Machine Learning

COURSE CODE: 18B1WCI634

COURSE CREDITS: 2

CORE/ELECTIVE: ELECTIVE

L-T-P: 2-0-0

Pre-requisite: None

Course Objectives:

1. Have a good understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.
2. Have an understanding of the strengths and weaknesses of many popular machine learning approaches.
3. Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.
4. Be able to design and implement various machine learning algorithms in a range of real-world applications.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO-1	To learn the basic concepts and terminology in machine learning	Familiarity
CO-2	To learn about the definition of learning systems, their goals and applications in machine learning	Familiarity
CO-3	To understand concepts associated with classification and experimental evaluation of classification algorithms	Assessment
CO-4	To learn concepts associated with decision trees and experimental evaluation of classification algorithms	Assessment
CO-5	To learn about instance-based learning, clustering and unsupervised learning	Usage

Course Contents:

Unit	Contents	Lectures required
1	**Introduction:** Definition of learning systems. Goals and applications of machine learning. Aspects of developing a learning system: training data, concept representation, function approximation. **Inductive Classification:** The concept learning task. Concept learning as search through a hypothesis space. General-to-specific ordering of hypotheses. Finding maximally specific hypotheses. Version spaces and the candidate elimination algorithm. Learning conjunctive concepts. The importance of inductive bias.	5
2	**Decision Tree Learning:** Representing concepts as decision trees. Recursive induction of decision trees. **Picking the best splitting attribute:** entropy and information gain.Overfitting, noisy data, and pruning, Linear regression	5
3	**Artificial Neural Networks:** Neurons and biological motivation. Perceptrons, Multilayer networks and back propagation. **Bayesian Learning:** Probability theory and Bayes rule. Naive Bayes learning algorithm. Logistic regression	5
4	**Support Vector Machine**, Kernel function and Kernel SVM **Instance-Based Learning:** Constructing explicit generalizations versus comparing to past specific examples. k-Nearest Neighbor algorithm. Case-based learning.	5

5	**Genetic Algorithm and Evolutionary Algorithms Introduction.** Representing hypothesis, Genetic Operators, Fitness function and selection. Hypothesis space search Genetic Programming	6
6	**Clustering and Unsupervised Learning:** Learning from unclassified data. Hierarchical Agglomerative Clustering. k-means partitioned clustering. Expectation maximization (EM) for soft clustering. Semi-supervised learning with EM using labeled and unlabeled data.	6
Total lectures		**32**

Suggested Text Book(s):

1. Tom Mitchell, "Machine Learning", McGraw Hill, 1997, ISBN 0070428077
2. Introduction to Machine Learning Edition 2, by Ethem Alpaydin.

Suggested Reference Book(s):

1. Richard o. Duda, Peter E. Hart, and David G. Stork, "Pattern Classification", John Wiley Asia, 2006
2. T. Hastie, R. Tibshirani, & J. H. Friedman, "The Elements of Statistical Learning: Data Mining, Inference, and Prediction", Springer Verlag, 2001.
3. Ian H. Witten & Eibe Frank, "Data Mining: Practical Machine Learning Tools and Techniques with Java Implementations", Morgan Kaufmann, 1999.
4. S. M. Weiss & C. A. Kulikowski, "Computer Systems that Learn", Morgan Kaufman Publishers, San Fancisco, CA, 1991

Other useful resource(s):

1. Link to NPTEL course contents: https://onlinecourses.nptel.ac.in/noc18_cs40/preview
2. Link to topics related to course:
   i. https://in.udacity.com/course/intro-to-machine-learning--ud120-india
   ii. https://www.edx.org/learn/machine-learning
   iii. https://www.datacamp.com/courses/introduction-to-machine-learning-with-r
   iv. https://www.simplilearn.com/big-data-and-analytics/machine-learning-certification-training-course

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment		Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course outcomes (Machine Learning)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	3	3	3	2	2	3	2	2	2	3	1	3	**2.4**
CO-2	3	3	3	2	3	2	3	2	2	3	1	3	**2.5**
CO-3	3	3	3	2	3	3	2	2	3	3	1	3	**2.6**
CO-4	3	3	3	2	3	3	2	2	2	3	1	3	**2.5**
CO-5	3	3	3	2	3	3	2	2	2	3	1	3	**2.5**
Average	**3**	**3**	**3**	**2**	**2.8**	**2.8**	**2.2**	**2**	**2.2**	**3**	**1**	**3**	

Approved in Academic Council held on 25.10.2018