SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Department of Computer Engineering / Information Technology

Ph.D Semester 1/2
(CO / IT Engineering)

Subject Name: Machine Learning **Subject Code:** PTCO13103
Type of course: PhD Credit Course
Prerequisites (if any): Artificial Intelligence, Probability Theory

Rationale: Machine Learning is a branch of Artificial Intelligence that allows computers to learn and improve automatically with experience. There has been a huge increase in both scientific and e-commerce driven data generation in recent times. This has led to increased focus on disciplines like machine learning and data analytics. Machine learning can be used to solve real world problems that require classification, prediction, pattern mining and trend detection. This course aims to cover important aspects of problem representation, data pre-processing, hypothesis evaluation and modeling using machine learning algorithms which are useful to the student in research.

Teaching and Examination Scheme:

Teaching Scheme				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
4	0	0	4	60	25	15	0	0	100

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests) CA2: Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems TEE: Term End Examination TEP: Term End Practical Exam (Performance and viva on practical skills learned in course) CA3: Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Contents

Sr No	Description	No. of Hours
1.	Introduction to Machine Learning, Defining a learning problem, Designing a machine learning system- Choosing training experience, Choosing and representing a target function, supervised and un-supervised learning, Model evaluation; Issues in Machine Learning reported in contemporary literature	12
2.	Data Pre-processing: Data Cleaning- removing noise, substitution of missing values, Data Normalization, Data Discretization	06

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3.	The Inductive Learning Hypothesis, Inductive Bias, Sampling, Hypothesis Evaluation, Comparing learning algorithms	08
4.	Bayesian Learning- Probability and Bayes' theorem, Maximum Likelihood Estimation, naïve Bayesian classifier, Bayesian Networks Decision Tree Learning- Algorithms for generating Decision trees, Inductive bias in decision tree learning, stopping criterion, handling missing values, overfitting and pruning of decision trees	12
5.	Artificial Neural Networks- Perceptrons, activation function, multilayer network, network topology, parameter tuning, Backpropagation Support Vector Machines- Linear discriminant, separating hyperplane, Maximum Margin Hyperplane, Support Vectors	12
6.	Applications of Machine Learning, Case Studies	10

Course Outcomes

Sr. No	CO Statement	Marks % Weightage
1.	Explain machine learning methods useful for generating models from data	30%
2.	Describe various issues in machine learning	20%
3.	Apply various data pre-processing techniques to prepare datasets for learning.	20%
4.	Use the algorithms for a real world problem, optimize the model learned and estimate the accuracy that can be achieved by applying the model	30%

Reference Books:

Sr no	Title of book /article	Author(s)	Publisher	Year of publication	Publication Edition
1	Machine Learning	Tom M. Mitchell	McGraw Hill	1997	--
2	Pattern Recognition and Machine Learning	Christopher M. Bishop	Springer	2006	--

3	Data Mining: Concepts and Techniques	Jiawei Han and Micheline Kamber	Morgan Kaufmann Publishers	2006	2nd Edition
4	Machine Learning: The Art and Science of Algorithms that Make Sense of Data	Peter Flach	Cambridge University Press	2012	--
5	Fundamentals of Machine Learning for Predictive Data Analytics	John D. Kelleher, Brian Mac Namee and Aoife D'Arcy	MIT Press	2020	2nd edition

List of Online Learning Resources:

1. NPTEL course on: Introduction to Machine Learning (https://nptel.ac.in/courses/106106139)
2. NPTEL course on: Machine Learning (https://nptel.ac.in/courses/106106202)