OPTIMISATION FOR MACHINE LEARNING: THEORY AND IMPLEMENTATION (HINDI)

PROF. PRAVESH BIYANI

Department of Electronics and Communication Engineering
IIIT Delhi

PRE-REQUISITES : Linear Algebra, Calculus, Basic Programming

INTENDED AUDIENCE : UG/PG

INDUSTRY SUPPORT : Google, Microsoft, Facebook, Amazon, Flipkart and all companies connected to Data Science, Signal Processing and AI/ML

COURSE OUTLINE :

Optimisation is the workhorse of machine learning. Knowing optimisation is a key prerequisite in understanding theory and practise of machine learning. In this course, we will discuss the foundations required for solving optimization problems in the context of machine learning through various case-studies/running-examples. We will start with covering the basics of linear algebra and calculus required for learning optimization theory. We will learn both the theory and implement optimization algorithms like stochastic gradient descent and its various variants to solve machine learning problems of classification, clustering etc using standard problem formulations which are convex (SVM etc) and non-convex (Neural Networks and Deep Neural Networks) etc.

ABOUT INSTRUCTOR :

Prof. Pravesh Biyani was born in Raigarh, India and received his BTech from IIT Bombay in 2002 and MS from McMaster University in the year 2004. He have also worked at the Ikanos Communications while pursuing his PhD at the IIT Delhi till early 2012. In the later 2012, he was a post- doctoral researcher at the University of Minnesota, Minneapolis with Prof. Tom Luo. He have won the INSPIRE Faculty award by the Govt. of India in 2012 and am currently an INSPIRE faculty at the IIIT Delhi. His research interests are physical layer wireless and wireline communications, optimization for signal processing and machine learning. Recently he have developed interest in applying ideas from Convex Optimization in solving problems in urban transportation, specially the bus route network design problem.

COURSE PLAN :

Week 1 : Basics of Linear Algebra and Calculus: Subspaces, EigenValue Decomposition, Singular Value Decomposition - Algorithms and Methods, PSD Matrices and Kernel Functions, Vector Calculus
Week 2 : Basics of Linear Algebra and Calculus: Subspaces, EigenValue Decomposition, Singular Value Decomposition - Algorithms and Methods, PSD Matrices and Kernel Functions, Vector Calculus(Continue...)
Week 3 : Convex Functions, First and Second Order Conditions for Optimisations, Convex and Non Convex Optimisation problems in Machine Learning
Week 4 : Gradient Descent: math, programming basic optimisation problems and their solutions
Week 5 : Variants of Gradient Descent: Projected, Stochastic, Proximal, Accelerated, Coordinate Descent, Training a Neural Network: Theory
Week 6 : Variants of Gradient Descent: Projected, Stochastic, Proximal, Accelerated, Coordinate Descent, Training a Neural Network: Theory(Continue...)
Week 7 : Newton’s Method, Optimization for ML in practice: Pytorch/Tensor Flow. Training a Neural Network, Implementation
Week 8 : Newton’s Method, Optimization for ML in practice: Pytorch/Tensor Flow. Training a Neural Network, Implementation(Continue...)