SIR C R REDDY COLLEGE OF ENGINEERING, ELURU

DEPARTMENT OF INFORMATION TECHNOLOGY

COURSE HANDOUT

SUBJECT: MACHINE LEARNING

CLASS: III/IV B.TECH SEMESTER-II, A.Y.2022-23

INSTRUCTOR: SMT J. MALATHI & SRI G. PAVAN

Course Handout Index

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College Vision & Mission

Vision: To emerge as a premier institution in the field of technical education and research in the state and as a home for holistic development of the students and contribute to the advancement of society and the region.

Mission: To provide high quality technical education through a creative balance of academic and industry oriented learning; to create an inspiring environment of scholarship and research; to instill high levels of academic and professional discipline; and to establish standards that inculcate ethical and moral values that contribute to growth in career and development of society in general.

Department Vision & Mission

Vision: To be a premier department in the region in the field of Information Technology through academic excellence and research that enable graduates to meet the challenges of industry and society.

Mission: To Provide dynamic teaching-learning environment to make the students industry ready and advancement in career; to inculcate professional and leadership quality for better employability and entrepreneurship; to make high quality professional with moral and ethical values suitable for industry and society.

Program Educational Objectives (PEOs)

PEO1: Solve real world problems through effective professional skills in Information Technology industry and academic research.

PEO2: Analyze and develop applications in Information Technology domain and adapt to changing technology trends with continuous learning.

PEO3: Practice the profession in society with ethical and moral values.

Program Outcomes (POs)

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, research literature, and analyze complex engineering problems reaching substantiated conclusions using the first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/Development of Solutions: Design solutions for complex engineering problems and system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, society, 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 modeling 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 society 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 multi-disciplinary 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, to manage projects and in multi-disciplinary 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.

Program Specific Outcomes (PSOs)

PSO1: Design Skill: Design and develop softwares in the area of relevance under realistic constraints.

PSO2: New Technology: Adapt new and fast emerging technologies in the field of Information Technology.

JNTUK Academic Calendar

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Directorate of Academic Planning
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA-533003, Andhra Pradesh, INDIA
(Established by AP Government Act No. 30 of 2008)

Lr. No. DAP/AC/III Year /B. Tech/B. Pharmacy/2022 *Date 14.09.2022*

Dr. KVSG Murali Krishna,
M.E, Ph.D.,
Director, Academic Planning
JNTUK, Kakinada

To
All the Principals of Affiliated Colleges,
JNTUK, Kakinada.

Academic Calendar for III Year - B. Tech/B. Pharmacy for the AY 2022-23
(2020-21 Admitted Batch)

I SEMESTER			
Description	**From**	**To**	**Weeks**
Community Service Project	**15.07.2022**	30.07.2022	2W
I Unit of Instruction	01.08.2022	24.09.2022	8W
I Mid Examinations	26.09.2022	01.10.2022	1W
II Unit of Instructions	03.10.2022	26.11.2022	8W
II Mid Examinations	28.11.2022	03.12.2022	1W
Preparation & Practicals	05.12.2022	10.12.2022	1W
End Examinations	12.12.2022	25.12.2022	2W
Commencement of II Semester Class Work	**02.01.2023**		
II SEMESTER			
I Unit of Instructions	**02.01.2023**	25.02.2023	8W
I Mid Examinations	27.02.2023	04.03.2023	1W
II Unit of Instructions	06.03.2023	29.04.2023	8W
II Mid Examinations	01.05.2023	06.05.2023	1W
Preparation & Practicals	08.05.2023	13.05.2023	1W
End Examinations	15.05.2023	27.05.2023	2W

*** As per the APSCHE Guidelines Out of the Total 180 hours of Community Service Project leading to 4 Credits, two weeks will be offline and remaining project work can be done during the III-I semester weekends and holidays. The summer internship can be done in online cum offline during III-I and III-II semesters.**

KVSG 14/9/22

Director,
Academics & Planning, JNTUK

Director
Academic Planning
JNTUK Kakinada

Copy to the Secretary to the Hon'ble Vice Chancellor, JNTUK
Copy to Rector, Registrar, JNTUK
Copy to Director Academic Audit, JNTUK
Copy to Director of Evaluation, JNTUK

Department Academic Calendar

Sir C R Reddy College of Engineering :: Department of Information Technology
III/IV B.Tech Academic Calendar for 2022-23

2022-23	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M
Jul 22						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
Aug 22		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31					
Sep 22					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30			
Oct 22							1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Nov 22			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30					
Dec 22					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31		
Jan 23	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31						
Feb 23				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28						
Mar 23				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31			
Apr 23							1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
May 23		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31					
Jun 23					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30			

List of Holidays			
July 10: Bakrid	Oct 5: Vijayadasami	Mar 8 : holi	Mid exams
Aug 9:Moharum	Oct 9: Maulud Nabi	Mar 22 : Ugadhi	End Examinations
Aug 15:Independence day	Oct 24 : Diwali	Mar 30: Srirama navami	Commencement of Class work
Aug 19: Janmastami	Dec 25 :Christmas	Apr 5: Babu Jagjivan Ram Jayanti	Workshops
Aug 31:Ganesh Chaturdi	Jan 14-16: sankranti	Apr 7: Good friday	Department fest/Elite
Oct 2: Gandhi jayanthi	Jan 26:Republic Day	Apr 14:Ambetkar Jayanthi	HoD
	Feb 18 :Sivaratri	Jun 29: Bakrid	Department of IT

Course Description

This course will introduce some of the principles and foundations of Machine Learning algorithms along with their real -world applications. This course covers the major approaches of learning namely, supervised, unsupervised and reinforcement learning, techniques on how to make learning by a model, how it can be evaluated, what are all different algorithms to construct a learning model. The topics covered in the course include statistical learning, regression, decision trees, support vector machines, random forests, PCA, neural networks and deep learning etc.

Course Objectives

- Identify problems that are amenable to solution by ANN methods, and which ML methods may be suited to solving a given problem.
- Formalize a given problem in the language/framework of different ANN methods (e.g., as a search problem, as a constraint satisfaction problem, as a planning problem, as a Markov decision process, etc).

Course Outcomes

After the completion of the course, student will be able to

CO	CO Description	Level
CO1	Understand the fundamental usage of the Machine Learning System concepts	L2
CO2	Demonstrate on various Regression Techniques	L2
CO3	Analyze the Ensemble Learning Methods	L4
CO4	Apply Supervised Learning Techniques, Clustering Techniques and Dimensionality Reduction Models in Machine Learning	L3
CO5	Discuss the Neural Network Models and Fundamentals concepts of Deep Learning	L2

Lesson Plan

S.No	Unit	Topics	Teaching Aids	CO
1	I	**Introduction**- Artificial Intelligence	BB/PPT	1
2		Introduction to Machine Learning	BB/PPT	1
3		Introduction to Deep learning	BB/PPT	1
4		Types of Machine Learning	BB/PPT	1
5		Systems, Main Challenges of Machine Learning	BB/PPT	1
6		Introduction to Statistical Learning	BB/PPT	1
7		Supervised and Unsupervised Learning	BB/PPT	1
8		Training and Test Loss	BB/PPT	1
9		Tradeoffs in Statistical Learning	BB/PPT	1
10		Estimating Risk Statistics	BB/PPT	1

11		Sampling distribution of an estimator	BB/PPT	1
12		Empirical Risk Minimization	BB/PPT	1
13	II	Supervised Learning (Regression / Classification): Basic Methods	BB/PPT	2
14		Distance based Methods, Nearest Neighbours	BB/PPT	2
15		Decision Trees	BB/PPT	2
16		Naive Bayes	BB/PPT	2
17		Linear Models: Linear Regression	BB/PPT	2
18		Logistic Regression	BB/PPT	2
19		Generalized Linear Models	BB/PPT	2
20		Support Vector Machines	BB/PPT	2
21		Binary Classification: Multiclass / Structured outputs	BB/PPT	2
22		MNIST, Ranking.	BB/PPT	2
23	III	Introduction to Ensemble Learning and Random Forests	BB/PPT	3
24		Voting Classifiers	BB/PPT	3
25		Bagging and Pasting	BB/PPT	3
26		Random Forests	BB/PPT	3
27		Boosting, Stacking	BB/PPT	3
28		Support Vector Machine: Linear SVM Classification	BB/PPT	3
29		Nonlinear SVM Classification, SVM Regression	BB/PPT	3
30		Naïve Bayes Classifiers	BB/PPT	3
31		Unsupervised Learning Techniques: Clustering	BB/PPT	4
32		K-Means, Limits of K-Means	BB/PPT	4

33	IV	Using Clustering for Image Segmentation	BB/PPT	4
34		Using Clustering for Preprocessing	BB/PPT	4
35		Using Clustering for Semi-Supervised Learning	BB/PPT	4
36		DBSCAN	BB/PPT	4
37		Gaussian Mixtures	BB/PPT	4
38		Dimensionality Reduction: The Curse of Dimensionality	BB/PPT	4
39		Main Approaches for Dimensionality Reduction	BB/PPT	4
40		PCA, Using Scikit-Learn	BB/PPT	4
41		Randomized PCA, Kernel PCA	BB/PPT	4
42	V	Introduction to Neural Networks and Deep Learning	BB/PPT	5
43		Introduction to Artificial Neural Networks with Keras	BB/PPT	5
44		Implementing MLPs with Keras	BB/PPT	5
45		Installing TensorFlow 2	BB/PPT	5
46		Loading and Preprocessing Data with TensorFlow	BB/PPT	5

Evaluation Pattern

S. No	Components	Internal	External	Total
1	Theory	30	70	100
2	Engineering Graphics/Design/Drawing	30	70	100
3	Practical	15	35	50
4	Mini Project/Internship/Industrial Training/ Skill Development programmes/Research Project	-	50	50
5	Project Work	60	140	200

Marks Range Theory (Max – 100)	Marks Range Lab (Max – 50)	Level	Letter Grade	Grade Point
≥ 90	≥ 45	Outstanding	A+	10
≥80 to <89	≥40 to <44	Excellent	A	9
≥70 to <79	≥35 to <39	Very Good	B	8
≥60 to <69	≥30 to <34	Good	C	7
≥50 to <59	≥25 to <29	Fair	D	6
≥40 to <49	≥20 to <24	Satisfactory	E	5
<40	<20	Fail	F	0
-		Absent	AB	0

Timetable

Day/Time	09.00-09.50	09.50-10.40	11.00-11.50	11.50-12.40	01.40-02.30	02.30-03.20	03.20-04.10	04.10-05.00
Mon	ML-A ML-B							
Tue		ML-A		ML-B	ML-A			
Wed								
Thu		ML-A			ML-B			
Fri	ML-B	ML-B		ML-A				
Sat					*********			

Syllabus

UNIT I

Introduction- Artificial Intelligence, Machine Learning, Deep learning, Types of Machine Learning Systems, Main Challenges of Machine Learning.

Statistical Learning: Introduction, Supervised and Unsupervised Learning, Training and Test Loss, Tradeoffs in Statistical Learning, Estimating Risk Statistics, Sampling distribution of an estimator, Empirical Risk Minimization.

UNIT II

Supervised Learning(Regression/Classification):Basic Methods: Distance based Methods, Nearest Neighbours, Decision Trees, Naive Bayes, Linear Models: Linear Regression, Logistic Regression, Generalized Linear Models, Support Vector Machines, Binary Classification: Multiclass/Structured outputs, MNIST, Ranking.

UNIT III

Ensemble Learning and Random Forests: Introduction, Voting Classifiers, Bagging and Pasting, Random Forests, Boosting, Stacking.

Support Vector Machine: Linear SVM Classification, Nonlinear SVM Classification SVM Regression, Naïve Bayes Classifiers.

UNIT IV

Unsupervised Learning Techniques: Clustering, K-Means, Limits of K-Means, Using Clustering for Image Segmentation, Using Clustering for Preprocessing, Using Clustering for Semi-Supervised Learning, DBSCAN, Gaussian Mixtures.

Dimensionality Reduction: The Curse of Dimensionality, Main Approaches for Dimensionality Reduction, PCA, Using Scikit-Learn, Randomized PCA, Kernel PCA.

UNIT V

Neural Networks and Deep Learning: Introduction to Artificial Neural Networks with Keras, Implementing MLPs with Keras, Installing TensorFlow 2, Loading and Preprocessing Data with TensorFlow.

Text Books:

1. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition, O'Reilly
2. Data Science and Machine Learning Mathematical and Statistical Methods,Dirk P. Kroese, Zdravko I. Botev, Thomas Taimre, Radislav Vaisman,25th November 2020

Reference Books:

1. Machine Learning Probabilistic Approach, Kevin P. Murphy, MIT Press, 2012