MACHINE LEARNING

IV/IV B.Tech (2020-21) VII Sem

Year:	2020-21	Semester:	S1		S2		S3		S4		
			S5		S6		S7	✓	S8		
Department:	**CSE**		**Core**		✓		**Elective**				
Programme:	**B.Tech**				**Section:**		4B1 & 4B2				
Paper Title :	**Machine Learning**				**Paper Code :**		**EID 403**				
Credits :	**4**	**Allotted Hours:**	**TBA**								

Course Instructor :	Dr. Sireesha Rodda
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Details of glearn :	glearn.gitam.edu
Course Overview (200 words)	Machine learning is the science of getting computers to act without being explicitly programmed. In the past decade, machine learning has given us self-driving cars, practical speech recognition, effective web search, and a vastly improved understanding of the human genome. Machine learning is so pervasive today that you probably use it dozens of times a day without knowing it. The field of machine learning is concerned with the question of how to construct computer programs that automatically improve with experience. In recent years many successful machine learning applications have been developed, ranging from data-mining programs that learn to detect fraudulent credit card transactions, to information-filtering systems that learn users' reading preferences, to autonomous vehicles that learn to drive on public highways. Machine learning draws on concepts and results from many fields, including statistics, artificial intelligence, philosophy, information theory, biology, cognitive science, computational complexity, and control theory. The best way to learn about machine learning is to view it from all of these perspectives and to understand the problem settings, algorithms, and assumptions that underlie each.

	This course introduces basic concepts from statistics, artificial intelligence, information theory, and other disciplines as the need arises. Upon successful completion of the course, students will be able to answer questions such as " How does learning performance vary with the number of training examples presented?" and which learning algorithms are most appropriate for various types of learning tasks?"	
Course Objectives (200 words)	1. To understand concepts of Machine learning - Concept learning and Decision tree learning. 2. To gain an insight into Neural network learning and the study of Genetic algorithms. 3. To have knowledge in Bayesian learning. 4. To explore the concept of Instance-based Learning. 5. To understand the inference and learning algorithms for Hidden Markov Model.	
Pre- requisites and co-requisites	**ARTIFICIAL INTELLIGENCE**	
Evaluation Components	Class participation / Assignments/ Quizzes/ Regularity to classes	10 Marks
	Mid-term examinations (Three mid exams are conducted, out of which better two are considered)	30 Marks
	Semester-end examination	60 Marks
	Total	100 Marks
Assessment pattern	Criteria will be elucidated in the class session-1	
Lesson plan	Presented in the subsequent pages	

IV/IV B.Tech (2020-21)

MACHINE LEARNING

VII Sem

Text Books	1. Tom M. Mitchell, Machine Learning, Mc Graw Hill, 2013 2. Ethem Alpaydin, Introduction to Machine Learning(Adaptive Computation and Machine Learning), The MIT Press, 2004
Reference Books	1.T. Hastie, R. Tibshirani, J.H. Friedman, The Elements of Statistical Learning 1/e, Springer, 2001 2. . M. Narasimha Murthy, Introduction to Pattern Recognition and Machine Learning, World Scientific Publishing Company, 2015
Course Notes	Course notes uploaded into X-learn of GITAM University
Course Outcomes (CO)	Course Outcomes: At the end of the course, the student will be able to: 1.understand Concept learning and Decision tree learning and track the working of respective algorithms. 2.investigate Neural network and Genetic algorithms and also Genetic programming. 3. illustrate the working of Bayesian learning algorithms through probability values. 4. demonstrate knowledge in foundations of Instance-based learning approaches. 5. train different Hidden Markov Models for calculating the best fitting model
Teaching Methods	BlackBoard lectures, Power point presentations, Tutorials, Videos (NPTEL) andCase studies

CO - Mapping			Programme Outcomes										
Subject Code	**Subject Name**	**Course Outcomes**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO 12
EID 403	**Machine Learning**	**CO 1**	4				3				5			2
		CO 2	4			5			3		5			2
		CO 3		2			3		1		1		2	
		CO 4			3		4	2					1	
		CO 5		2			5	3		1	1			

IV/IV B.Tech (2020-21)

MACHINE LEARNING

VII Sem

LESSON PLAN

S No	Day	Description of the topic to be covered	Methodolgy Adopted (Black Board/PPT/Practice in Lab,etc)
1	Day 1	**MODULE – 1 Introduction :** Learning Problems, perspectives and Issues	Black Board
2	Day 2	Learning Problems, perspectives and Issues	Black Board
3	Day 3	Concept Learning	Black Board
4	Day 4	Version Spaces and Candidate Elimination	Black Board
5	Day 5	Version Spaces and Candidate Elimination	Black Board
6	Day 6	Version Spaces and Candidate Elimination	Black Board
7	Day 7	Inductive Bias	Black Board
8	Day 8	Decision Tree Learning, Algorithm	Black Board
9	Day 9	Hypothesis Space Search	Black Board
10	Day 10	Discussion on the overall Module I	Interaction with students
Total hours for MODULE - 1			**10**
11	Day 11	**MODULE -2 Neural Networks and Genetic Algorithms:** Neural Network Representation, problems	Black Board
12	Day 12	Perceptrons	Black Board
13	Day 13	Perceptrons	Black Board

14	Day 14	Multilayer Networks and the BackPropagation algorithm	Black Board
15	Day 15	Advanced Topics	Black Board
16	Day 16	Genetic Algorithms	Black Board
17	Day 17	Hypothesis Space Search	Black Board
18	Day 18	Genetic Programming	Black Board
19	Day 19	Models of Evaluation and Learning	Black Board
20	Day 20	Discussion on the overall module II	Interaction with students
21	Day 21	**MODULE – 3 Bayesian and Computational Learning:** Bayes Theorem, Concept learning	Black Board
22	Day 22	Maximum Likelihood	Black Board
23	Day 23	Minimum Description Length Principle	Black Board
24	Day 24	Bayes Optimal Classifier, Gibbs Algorithm	Black Board
25	Day 25	Naïve Bayes Classifier	Black Board
26	Day 26	Bayesian Belief Networks	Black Board
27	Day 27	EM algorithm	Black Board
28	Day 28	Probably Learning	Black Board
29	Day 29	Sample complexity for finite Hypothesis Spaces	Black Board
30	Day 30	Sample Complexity for infinite Hypothesis spaces	Interaction with students

31	Day 31	Mistake Bound Model of learning	Black Board
32	Day 32	Discussion on the overall module III	Black Board
33	Day 33	**MODULE – 4 Instance Based Learning :**	Black Board
34	Day 34	k-nearest neighbor Learning	Black Board
35	Day 35	k-nearest neighbor Learning	Black Board
36	Day 36	Locally weighted regression	Black Board
37	Day 37	Radial Basis Functions	Black Board
38	Day 38	Case Based Reasoning	Black Board
39	Day 39	Case Based Reasoning	Black Board
40	Day 40	Discussion on the overall module IV	Interaction with students
41	Day 41	**MODULE - 5 Hidden Markov Models:** Introduction, Discrete Markov Processes	Black Board
42	Day 42	Hidden Markov Models	Black Board
43	Day 43	Three Basic Problems of HMMs	Black Board
44	Day 44	Evaluation Problem	Black Board
45	Day 45	Evaluation Problem	Black Board
46	Day 46	Finding the state sequence	Black Board
47	Day 47	Learning Model Parameters	Black Board

48	Day 48	Learning Model Parameters and Continuous Observations	Black Board
49	Day 49	HMM with input and model selection in HMM	Black Board
50	Day 50	Discussion on the overall module V	Interaction with students

IV/IV B.Tech (2020-21)

MACHINE LEARNING

VII Sem

Syllabus

Module I **10 hours**

Introduction: Learning problems, perspectives and issues, concept learning, version spaces and candidate eliminations, inductive bias, decision treelearning, representation, algorithm, heuristic space search.

Module II **10 hours**

Neural Networks And Genetic Algorithms: Neural network representation, problems, perceptrons, multilayer networks and back propagation algorithms, advanced topics, Genetic algorithms, hypothesis space search, genetic programming, models of evaluation and learning.

Module III **12 hours**

Bayesian and Computational Learning: Bayes theorem , concept learning, maximum likelihood, minimum description length principle, Bayes optimal classifier, Gibbs Algorithm, Naïve Bayes Classifier, Bayesian belief network, EM algorithm, probability learning, sample complexity, finite and infinite hypothesis spaces, mistake bound model.

Module IV **10 hours**

Instance Based Learning: K-Nearest neighbour learning, locally weighted regression, radial basis functions, case based learning.

Module V **10 hours**

Hidden Markov Models: Introduction, discrete Markov processes, hidden Markov models, three basic problems of HMMs evaluation problem, finding the state sequence, learning model parameters, continuous observations, the HMM with input, model selection in HMM.

Text Book(s)

1. Tom M. Mitchell, Machine Learning, McGraw Hill , 2013.
2. Ethem Alpaydin, Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press, 2004

References

1. T. Hastie, R. Tibshirani, J. H. Friedman, The Elements of Statistical Learning, 1/e, Springer, 2001.
2. M Narasimha Murty, Introduction to Pattern Recognition and Machine Learning, World Scientific Publishing Company, 2015

Appendix: Page Number References From different Text Books

IV/IV B.Tech (2020-21)

MACHINE LEARNING

VII Sem

S No	Description of the topic	Reference page No.s from Tom M. Mitchell	Reference page No.s from Ethem Alpaydin
1.	**MODULE – 1 Introduction :** Learning Problems, perspectives and Issues	1-15	
2.	Learning Problems, perspectives and Issues	1-15	
3.	Concept Learning	20-26	
4.	Version Spaces and Candidate Elimination	29-36	
5.	Version Spaces and Candidate Elimination	29-36	
6.	Version Spaces and Candidate Elimination	29-36	-
7.	Inductive Bias	39-45	-
8.	Decision Tree Learning, Algorithm	52-60	-
9.	Hypothesis Space Search	60-62	
10	**MODULE -2 Neural Networks and Genetic Algorithms:** Neural Network Representation, problems	81-86	
11	Perceptrons	86-95	
12	Perceptrons	86-95	
13	Multilayer Networks and the BackPropagation algorithm	95-103	
14	Advanced Topics	104-112	
15	Genetic Algorithms	249-256	
16	Hypothesis Space Search	259-262	

1	Genetic Programming	262-266	
1	Models of Evaluation and Learning	266-268	
1	**MODULE – 3 Bayesian and Computational Learning:** Bayes Theorem, Concept learning	154-162	
2	Maximum Likelihood	164-171	
2	Minimum Description Length Principle	171-174	
2	Bayes Optimal Classifier, Gibbs Algorithm	174-176	
2	Naïve Bayes Classifier	177-180	
2	Bayesian Belief Networks	184-191	
2	EM algorithm	191-196	
2	Probably Learning	201-207	
2	Sample complexity for finite Hypothesis Spaces	207-214	
2	Sample Complexity for infinite Hypothesis spaces	214-220	
2	Mistake Bound Model of learning	220-225	
3	**MODULE – 4 Instance Based Learning :**	230-231	
3	k-nearest neighbor Learning	231-236	
3	k-nearest neighbor Learning	231-236	
3	Locally weighted regression	236-238	
3	Radial Basis Functions	238-240	

3	Case Based Reasoning	240-244	
3	Case Based Reasoning	240-244	
3	**MODULE - 5 Hidden Markov Models:** Introduction, Discrete Markov Processes		305-306
3	Hidden Markov Models		309-311
3	Three Basic Problems of HMMs		311
4	Evaluation Problem		311-315
4	Evaluation Problem		311-315
4	Finding the state sequence		315-317
4	Learning Model Parameters		317-319
4	Learning Model Parameters and Continuous Observations		319-321
4	HMM with input and model selection in HMM		321-323