MACHINE LEARNING

Objectives

Machine Learning is a growing field in the area of pattern recognition, natural language processing, speech processing, image processing and vision. This course provides requisite introduction to machine learning and deep learning architectures. The objectives include: 1. Formulate machine learning problems related to different applications and develop algorithms to solve them. 2. Read current research papers and understand the issues:

Pre-requisites:

- Good Understanding of:
  - Linear Algebra
  - Probability, random variables, estimation theory
  - Optimization techniques.
  - Languages – Python/R/Julia (any of these)

Course Contents:

Supervised Vs Unsupervised learning, Linear and Polynomial regressions, [convex/non convex functions, constrained/unconstrained minimization, Least squares (LS) estimation, Maximum likelihood (ML) and Maximum a posteriori (MAP) estimations,] LDA, QDA, bias and variance, overfitting and regularization, cross validation, entropy, cross entropy, KL divergence, logistic regression, soft max for multiclass classification, Support vector machine (Soft margin and Hard margin classifiers), K means clustering, Principal component Analysis, ICA, GMM

Introduction to Neural networks, Multilayer perceptron (MLP),

Expected Outcomes

After studying this course, students will be able to understand a variety of machine learning architectures, use them to solve problems in object classification, segmentation (clustering). The course will be helpful for the students to come up with new research ideas in various application areas of machine learning.

This course has both Theory and Lab.

READINGS
Evaluation Scheme:

- Lab exam - 15%
- Class Reward (Extra) – for answering questions asked during class hours.
- Insem - exam -30%
- End-sem exam - 35%
- Course project (with presentation). -20% (Each group in which a person randomly chosen will be presenting on prescribed dates. The marks obtained by that student will be awarded to all students in that group – Two presentations. At the beginning and towards the end)
- Minimum pass marks 35% (excluding lab marks).

1. Andrew Ng Notes
2. Lectures by Ali Ghodsi, University of Watrloo
3. Lectures by Kilian Weinberger, Cornell University

Books on Machine learning
1. Kevin Murphy Machine Learning A Probabilistic Perspective, MIT
2. Hastie, Tibshirani, Friedman The Elements of Statistical Learning, Springer.