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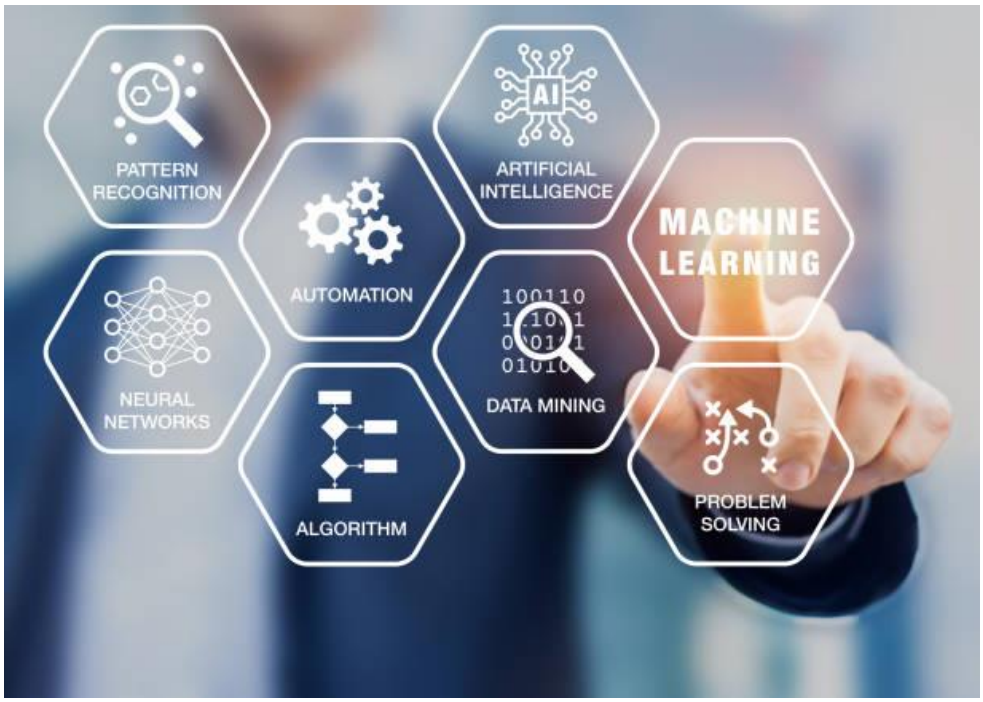
KOMMURI PRATAP REDDY INSTITUTE OF TECHNOLOGY

R18 JNTUH CSE III-II SEMESTER

CS601PC: MACHINE LEARNING

ACADEMIC YEAR 2021-22 COURSE FILE



Prepared by

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Assistant Professor

Department of CSE

Vision of the Institute

To emerge as a premier institute for high quality professional graduates who can contribute to economic and social developments of the Nation.

Mission of the Institute

Mission	Statement
IM_1	To have holistic approach in curriculum and pedagogy through industry interface to meet the needs of Global Competency.
IM_2	To develop students with knowledge, attitude, employability skills, entrepreneurship, research potential and professionally ethical citizens.
IM_3	To contribute to advancement of Engineering & Technology that would help to satisfy the societal needs.
IM_4	To preserve, promote cultural heritage, humanistic values and spiritual values thus helping in peace and harmony in the society.

Vision of the Department

To Provide Quality Education in Computer Science for the innovative professionals to work for the development of the nation.

Mission of the Department

Mission	Statement
DM_1	Laying the path for rich skills in Computer Science through the basic knowledge of mathematics and fundamentals of engineering
DM_2	Provide latest tools and technology to the students as a part of learning infrastructure
DM_3	Training the students towards employability and entrepreneurship to meet the societal needs.
DM_4	Grooming the students with professional and social ethics.

Program Educational Objectives (PEOs)

PEO's	Statement
PEO1	The graduates of Computer Science and Engineering will have successful career in technology.
PEO2	The graduates of the program will have solid technical and professional foundation to continue higher studies.
PEO3	The graduate of the program will have skills to develop products, offer services and innovation.
PEO4	The graduates of the program will have fundamental awareness of industry process, tools and technologies.

Program Outcomes

PO1	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of Solutions:** Design solutions for complex 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 investigations 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.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to

	complex engineering activities with an understanding of the limitations.
PO6	**The engineer 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	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental context, 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 network:** 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, 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, to manage projects and in multidisciplinary environments.
PO12	**Life-Long learning:** Recognize the need for, and have the preparation and able to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOME'S:

PSO1	**Foundation of mathematical concepts**: To use mathematical methodologies to crack problem using suitable mathematical analysis, data structure and suitable algorithm.
PSO2	**Foundation of Computer Science:** The ability to interpret the fundamental concepts and methodology of computer systems. Students can understand the functionality of hardware and software aspects of computer systems.
PSO3	**Foundation of Software development:** The ability to grasp the software development lifecycle and methodologies of software systems. Possess competent skills and knowledge of software design process.

SYLLABUS

UNIT - I

Introduction - Well-posed learning problems, designing a learning system, Perspectives and issues in machine learning Concept learning and the general to specific ordering – introduction, a concept learning task, concept learning as search, find-S: finding a maximally specific hypothesis, version spaces and the candidate elimination algorithm, remarks on version spaces and candidate elimination, inductive bias.
Decision Tree Learning – Introduction, decision tree representation, appropriate problems for decision tree learning, the basic decision tree learning algorithm, hypothesis space search in decision tree learning, inductive bias in decision tree learning, issues in decision tree learning.

UNIT - II

Artificial Neural Networks-1– Introduction, neural network representation, appropriate problems for neural network learning, perceptions, multilayer networks and the back-propagation algorithm.

Artificial Neural Networks-2- Remarks on the Back-Propagation algorithm, An illustrative example: face recognition, advanced topics in artificial neural networks.

Evaluation Hypotheses – Motivation, estimation hypothesis accuracy, basics of sampling theory, a general approach for deriving confidence intervals, difference in error of two hypotheses, comparing learning algorithms.

UNIT - III

Bayesian learning – Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum Likelihood and least squared error hypotheses, maximum likelihood hypotheses for predicting probabilities, minimum description length principle, Bayes optimal classifier, Gibs algorithm, Naïve Bayes classifier, an example: learning to classify text, Bayesian belief networks, the EM algorithm.
Computational learning theory – Introduction, probably learning an approximately correct hypothesis, sample complexity for finite hypothesis space, sample complexity for infinite hypothesis spaces, the mistake bound model of learning.

Instance-Based Learning- Introduction, k-nearest neighbour algorithm, locally weighted regression, radial basis functions, case-based reasoning, remarks on lazy and eager learning.

UNIT - IV

Genetic Algorithms – Motivation, Genetic algorithms, an illustrative example, hypothesis space search, genetic programming, models of evolution and learning, parallelizing genetic algorithms.

Learning Sets of Rules – Introduction, sequential covering algorithms, learning rule sets: summary, learning First-Order rules, learning sets of First-Order rules: FOIL, Induction as inverted deduction, inverting resolution.

Reinforcement Learning – Introduction, the learning task, Q–learning, non-deterministic, rewards and actions, temporal difference learning, generalizing from examples, relationship to dynamic programming.

UNIT - V

Analytical Learning-1- Introduction, learning with perfect domain theories: PROLOG-EBG, remarks on explanation-based learning, explanation-based learning of search control knowledge.

Analytical Learning-2- Using prior knowledge to alter the search objective, using prior knowledge to augment search operators.

Combining Inductive and Analytical Learning – Motivation, inductive-analytical approaches to learning, using prior knowledge to initialize the hypothesis.

TEXT BOOK

1.Machine Learning – Tom M. Mitchell, - MGH

Reference books:

1. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis

Web resources:

1. https://nptel.ac.in/courses/106105152
2. https://nptel.ac.in/courses/106106182
3. https://en.wikipedia.org/wiki/Machine_learning
4. https://www.javatpoint.com/machine-learning
5. https://www.tutorialspoint.com/machine_learning/index.htm

COURSE OBJECTIVES

- This course explains machine learning techniques such as decision tree learning, Bayesian learning etc.
- To understand computational learning theory
- To study the pattern comparison techniques.

COURSE OUTCOMES

Students will be able to:

C321.1: Define the learning techniques and **Discuss** the mechanism of Concept Learning. (Remember & Understand).

C321.2: Implement effectively Neural Networks for appropriate applications. (Apply).

C321.3: Apply Bayesian Techniques and **Examine** the hypothesis for Computational Learning. (Apply & Analyze).

C321.4: Evaluate hypothesis and **investigate** instant based learning and reinforced learning. (Evaluate & Create).

C321.5: Design Analytical Learning and **investigate** Explanation based learning. (Create).

Mapping of Course Outcomes with PO's and PSO's:

High -3 Medium -2 Low-1

Course Outcomes	Program Outcomes												Program Specific Outcomes		
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C321.1	3	3	3	3	3	-	2	-	2	-	2	3	3	3	3
C321.2	3	3	3	2	3	-	3	-	-	3	-	3	3	3	3
C321.3	3	3	3	3	-	3	-	-	-	3	-	3	3	-	-
C321.4	3	3	3	3	-	-	3	-	-	-	-	3	3	-	-
C321.5	3	3	3	3	-	-	-	-	3	-	-	3	3	-	-
C321	3	3	3	2.8	1.2	0.6	1.6	-	1	1.2	0.4	3	3	1.2	1.2

CO-PO Mapping Justification

C321.1: Define the learning techniques and **Discuss** the mechanism of Concept Learning. (Remember & Understand).

	Justification
PO1	Students will be able to apply the knowledge of mathematics to solve problems.
PO2	Students will be able to identify and analyse the problems based on the given dataset.
PO3	Students will be able to design solutions for complex datasets.
PO4	Students will be able to conduct research and investigate on complex problems.
PO5	Students will be able to use modern techniques to solve complex problems easily.
PO7	Students will be able to understand the requirements needed to the environment and society.
PO9	Students will be able to work in any kind of environment and explain the concepts.
PO11	Students will be able to understand the engineering principles and apply them on their datasets.
PO12	Students will be able to recognize the need and alter to the technological change.

C321.2: Implement effectively Neural Networks for appropriate applications. (Apply).

	Justification
PO1	Students will be able to apply the mathematical concepts to construct neural network.
PO2	Students will be able to analyze the problem to define neural network.
PO3	Students will be able to develop the solution and design appropriate neural network.
PO4	Students will be able to conduct experiments before constructing neural network.

PO5	Students will be able to apply appropriate formulae to design neural network.
PO7	Students will be able to understand the impact of complex solutions and provide a best solution for the datasets.
PO10	Students will be able to communicate effectively and provide good design for a neural network.
PO12	Students will be able to recognize the need to use the neural network.

C321.3: Apply Bayesian Techniques and **Examine** the hypothesis for Computational Learning. (Apply & Analyze).

	Justification
PO1	Students will be able to use the mathematical concepts to compute the hypothesis.
PO2	Students will be able to analyze the problem and identify the principles to calculate the hypothesis.
PO3	Students will be able to design the best solutions to get a good hypothesis.
PO4	Students will be able to use research based knowledge to solve complex problems.
PO6	Students will be able to assess the Bayesian techniques for complex problems.
PO10	Students will be able to Communicate easily and make effective presentations for complex problems.
PO12	Students will be able to recognize the need and analyze the hypothesis for complex problems.

C321.4: Evaluate hypothesis and **investigate** instant based learning and reinforced learning. (Evaluate & Create).

	Justification
PO1	Students will be able to apply the knowledge of mathematics and investigate the hypothesis for a given problem.
PO2	Students will be able to identify the problem for the given learning mechanism.
PO3	Students will be able to develop solutions for different hypothesis.
PO4	Students will be able to conduct investigations on complex problems and interpret the data and provides valid conclusion.
PO7	Students will be able to understand the context of hypothesis and provide good solutions for complex problems.
PO12	Students will be able to recognize the need and evaluate the hypothesis.

C321.5: Design Analytical Learning and **investigate** Explanation based learning. (Create).

	Justification
PO1	Students will be able to apply the knowledge of mathematics to design analytical learning mechanisms.
PO2	Students will be able to analyze the learning problems.
PO3	Students will be able to develop solutions for various learning concepts.
PO4	Students will be able to conduct investigations by using research based knowledge and interpret the data to provide valid conclusions.
PO9	Students will be able to function effectively as a team to solve complex problems.
PO12	Students will be able to recognize the need and design solutions for learning.

Lesson Plan – (CS601PC) MACHINE LEARNING

Faculty Name: E.Samatha Sree	**Year/Sem:** III/II	**Academic Year:** 2021-2022

w.e.f: 03-03-2022

L. No	Name of the Topic	Plan Date	Actual Date	Teaching Method
	UNIT - 1			
1	Introduction - Well-posed learning problems	03-03-22		Chalk & Talk
2	Designing a learning system	04-03-22		Chalk & Talk
3	Perspectives and issues in machine learning	05-03-22		Chalk & Talk
4	Concept learning and the general to specific ordering introduction, a concept learning task, concept learning as search	08-03-22 10-03-22		Chalk & Talk
5	find-S: finding a maximally specific hypothesis, version spaces and the candidate elimination algorithm	11-03-22		Chalk & Talk
6	Remarks on version spaces and candidate elimination, inductive bias	15-03-22		Chalk & Talk
7	Introduction, decision tree representation, appropriate problems for decision tree learning	17-03-22 19-03-22		Chalk & Talk
8	The basic decision tree learning algorithm, hypothesis space search in decision tree learning	22-03-22		Chalk & Talk
9	Inductive bias in decision tree learning, issues in decision tree learning.	24-03-22		Chalk & Talk
10	Unit 1 - Review	25-03-22		Chalk & Talk
	UNIT – II			
11	Artificial Neural Networks– Introduction,neural network representation,appropriate problems for neural network learning	26-0-22 29-03-22		Chalk & Talk
12	Perceptrons, Multi layer networks	31-03-22		Chalk & Talk
13	Back-propagation algorithm.	01-04-22		Chalk & Talk
14	Remarks on the Back-Propagation algorithm, An illustrative example: face recognition, advanced topics in artificial neural networks.	07-04-22		Chalk & Talk
15	Evaluation Hypotheses – Motivation, estimation hypothesis accuracy, basics of sampling theory	08-04-22 09-04-22		Chalk & Talk
16	A general approach for deriving confidence intervals	12-04-22		Chalk & Talk
17	difference in error of two hypotheses	16-04-22		Chalk & Talk
18	comparing learning algorithms.	19-04-22		Chalk & Talk
19	Unit 2 - Review	21-04-22		Chalk & Talk

UNIT III				
20	**Bayesian learning** – Introduction, Bayes theorem	22-04-22		Chalk & Talk
21	Bayes theorem and concept learning	23-04-22		Chalk & Talk
22	Maximum Likelihood and least squared error hypotheses	26-04-22		Chalk & Talk
23	Maximum likelihood hypotheses for predicting probabilities, Minimum description length principle	28-04-22		Chalk & Talk
24	Bayes optimal classifier, Gibs algorithm	29-04-22		Chalk & Talk
25	Naïve Bayes classifier, an example: learning to classify text	30-04-22		Chalk & Talk
26	Bayesian belief networks, the EM algorithm.	30-04-22		Chalk & Talk
Mid I Exams (02-05-22 To 07-05-22)				
27	**Computational learning theory** – Introduction, probably learning an approximately correct hypothesis	05-05-22		Chalk & Talk
28	Sample complexity for finite hypothesis space and infinite hypothesis space	06-05-22		Chalk & Talk
29	The mistake bound model of learning.	07-05-22		Chalk & Talk
30	**Instance-Based Learning**- Introduction, k-nearest neighbour algorithm	17-05-22		Chalk & Talk
31	locally weighted regression, radial basis functions	19-05-22		Chalk & Talk
32	Case-based reasoning, remarks on lazy and eager learning.	20-05-22		Chalk & Talk
33	Unit 3 - Review	21-05-22		Chalk & Talk
UNIT- IV				
34	Genetic Algorithms – Motivation, Genetic algorithms, an illustrative example,	24-05-22		Chalk & Talk
35	hypothesis space search	26-05-22		Chalk & Talk
36	genetic programming	27-05-22		Chalk & Talk
37	models of evolution and learning	28-05-22		Chalk & Talk
38	parallelizing genetic algorithms.	31-05-22		Chalk & Talk
39	Learning Sets of Rules – Introduction	02-06-22		Chalk & Talk
40	sequential covering algorithms	03-06-22		Chalk & Talk
41	Learning rule sets: summary, learning First-Order rules	04-06-22 07-06-22		Chalk & Talk
42	Learning sets of First-Order rules: FOIL	09-06-22 10-06-22		Chalk & Talk
43	Induction as inverted deduction	11-06-22		Chalk & Talk

44	Inverting resolution.	14-06-22 16-06-22		Chalk & Talk
45	Reinforcement Learning – Introduction, the learning task	17-06-22		Chalk & Talk
46	Q–learning, non-deterministic, rewards and actions	18-06-22		Chalk & Talk
47	Temporal difference learning, generalizing from examples	21-06-22		Chalk & Talk
48	Relationship to dynamic programming.	23-06-22		Chalk & Talk
49	Unit 4 - Review	24-06-22		Chalk & Talk
UNIT – V				
50	Analytical Learning-1- Introduction, learning with perfect domain theories:PROLOG-EBG	25-06-22		Chalk & Talk
51	remarks on explanation-based learning	28-06-22		Chalk & Talk
52	explanation-based learning of search control knowledge.	30-06-22		Chalk & Talk
53	Analytical Learning-2-Using prior knowledge to alter the search objective	1-07-22		Chalk & Talk
54	using prior knowledge to augment search operators.	2-07-22		Chalk & Talk
55	Combining Inductive and Analytical Learning – Motivation	5-07-22		Chalk & Talk
56	inductive-analytical approaches to learning,	7-07-22		Chalk & Talk
57	using prior knowledge to initialize the hypothesis.	8-07-22		Chalk & Talk
58	Unit 5 - Review	9-07-22		Chalk & Talk
Mid II Exams (11-07-22 To 16-07-22)				

TIME TABLE

Class: III-B.Tech II Sem **A.Y: 2021-22** **W.E.F- 03-03-2022**
LH:- B-202

Period / Day	I 9:30-10:20	II 10:20 - 11:10	11:10-11:20	III 11:20-12:10	IV 12:10-1:00	1:00-1:40	V 1:40-2:30	VI 2:30-3:20	VII 3:20-4:10
MON	SEED		BREAK	SL	DPPM	LUNCH	CD	INTERNET	REM/COUNS
TUE	SEED			ML	SL		DPPM	DAA	LIB
WED	SEED			DPPM	CD		SL (B1) / CD (B2) LAB		
THU	CD	SL		ML	DAA		CD (B1) / ML (B2) LAB		
FRI	SL	ML		CD	DAA		ML (B1) / SL (B2) LAB		
SAT	ML	CD		DAA	DPPM		SL	ML	SPORTS

UNIVERSITY CALENDAR

II SEM

S. No	Description	Duration	
		From	To
1	Commencement of II Semester classwork	*03.03.2022*	
2	1st Spell of Instructions	*03.03.2022*	*30.04.2022 (8 Weeks)*
3	First Mid Term Examinations	*02.05.2022*	*07.05.2022 (1 Week)*
4	Submission of First Mid Term Exam Marks to the University on or before	*14.05.2022*	
5	Summer Vacation	*09.05.2022*	*14.05.2022 (1 Week)*
6	2nd Spell of Instructions (including Summer Vacation)	*16.05.2022*	*09.07.2022 (8 Weeks)*
7	Second Mid Term Examinations	*11.07.2022*	*16.07.2022 (1 Week)*
8	Preparation Holidays and Practical Examinations	*18.07.2022*	*23.07.2022 (1 Week)*
9	Submission of Second Mid Term Exam Marks to the University on or before	*23.07.2022*	
10	End Semester Examinations	*26.07.2022*	*06.08.2022 (2 Weeks)*

ASSIGNMENT-1

1). Define Well Posed Learning Problem. Write Three Examples.

2) What are the Perspectives and issues in Machine Learning?

3) What are the steps involved in designing a learning system.

4) Explain about Candidate Elimination Algorithm.

5) Define Concept Learning. Explain about Find-S Algorithm by considering Enjoy Sport Example.

Example	Sky	AirTemp	Humidity	Wind	Water	Forecast	EnjoySport
1	Sunny	Warm	Normal	Strong	Warm	Same	Yes
2	Sunny	Warm	High	Strong	Warm	Same	Yes
3	Rainy	Cold	High	Strong	Warm	Change	No
4	Sunny	Warm	High	Strong	Cool	Change	Yes

6) What are the appropriate problems for Neural Networks Learning?

7).What is an ANN. Write the representation of ANN. Explain about Perceptron.

8) What is Bayes Theorem? Explain with an example.

ASSIGNMENT-2

1)Explain the learning sets of first order rules - FOIL Algorithm.

2). Describe the explanation based learning algorithm - PROLOG - EBG.

3). Design the process of Genetic Algorithms.

4). Examine the Sequential Covering Algorithms in a step by step manner.

5). Explain how to use Bayesian Classifier to learn text classification with an example.

6). Differentiate between lazy learners and eager learners.

Machine Learning Unit-I to Unit-V Notes can be accessed from the below link.

Name of the Content	**Resource URL**
Digital Notes Unit-I to Unit-V	**https://drive.google.com/file/d/1NsJbRP-JdUnZHbxr_pDG8K__LAvd7q-h/view?usp=sharing**