

# Semester – 2

## 1. Machine Learning L-T-P 3-0-0 Cr. –3

### Objective:

1. To understand the principles of Machine Learning.
2. To be familiar with the various Machine Learning Models and their applications.

### MODULE – I

Introduction to ML: Motivation and role of machine learning in computer science and problem solving. Representation (features), linear transformations, Appreciate linear transformations and matrix vector operations in the context of data and representation. Problem formulations (classification and regression). Appreciate the probability distributions in the context of data, Prior probabilities and Bayes Rule. Introduce paradigms of Learning (primarily supervised and unsupervised. Also a brief overview of others)

### MODULE – II

Fundamentals of ML: PCA and Dimensionality Reduction, Nearest Neighbours and KNN. Linear Regression, Decision Tree Classifiers, Notion of Generalization and concern of Overfitting, Notion of Training, Validation and Testing; Connect to generalization and overfitting.

### MODULE – III

Ensembling and RF, Linear SVM, K Means, Logistic Regression, Naive Bayes, Role of Loss Functions and Optimization, Gradient Descent and Perceptron/Delta Learning, MLP, Backpropagation MLP for Classification and Regression, Regularisation, Early Stopping.

### MODULE – IV

Kernels (with SVM), Bayesian Methods, Generative Methods, HMM, EM, PAC learning, Popular CNN, Architectures, RNNs, GANS and Generative Models, Advances in Backpropagation and Optimization for Neural Networks, Adversarial Learning

### Outcome:

1. Technical knowhow of the Machine Learning techniques for real time applications.

### Books Recommended:

1. Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, Mathematics for Machine Learning, Cambridge University Press (23 April 2020)
2. Tom M. Mitchell- Machine Learning - McGraw Hill Education, International Edition
3. Aurélien Géron Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, O'Reilly Media, Inc. 2nd Edition
4. Ian Goodfellow, Yoshua Bengio, and Aaron Courville Deep Learning MIT Press Ltd, Illustrated edition
5. Christopher M. Bishop Pattern Recognition and Machine Learning - Springer, 2nd edition
6. Trevor Hastie, Robert Tibshirani, and Jerome Friedman - The Elements of Statistical Learning: Data Mining, Inference, and Prediction - Springer, 2nd edition