SRI KRISHNA INSTITUTE OF TECHNOLOGY

(Accredited by NAAC, Approved by A.I.C.T.E. New Delhi, Recognised by Govt. of Karnataka & Affiliated to V.T U., Belgaum)

Academic Year: 2022-2023	**Semester: 6**
Course Name: Machine Learning	**Course Code: 18AI61**
Total Contact hours: 50	**Credits:4**
SEE Marks:40 ; CIE: 60	**Total Marks: 100**
Course Plan Author: Dr Geetha C Megharaj	**Date: 15-3-2023**

Course Prerequisites:

- Python Programming

Course Objectives: This course will enable students to:

- Define machine learning and understand the basic theory underlying machine learning.
- Differentiate supervised, unsupervised and reinforcement learning
- Understand the basic concepts of learning and decision trees.
- Understand Bayesian techniques for problems appear in machine learning.
- Perform statistical analysis of machine learning techniques.

Course Outcomes:

CO Number	Course Outcome At the end of the course, student should be able to . . .	Blooms' Level
CO1	Choose the learning techniques with basic knowledge.	L2
CO2	Differentiate supervised, unsupervised and reinforcement learning	L3
CO3	Apply effectively ML algorithms for appropriate applications.	L3
CO4	Apply Bayesian techniques and derive learning rules effectively.	L3

Program Outcomes and Program Specific Outcomes

PO1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an Engineering specialization to the solution of complex problems in Computer Science and Engineering.
PO2. Problem Analysis: Identify, formulate, review research literature and analyze complex Computer Science Engineering problems reaching substantiated conclusions using first principles ofmathematics, natural sciences and engineering sciences.
PO3. Design / Development of Solution: Design solutions for complex Computer Science Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety and the cultural, societal and environmental considerations.
PO4. Conduct investigation of complex problems: Use research based knowledge and research methods including design of experiments, analysis and

interpretation of data and synthesis of the information to provide valid conclusions related to Computer Science Engineering.
PO5. Modern Tool Usage: Ability to create, select, and apply appropriate techniques, resources and modern engineering and IT tools including prediction, modeling and analysis to complex Computer Science Engineering activities with an understanding of the limitations
PO6. The Engineering and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7. Environmental and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.
PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9. Individual and Team Work: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings.
PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions
PO11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, tomanage projects and in multidisciplinary environments
PO12. Life-long Learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PSO1. Adapt, Contribute and Innovate ideas in the field of Artificial Intelligence and Machine Learning;
PSO2. Enrich their abilities to qualify for Employment, Higher studies and Research in various domains of Artificial Intelligence and Machine Learning such as Data Science, Computer Vision, Natural Language Processing with ethical values;
PSO3 Acquire the practical proficiency with niche technologies and open source platforms and to become Entrepreneur in the domain of Artificial Intelligence and Machine Learning

CO – PO Mapping

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3				2							1	2	3	3
CO2	3	3	2		3	1			1	1		1	2	2	2
CO3	3	2	1		2				1		1	1	2	1	2
CO4	3	2	2		3	2		1	1			1	3	3	1

Course Content (Syllabus)

Module1:	**Contact Hours**
Introduction: **Machine learning Landscape**: what is ML?, Why, Types of ML, main challenges of ML **T2:Chapter1** **Concept learning and Learning Problems** – Designing Learning systems, Perspectives and Issues – Concept Learning – Find S-Version Spaces and Candidate Elimination Algorithm –Remarks on VS Inductive bias T1:Chapter 1 and 2	10
Module2:	
End to end Machine learning Project : Working with real data, Look at the big picture, Get the data, Discover and visualize the data, Prepare the data, select and train the model, Fine tune your model **Classification**: MNIST, training a Binary classifier, performance measure, multiclass classification, error analysis, multi label classification, multi output classification T2: chapter 2 and 3	10
Module3:	
Training Models: Linear regression, gradient descent, polynomial regression, learning curves, regularized linear models, logistic regression Support Vector Machine: linear, Nonlinear, SVM regression and under the hood T2: Chapter 4 and 5 RBT: L1, L2	10
Module4:	
Decision Trees Training and Visualizing DT, making prediction, estimating class, the CART training, computational complexity, GINI impurity, Entropy, regularization Hyper parameters, Regression, instability **Ensemble learning and Random Forest:**Voting classifiers, Bagging and pasting, Random patches, Random forests, Boosting, stacking T2: Chapter 6 and 7 RBT: L1, L2	10
Module5:	
Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier– example- Bayesian Belief Network – EM Algorithm T1: Chapter 6 RBT: L1, L2	10

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Schedule of Instruction

Sl.No	Class no	Module	Topic	Text Book, Page no.	Course Outcome	Delivery mode
1	1	Module1	Introduction to Machine Learning	(T2,4)	CO1	Lecture
2	2		Why Machine Learning	(T2,4)	CO1	Lecture
3	3		Types of ML	(T2,8)	CO1	Lecture
4	4		Challenges of ML	(T2,24)	CO1	Lecture
5	5		Well posed problems	(T1,2)	CO1	Lecture
6	6		Perspectives and Issues	(T1,5).	CO1	Lecture
7	7		Designing Learning systems,	(T1,5).	CO1	Lecture
8	8		Concept Learning – Find S	(T1,26)	CO1	Lecture
9	9		Version Spaces and Candidate Elimination Algorithm	(T1,29)	CO1	Lecture
10	10		Remarks on VS Inductive bias	(T1,37)	CO1	
11	11	Module 2	Working with real data, Look at the big picture	(T1,38)	CO1	Lecture
12	12		Get the data,	(T1,45)	CO1	Lecture
13	13		Discover and visualize the data	(T1,58)	CO1	Lecture
14	14		Prepare the data	(T1,66)	CO1	Lecture
15	15		Select and train the model	(T1,75)	CO1	Lecture
16	16		Fine tune ML model	(T1,79)	CO1	Lecture
17	17		MNIST **Classification,** training a Binary classifier	(T1,87)	CO1	
18	18		Performance measure,	(T1,90)	CO1	
19	19		Multiclass classification, error analysis,	(T1,102)	CO1	Lecture
20	20		Multi label classification, multi output classification	(T1,108)	CO1	Lecture
21	21	Module 3	**Training Models:** Linear Regression	(T1,114)	CO2	Lecture
22	22		Gradient Descent	(T1,119)	CO2	Lecture
23	23		Polynomial Regression	(T1,130)	CO2	Lecture
24	24		Learning curves	(T1,132)	CO2	Lecture
25	25		Regularized linear models	(T1,136)	CO2	Lecture
26	26		Logistic regression	(T1,144)	CO2	Lecture
27	27		Support Vector Machine	(T1,155)	CO2	Lecture
28	28		Linear SVM	(T1,155)	CO2	Lecture
29	29		Nonlinear SVM	(T1,159)	CO2	Lecture
30	30		SVM Regression	(T1,164)	CO2	Lecture
31	31	Module 4	**Decision Trees:** Training and Visualizing DT	(T1,177)	CO3	Lecture
32	32		Making Prediction	(T2,179)	CO3	Lecture
33	33		Estimating Class	(T2,181)	CO3	Lecture

34	34		CART Training	(T2,182)	CO3	Lecture
35	35		Computational complexity	(T2,183)	CO3	Lecture
36	36		GINI Impurity	(T2,184)	CO3	Lecture
37	37		Entropy, Regularization Hyper parameters	(T2,185)	CO3	Lecture
38	38		Regression, Instability	(T2,188)	CO3	Lecture
39	39		Voting classifiers, Bagging and pasting, Random patches	(T2,192)	CO3	Lecture
40	40		Random forests, Boosting, stacking	(T2,197)	CO3	Lecture
41	41	**Module 5**	**Bayes Theorem** – Concept Learning	(T1,158)	CO4	PPT
42	42		Minimum Description Length Principle	(T1,164)	CO4	PPT
43	43		Maximum Likelihood	(T1,171)	CO4	PPT
44	44		Maximum Likelihood	(T1,174)	CO4	PPT
45	45		Bayes Optimal Classifier			
46	46		Bayes Optimal Classifier			
47	47		Gibbs Algorithm	(T1,176)	CO4	PPT
48	48		Naïve Bayes Classifier	(T1,177)	CO4	PPT
49	49		Bayesian Belief Network	(T1,184)	CO4	PPT
50	50		EM Algorithm	(T1,191)	CO4	PPT

Textbooks

T1	Tom M. Mitchell, Machine Learning, McGraw-Hill Education, 2013
T2	Aurelien Geron, Hands-on Machine Learning with Scikit-Learn &TensorFlow , O‟Reilly, Shroff Publishers and Distributors pvt.Ltd 2019

Reference books

R1	Ethem Alpaydin, Introduction to Machine Learning, PHI Learning Pvt. Ltd, 2nd Ed., 2013
R2	. T. Hastie, R. Tibshirani, J. H. Friedman, The Elements of Statistical Learning, Springer, 1st edition, 2001
R3	Machine Learning using Python ,Manaranjan Pradhan, U Dinesh kumar, Wiley, 2019
R4	Machine Learning, SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Pearson,2020

Web links and Video Lectures (e-Resources):	
1	https://www.youtube.com/@MaheshHuddar
2	https://www.youtube.com/watch?v=N7sx9_nX8Ng&list=PLPN-43XehstOjGY6vM6nBpSggHoAv9hkR
3	

Assessment Schedule:						
Sl. No.	**Assessment type**	**Contents**	**CO**	**Duration In Hours**	**Marks**	**Date & Time**
1	CIE Test 1	Module1	CO1	1.5	30	
2	CIE Test 2	Module2 &Module3	CO2, CO3	1.5	30	
3	CIE Test 3	Module4 & Module5	CO4	1.5	30	
4	Assignment 1	Module1	CO1		10	
5	Assignment 2	Module2 & Module 3	CO2, CO3		10	
6	Assignment 3	Module4 & Module 5	CO4		10	
7	**Semester End Examination**	Module1,Module2, Module3 , Module4, Module5	CO1-4	3	60	

Faculty Incharge **DAC Chairman**