Syllabus for B.Tech (CSE) III YEAR II SEM
Computer Science and Engineering
MACHINE LEARNING

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3	0	0	3

Code: 9LC03
Prerequisite: Introduction to Data Science

Course Objective:

Enable the students with basic knowledge on the techniques to build an intellectual machine for making decisions behalf of humans, and covers the techniques on how to make learning by a model, how it can be evaluated, what are all different algorithms to construct a learning model.

Course Outcomes:

At the end of this course, the student will be able to

1. Understand basic types of machine learning and apply linear models like perceptron and regression for classification tasks. [L2]-U1
2. Design and implement machine learning models like multi-layer perceptrons, RBF networks, and support vector machines for practical applications. [L5]-U2
3. Analyze decision trees, ensemble learning, and probabilistic models like k-means and Gaussian mixtures for various learning tasks. [L4]-U3
4. Examine dimensionality reduction techniques and evolutionary strategies such as genetic algorithms to improve model performance. [L4]-U4
5. Apply advanced concepts like graphical models (Bayesian networks, Hidden Markov models) and analytical learning techniques to solve complex problems. [L3]-U5, U6

UNIT-I

INTRODUCTION: Learning– Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Linear Discriminants: Definitions of Perceptron, Linear separability, Linear Regression.

Design a Learning System– Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm.

UNIT-II

LINEAR MODELS:

Multi-layer Perceptron– Going Forwards – Going Backwards: Back Propagation Error – Multi-layer Perceptron in Practice – Examples of using the MLP – Overview – Deriving Back-Propagation – Radial Basis Functions and Splines – Concepts – RBF Network – Interpolations and Basis Functions – Support Vector Machines.

UNIT-III

TREE AND PROBABILISTIC MODELS:

Learning with Trees– Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Basic Statistics – Gaussian Mixture Models – Nearest Neighbor Methods – Unsupervised Learning – K means Algorithms.

UNIT-IV

DIMENSIONALITY REDUCTION AND EVOLUTIONARY MODELS:

Dimensionality Reduction– Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Least Squares Optimization – Evolutionary Learning – Genetic algorithms – Genetic Offspring: - Genetic Operators – Using Genetic Algorithms – Reinforcement Learning – Overview – Getting Lost Example.

UNIT-V

GRAPHICAL MODELS:

Markov Chain Monte Carlo Methods– Sampling – Proposal Distribution – Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Methods.

UNIT – VI

ANALYTICAL LEARNING

Learning with perfect domain theory– Explanation based Learning – Inductive analytical approach to learning – KBANN algorithm.

TEXT BOOKS:

1. Stephen Marsland, ―Machine Learning – An Algorithmic Perspective, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
2. Tom M Mitchell, ―Machine Learning, First Edition, McGraw Hill Education, 2013.

REFERENCES:

1. Peter Flach, ―Machine Learning: The Art and Science of Algorithms that Make Sense of Data, First Edition, Cambridge University Press, 2012.
2. Jason Bell, ―Machine learning – Hands on for Developers and Technical Professionals‖, First Edition, Wiley, 2014.
3. Ethem Alpaydin, ―Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series), Third Edition, MIT Press, 2014.