CS/IT323 - MACHINE LEARNING

Lectures	:	3 periods/week	Internal Marks	:	30
Tutorial:	:	0 period/week	Semester End Examination Marks	:	70
Sem End Exam Duration	:	3 Hours	Credits	:	3

Course Objectives:

The main objectives of this course are to:

1. Basic concepts and applications of machine learning.
2. Supervised learning and its applications
3. Unsupervised learning and its applications
4. Multilayer perceptions and kernel tricks

Course Outcomes:

After successful completion of the course, the students are able to:

1. Apply the machine learning concepts in real life problems
2. Design solutions for supervised learning problems
3. Use rule sets and reinforcement learning to solve real world problems
4. Discuss the issues in dimensionality reduction and unsupervised learning algorithms.

Course Content:

UNIT I **CO1** **12 Periods**

Introduction: Well posed learning problems, Designing a Learning System, Perspectives and Issues in machine learning.
Concept Learning and general to specific ordering: concept learning Task , Concept learning as a search, Finding a Maximally Specific Hypothesis , Version Spaces and Candidate Elimination Algorithm, Remarks on Version space and candidate elimination. **Bayesian Learning:** Bayes Theorem, Maximum Likelihood and Least Square Error Hypotheses, Bayes Optimal Classifier, Naïve-Bayes Classifier, Bayesian Belief Network.

UNIT II **CO2** **12 Periods**

Decision Tree Learning : Decision Tree Representation, appropriate problems for decision tree, the basic decision tree Algorithm, Issues in decision tree learning. **Artificial Neural Networks:** Introduction, Neural Network Representation, appropriate problems for neural network, Perceptrons , Multilayer Networks and the Back Propagation Algorithm. **Instance Based Learning:** Introduction, KNN Learning, Locally Weighted Regression , Radial Bias Functions, Case-Based Reasoning.

UNIT III **CO3** **12 Periods**

Learning Sets of Rules: Sequential Covering Algorithm , Learning Rule Sets: summary , Learning First Order Rules, Learning set of first order rules: FOIL.
Reinforcement Learning: Introduction, the Learning Task , Q Learning , Non Deterministic Rewards and Actions , Temporal Difference Learning , Generalizing from Examples , Relationship to Dynamic Programming

UNIT IV **CO4** **12 Periods**

Dimensionality Reduction : Introduction, subset selection, Principal component analysis, Feature Embedding, Factor analysis, Singular Value Decomposition and Matrix factorization, Multidimensional Scaling, Linear Discriminant analysis, Canonical correlation analysis. **Clustering:** Introduction, Mixture Densities, K-Means Clustering, Expectation-Maximization Algorithm, Mixtures of Latent Variable Models, Supervised Learning after Clustering, Spectral Clustering, Hierarchical Clustering, Choosing the Number of Clusters.

Learning Resources:

Text Books:

1. Tom M. Mitchell, —Machine Learning, McGraw-Hill Education (India) Private Limited, 2013. (UNIT I , UNIT II, and UNIT III)
2. EthemAlpaydin, Introduction to Machine Learning , MIT Press, Prentice Hall of India, Third Edition 2014. (UNIT IV)

Reference Books:

1. Stephen Marsland, —Machine learning: An Algorithmic Perspective‖, CRC Press, 2009
2. Machine Learning: a Probabilistic Perspective, Kevin P. Murphy, MIT Press, 2012
3. Foundations of Machine Learning, MehryarMohri, AfshinRostamizadeh and Ameet Talwalkar, MIT Press, 2012.
4. Machine Learning -The Art and Science of Algorithms that Make Sense of Data, Peter Flach, Cambridge