Foundations of Applied Machine Learning
Course # PHYS 243
Spring 2019

Syllabus

Week 1
Background and Introduction
Historical Development of machine learning
Applications of Machine Learning
What we learn in this course
Python and R Programming- installation on Window or Mac platforms

Week 2
Basic linear algebra
Review of statistics and probability theory
Matrix formulation and calculation of least squares
Multivariate Calculus
Partial Derivative Gradients
Gradient Descent

Week 3
Multivariate statistics
Joint distributions
Mean vectors, variance-covariance matrices
Conditional distributions, marginal distributions
Multivariate normal distributions and their basic properties

Week 4
Classifications
K-Nearest Neighbors
Logistic regression
Naïve Bayes

Week 5
Case Studies and applications of classifications

Week 6
Regressions
Linear, Multiple and polynomial Regressions
Ridge Regression
Over-fitting
Regularization

Week 7
Case Studies and Applications of regressions-

Week 8
Advanced topics in Machine Learning
Cross validation
Receiver Operating Characteristic (ROC) curves
P-R Curves
Principle Component Analysis (PCA)
Stochastic Gradient Descent (SGD)

Week 9
Deep Learning
Neural Nets
Artificial Neural Nets
Convolutional Neural Nets
Multi-layer networks
Back propagation
Deep Neural Networks

Week 10
Case Studies and Review

Books:

Machine Learning- A probabilistic Perspective
Kevin P. Murphy
The MIT Press
(Chapters 1 and 2)

Lecture notes in Linear Algebra by
Zico Kolter and Chuong Do
(or any books on basic linear algebra)

Machine Learning in Action
Peter Harrington
Manning Publications