

IT -455 : Statistical and Computational Machine Learning

Credits: 3

Prerequisite: IT-412 Topics in Statistics and Linear Algebra

Lectures: Lectures (3 hrs a week) + Assignment (1 hr weekly, or as needed)

Topics to be covered (not necessarily in the given order):

- A quick overview of matrix algebra with emphasis on covariance matrices, quadratic forms, the multivariate normal distribution
- Introduction to supervised and unsupervised learning
- Bayesian Decision Theory, Discriminant Functions for the Normal Density
- **Unsupervised learning:** Singular Value Decomposition/Principal Components analysis, hierarchical clustering (with different distance metrics).
- Nonparametric Techniques (Density Estimation, Parzen Windows and Nearest Neighbours)
- Linear Discriminant Functions,
- **Supervised Learning:** Multiple Linear Regression, introduction to the Inverse Variance lemma (an extremely helpful tool in constructing networks from data matrices)
- Logistic Regression, Ridge Regression, Principal Components Regression,
- Decision Tree Learning
- Introduction to Neural networks (time permitting a brief introduction to Deep Learning)

The course may be modified based on needs of the class. Make sure you check with the course instructor for sections covered on the exams, HW problems and other course related announcements.

References:

- 1) Introduction to Linear Algebra (4th edition) by Gilbert Strang
- 2) Applied Multivariate Statistical Analysis (6th edition), by Johnson and Wichern
- 3) Pattern Classification, by Duda Hart and Stork

Grading Policy: The policy for grading subjects is as follows: Quiz/Assignment: 20%; Mid-semester exam: 30%; Final: 50%

Assignments: The assignments will be a mixture of theoretical and programming jobs. You are encouraged to discuss the solutions amongst your fellow students, but the submissions have to be your own and will be graded likewise. Homework submitted late will not be graded. Retake of missed quizzes is not allowed.