

Course: Machine Learning (MSC527)

Course Type	Course Code	Name of Course	L	T	P	Credit
Core Course	MSC527	Machine Learning	3	0	0	9

Course Objective

In this course, students will be exposed to the fundamentals of machine learning and some popular machine learning algorithms. It will help students to understand the relevance of machine learning algorithms & its application in various domain. In this course, it is required that students should be familiar with the programming & coding (R, Matlab, Python, Octave) as it will be helpful to them for their assignments.

Learning Outcomes

- To understand the concept of Machine Learning
- To develop understanding in various types of machine learning algorithm
- To develop the skill in application software like Python or R for solving business application problems through machine learning.

Unit	Topics to be Covered	Lectures	Learning Outcome
1.	Introduction: Basic Principles, Applications, Challenges.	[4L]	Students will learn the fundamental concepts of machine learning, types of learning and their challenges.
2.	Supervised Learning: Linear Regression (with one variable and multiple variables), Gradient Descent; Classification (Logistic Regression, Overfitting, Regularization, Support Vector Machines); Artificial Neural Networks (Perceptron, Multilayer networks, and back-propagation); Decision Trees.	[14L]	Students will learn the supervised learning models used in the applications and also the assumptions under each model. They will get to learn different types of supervised learning algorithms: classification/regression problems.
3.	Unsupervised Learning: Clustering (K-means, Hierarchical); Dimensionality reduction; Principal Component Analysis; Anomaly Detection.	[10L]	Students will learn to find the structures and patterns in the data. Learn to apply unsupervised learning algorithm on real-life problems. Also get to know the limitations and assumptions for the clustering algorithms.
4.	Theory of Generalization: In-sample and out-of-sample error, VC inequality, VC analysis, Bias and Variance Analysis.	[6L]	Students will get to learn different types of error, and their impact on the model. Also, they will get to learn techniques to minimize error in the model.
5.	Applications: Spam Filtering, recommender systems, and others	[5L]	Students will get to learn the implementation of different types of machine learning algorithms for real-life problems using software.

Evaluation Components	100 Marks
Mid-Term Exam	32 Marks
End-Term Exam	48 Marks
2 Quizzes (subjective/multiple-choice questions)	10 Marks
Assignments	10 Marks

References for Reading

Text Books/Reference Books:

1. Understanding Machine Learning. Shai Shalev-Shwartz and Shai Ben-David. Cambridge University Press. 2017.
2. The Elements of Statistical Learning. Trevor Hastie, Robert Tibshirani and Jerome Friedman. Second Edition. 2009.
3. Foundation of Data Science. Avrim Blum, John Hopcroft and Ravindran Kannan. January 2017.
4. Pattern Recognition and Machine Learning. Christopher Bishop. Springer. 2006.
5. Machine Learning. Tom Mitchell. First Edition, McGraw-Hill, 1997.