JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

IV Year –I Semester		L	T	P	C
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	MACHINE LEARNING				

Course Objectives:
The course is introduced for students to
- Gain knowledge about basic concepts of Machine Learning
- Study about different learning algorithms
- Learn about of evaluation of learning algorithms
- Learn about Dimensionality reduction

Course Outcomes:
- Identify machine learning techniques suitable for a given problem
- Solve the problems using various machine learning techniques
- Apply Dimensionality reduction techniques
- Design application using machine learning techniques

UNIT I
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.

UNIT II
Decision Tree Learning: Representing concepts as decision trees, Recursive induction of decision trees, Picking the best splitting attribute: entropy and information gain, Searching for simple trees and computational complexity, Occam's razor, Overfitting, noisy data, and pruning.
Experimental Evaluation of Learning Algorithms: Measuring the accuracy of learned hypotheses. Comparing learning algorithms: cross-validation, learning curves, and statistical hypothesis testing.

UNIT III
Computational Learning Theory: Models of learnability: learning in the limit; probably approximately correct (PAC) learning. Sample complexity for infinite hypothesis spaces, Vapnik-Chervonenkis dimension.
Rule Learning: Propositional and First-Order, Translating decision trees into rules, Heuristic rule induction using separate and conquer and information gain, First-order Horn-clause induction (Inductive Logic Programming) and Foil, Learning recursive rules, Inverse resolution, Golem, and Progol.

UNIT IV
Artificial Neural Networks: Neurons and biological motivation, Linear threshold units. Perceptrons: representational limitation and gradient descent training, Multilayer networks and backpropagation, Hidden layers and constructing intermediate, distributed representations. Overfitting, learning network structure, recurrent networks.
Support Vector Machines: Maximum margin linear separators. Quadractic programming solution to finding maximum margin separators. Kernels for learning non-linear functions.

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UNIT V
Bayesian Learning: Probability theory and Bayes rule. Naive Bayes learning algorithm. Parameter smoothing. Generative vs. discriminative training. Logisitic regression. Bayes nets and Markov nets for representing dependencies.

Instance-Based Learning: Constructing explicit generalizations versus comparing to past specific examples. k-Nearest-neighbor algorithm. Case-based learning.

Text Books:
1) T.M. Mitchell, "Machine Learning", McGraw-Hill, 1997.
2) Machine Learning, Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, Pearson, 2019.

Reference Books:
1) Ethern Alpaydin, "Introduction to Machine Learning", MIT Press, 2004.
2) Stephen Marsland, "Machine Learning -An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
3) Andreas C. Müller and Sarah Guido "Introduction to Machine Learning with Python: A Guide for Data Scientists", Oreilly.

e-Resources:
1) Andrew Ng, "Machine Learning Yearning" https://www.deeplearning.ai/machine-learning-yearning/
2) Shai Shalev-Shwartz , Shai Ben-David, "Understanding Machine Learning: From Theory to Algorithms" , Cambridge University Press
https://www.cse.huji.ac.il/~shais/UnderstandingMachineLearning/index.html