CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF TECHNOLOGY & ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

CS360: MACHINE LEARNING

Credits and Hours:

Teaching Scheme	Theory	Practical	Tutorial	Total	Credit
Hours/week	4	2	-	6	5
Marks	100	50	-	150	

Objective of the Course:

The intent of this course is to present a broad introduction to Machine Learning, the study of computing systems that improve their performance with experience; including discussions of each of the major approaches. The primary focus of the course will be on understanding the underlying algorithms used in various learning systems.

At the end of the course the student will understand:

To understand the basics of Machine Learning.

Basic concepts of various learning methods.

To learn mathematical concepts, and algorithms used in machine learning.

To have exposure to machine learning concepts and range of problems that can be handled by machine learning.

To compare and parameterize different learning algorithms.

To apply the machine learning concepts in real life problems.

Outline of the Course:

Sr. No.	Title of the unit	Minimum number of Hours
1.	Fundamental Concepts	05
2.	Statistical data analysis	10
3.	Supervised Learning	20
4.	Unsupervised Learning	17
5.	Advanced Topics and Case study in ML	08

Total Hours (Theory):60

Total Hours (Lab):30

Total Hours: 90

Detailed Syllabus:

1	**Fundamental concepts**	**05 hours**	**9%**
	Introduction to Machine Learning, Theory and practices in machine learning, Designing a Learning System, Types of Machine Learning, Issues in Machine Learning, Applications of ML, Global Developments of ML, Key challenges to adoption of ML in India/world.		
2	**Statistical Data Analysis**	**10 hours**	**17%**
	Descriptive statistics, Data Cleaning, Data Transformation, Feature selection, Sampling, Correlation, Box Plot, Scatter Plot, Visualization		
3	**Supervised Learning**	**20 hours**	**33%**
	Classification, Linear Regression, Logistic Regression, Decision Trees, Naïve Bayes Classifiers, ~~Bayesian Belief Networks~~, ~~Support Vector Machine~~, K - Nearest Neighbours, ~~Neural Networks.~~ Evaluation for supervised learning**:** Cross-Validation, Measures of Performance for Classification (Accuracy, Confusion Matrix, Precision, Recall, F1-Score), RMSE		
4	**Unsupervised Learning**	**17 hours**	**28%**
	Clustering, K-means, Hierarchical clustering, Density based clustering, Association Rules, Dimensionality Reduction Techniques. Evaluation for unsupervised learning: Measures of Performance for Clustering (Homogeneity, Completeness, V-Measure)		
5	**Advanced Topics and Case study in ML**	**08 hours**	**13%**
	Recent Trends in Machine Learning, Deep Learning algorithms – CNN, RNN and GAN, Case study: Agriculture, Healthcare, Transportation, Education, E-commerce, Finance, Data Security.		

Course Outcome:

After completion of the course, Students will be able to:

CO1	Apply basic concepts of Machine Learning and understanding of standard learning algorithms.
CO2	Understanding challenges of machine learning like data characteristics, model selection, and Model complexity with mathematical modelling.
CO3	Apply supervised machine learning algorithms suitable for a given problem domain and identify strengths and weaknesses using evaluation measures.
CO4	Apply unsupervised machine learning algorithms suitable for a given problem domain and identify strengths and weaknesses using evaluation measures.
CO5	Design and apply various machine learning algorithms in a range of real world applications.

Course Articulation Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	3	2	-	-	-	-	3	-	-	-	-	-	2	-
CO 3	3	2	-	2	2	-	-	-	-	-	-	-	2	-
CO 4	3	2	-	2	2	-	-	-	-	-	-	-	2	-
CO 5	2	-	2	-	-	-	-	-	-	-	2	2	3	2

Instructional Method and Pedagogy:

At the start of course, the course delivery pattern, prerequisite of the subject will bediscussed.

Minimum 5 experiments shall be there in the laboratory related to course contents.

Research / technical papers in relevant areas must be covered.

The course includes a laboratory, where students have an opportunity to build anappreciation for the concepts being taught in lectures.

Student Learning Outcome:

Student will know how prediction from data can do.

The course introduces an approach to thinking about machine learning.

The students will be able to describe why a particular model is appropriate in a givensituation, formulate the model and use it appropriately.

Recommended Study Material:

- Text Books:
  1. Machine Learning, Tom Mitchell, McGraw Hill, 1997. ISBN 0070428077
  2. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, 2004
- Reference Books:
  1. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer,2006.
  2. Richard O. Duda, Peter E. Hart & David G. Stork, "Pattern Classification. SecondEdition", Wiley & Sons, 2001.
  3. Trevor Hastie, Robert Tibshirani and Jerome Friedman, "The elements of statisticallearning", Springer, 2001.
  4. Richard S. Sutton and Andrew G. Barto, "Reinforcement learning: Anintroduction", MIT Press, 1998.