

4EC45: MACHINE LEARNING
CREDITS - 4 (LTP: 3,0,1)

Course Objective:

To learn basic concept of various learning methods, mathematical concepts and algorithms used in machine learning to discover patterns in the data and then make predictions based on often complex patterns to answer real world questions, detect and analyse trends and help to solve problems.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				
L	T	P		Theory Marks		Practical Marks		Total Marks
			ESE	CE	ESE	CE		
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	Introduction to Machine Learning : Overview of Machine Learning, Supervised and Unsupervised Learning, Reinforcement Learning, Application of Machine Learning and Review of Linear Algebra.	04
2	Regression and Classification : Supervised Learning – Introduction, Hypothesis Representation, Cost Function, Gradient Descent Algorithm, Linear Regression with Single and Multiple Variables, Feature Scaling, Learning Rate, Logistic Regression, Problem of Under and Over Fitting with Linear and Logistic Regression, Regularized Linear and Logistic Regression, Support Vector Machines (SVM), Large Margin Classifiers and SVM Kernels.	08
3	Clustering and Dimensionality Reduction : Unsupervised Learning – Introduction, K-Means Algorithm, K-Means for Non-Separated Clusters, K-Means Optimization Objective, DBSCAN, Introduction to Principle Component Analysis (PCA) Algorithm, Reconstruction from Compressed Representation, Choosing the number of Principle Components and Applications of PCA.	08
4	Artificial Neural Network : Introduction, Neural Network and Model Representation, Forward Propagation, Neural Network Cost Function, Back Propagation, Gradient Checking, Error Minimization and Neural Network's Applications, Convolution Neural Network (CNN) and Recurrent Neural Network (RNN).	08
5	Machine Learning System Design : Introduction, Advice for Applying Machine Learning Techniques, Model Selection and Training, Cross Validation and Test Sets, Diagnosis - Bias v/s Variance, Regularization and Bias/Variance, Learning Curves, Skewed Classes, Precision and Recall.	04

Unit No.	Topics	Teaching Hours
6	Reinforcement Learning : Introduction, The Learning Task, Q – Learning, The Q – Function and An Algorithm for Learning Q.	05
7	Application of Machine Learning : Anomaly Detection, Recommender Systems, Content-based Recommender Systems and Collaborative Filtering, Transfer Learning - One-Shot Learning and Zero-Shot Learning.	08
Total		45

List of References:

1. Tom M. Mitchell, “*Machine learning*”, McGraw Hill, 1st Edition, 1997.
2. Rajasekaran, Sanguthevar and GA Vijayalakshmi Pai, “*Neural networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications*”, PHI, Paperback Edition, 2003.
3. Bishop, Christopher M, “*Pattern Recognition and Machine Learning*”, Springer, 1st Edition, 2006.
4. Dutt, Chandramouli and Das, “*Machine Learning*”, Pearson, 1st Edition, 2018.

Course Outcomes (COs) :

By learning this course students will be able to...

1. Understand fundamental issues and challenges of machine learning like a data, model selection and model complexity etc.
2. Design and implement various supervised and un-supervised machine learning techniques.
3. Develop an appreciation for what is involved in learning models from data.
4. Analyze how to evaluate models generated from data.
5. Apply various machine learning algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.
6. Understand the concept of reinforcement learning and deep learning.