	Moderate	Yes			
6	>=9	Yes	Good	Moderate	Yes			
7	<8	Yes	Good	Poor	No			
8	>=9	No	Very good	Good	Yes			
9	>=8	Yes	Good	Good	Yes			
10	>=8	Yes	Average	Good	Yes			

UNIT IV

UNIT – IV   :   UNSUPERVISED LEARNING   9

Introduction to clustering, Hierarchical: AGNES, DIANA, Partitional: K-means clustering, K-Mode Clustering, Expectation Maximization, Gaussian Mixture Models. Bayesian Learning, Bayes Optimal Classifier, Naıve Bayes Classifier, Bayesian Belief Networks

PART – A			
Q.No.	Questions	BT Level	Competence
1	Define clustering.	BTL 2	Understanding
2	List out the disadvantages of clustering schemes.	BTL 4	Analyzing
3	Distinguish between classification and Clustering.	BTL 4	Analyzing
4	List out the applications of clustering algorithm.	BTL 1	Remembering
5	Identify the challenges of clustering algorithm.	BTL 3	Applying
6	Estimate the problems associated with clustering large data.	BTL 5	Evaluating
7	What is k in k-means algorithm? How it is selected?	BTL 1	Remembering
8	What is meant by probabilistic based learning?	BTL 1	Remembering
9	Define Objective probability	BTL 2	Understanding
10	Define subjective probability	BTL 2	Understanding
11	Discuss Bayesian probability	BTL 6	Creating
12	Explain conditional probability	BTL 2	Understanding
13	Explain joint probability	BTL 2	Understanding
14	Compare probabilistic model and deterministic model	BTL 5	Evaluating
15	Develop the procedure for agglomerative algorithm.	BTL 3	Applying
16	Discuss Bayesian network	BTL 6	Creating
17	What is belief measure?	BTL 1	Remembering
18	State Bayes theorem	BTL 1	Remembering
19	What is meant by Bayesian belief network (BBN)?	BTL 1	Remembering
20	Choose type of inference performed in BBN?	BTL 3	Applying

PART – B				
Q.No.	Questions	Marks	BT Level	Competence
1	Explain the concepts of clustering approaches. How it differ from classification.	13	2	Understanding
2	List the applications of clustering and identify advantages and disadvantages of clustering algorithm.	13	1	Remembering
3	Explain about Hierarchical clustering algorithm.	13	2	Understanding
4	Develop Mean Shift Clustering algorithm.	13	3	Applying
5	Recall the steps involved in Partitional clustering algorithm.	13	1	Remembering
6	Explain about EM algorithm.	13	2	Understanding
7	Write short notes on a) Cohesion & Separation	6 7	1	Remembering

	b) Silhouette Co-efficient			
8	Discuss the fundamentals of Bayes theorem.	13	4	Analyzing
9	Explain the classification using Bayes Model.	13	4	Analyzing
10	Develop the following a) Bayes Optimal Classifier. b) Gibbs Algorithm	6 7	3	Applying
11	Explain about Naïve Bayes algorithm for continuous attributes with examples.	13	4	Analyzing
12	Explain about various Bayesian classifier.	13	5	Evaluating
13	Consider a boy who has a volleyball tournament on the next day, but today he feels sick. It is unusual that 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 much interested in volley ball, so there is a 90% probability that he would participate in tournaments and 20% that he will fall sick given that he participates in the tournament.	13	1	Remembering
14	Design and discuss how to construct BBN.	13	6	Creating

PART – C				
Q.No.	Questions	Marks	BT Level	Competence
1	a) If the coordinates of the objects are (0,-3) and (5,8) then what is the Chebyshev distance. b) Discuss MIN algorithm with suitable examples c) Discuss Quantitative variables evaluation in clustering algorithm	5 5 5	BTL 5	Evaluating
2	Compile the single linkage algorithm for the following array points 	Objects	X	Y
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0	1	4
1	2	8
2	5	10
3	12	18
4	14	28		15	BTL 6	Creating
3	Cluster the following set of data using k-means algorithm with initial value of objects 2 and 5 with the coordinate values (4,6) and (12,4) as initial seeds. 	Objects	X-coordinate	Y-coordinate
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1	2	4
2	4	6
3	6	8
4	10	4
5	12	4		15	BTL 5	Evaluating
4	a) Discuss about Bayesian inferences b) Explain Top down inference & Bottom-up reasoning approaches.	5 10	BTL 6	Creating

UNIT V

UNIT – V   :   PATTERN RECOGNITION   9
Introduction: Basics of pattern recognition – Design principles of pattern recognition system – Learning and adaptation – Pattern recognition approaches. Parameter Estimation Techniques, Non-parametric Estimation Techniques, Linear Discriminant Functions, Dimension Reduction Techniques, Nonmetric Data

PART – A			
Q.No.	Questions	BT Level	Competence
1	Define Pattern?	BTL 1	Remembering
2	Explain pattern recognition	BTL 2	Understanding
3	Compare statistical and structural approaches in pattern recognition	BTL 5	Evaluating
4	State Bayes theorem.	BTL 1	Remembering
5	Illustrate the random variable.	BTL 2	Understanding
6	Examine the parametric estimation method.	BTL 4	Analyzing
7	Distinguish between maximum likely hood and Bayes' method.	BTL 4	Analyzing
8	Explain feature extraction.	BTL 5	Evaluating
9	List properties of expectation-maximization algorithm.	BTL 1	Remembering
10	What is clustering?	BTL 1	Remembering
11	List Parametric and Non-Parametric techniques	BTL 2	Understanding
12	Develop the F1 score? How would you use it?	BTL 3	Applying
13	Apply Precision and Recall to any model?	BTL 3	Applying
14	Organize how to Tackle Overfitting and Under fitting?	BTL 3	Applying
15	Summarize Ensemble learning.	BTL 2	Understanding
16	Explain Correlation and Covariance?	BTL 5	Evaluating
17	Build the design pattern recognition system.	BTL 3	Applying
18	Discuss on Principal Component Analysis.	BTL 6	Creating
19	Discuss on non-parametric methods.	BTL 6	Creating
20	Define dimensionality reduction.	BTL 1	Remembering

PART – B				
Q.No.	Questions	Marks	BT Level	Competence
1	Explain general principles of likelihood estimation.	13	BTL 2	Understanding
2	Recall maximum Likelihood estimation with mean and variance.	13	BTL 1	Remembering
3	When the maximum likelihood and Bayes' method differ? Explain.	13	BTL 3	Applying
4	Explain principle component analysis.	13	BTL 2	Understanding
5	Write an algorithm for expectation-maximization.	13	BTL 1	Remembering
6	Derive the computation of hidden Markov model.	13	BTL 4	Analyzing
7	Estimate density Estimation under non-parametric method.		BTL 5	Evaluating

8	Write Short notes on
	    (a) Parzen-Window Estimation
	    (b) Estimation of Posterior Probability.
		6
		7
			BTL 6	Creating

9	What is Linear Discriminant Function and explain its categories.	13	BTL 1	Remembering
10	Write a Descent Algorithm under Relaxation procedures.	13	BTL 1	Remembering
11	Describe Support Vector Machine. How the vector developed in the training pattern.	13	BTL 3	Applying
12	Discuss SVM for XOR problems.	13	BTL 2	Understanding
13	Examine Pattern Recognition Systems and explain each components.	13	BTL 4	Analyzing
14	Construct a general Pattern Recognition Systems under design cycle.	13	BTL 6	Creating

PART – C				
Q.No.	Questions	Marks	BT Level	Competence
1	List non-parametric techniques and Explain K-nearest neighbor estimation.	15	BTL 4	Analyzing

2	Define pattern. Develop the design cycle of pattern recognition system and explain components involved in PR system.	15	BTL 6	Creating
3	List parametric techniques and explain any one.	15	BTL 4	Analyzing
4	Explain about Dimension reduction and its techniques	15	BTL 5	Evaluating