STAT 718 Spring 2023 Class Schedule

Ray Bai

Supervised Learning

- **1/9/23**: syllabus, course overview, model validation methods for machine learning
- **1/11/23**: matrix factorizations, ordinary least squares in linear regression
- **1/13/23**: bias-variance trade-off
- **1/16/23**: **Martin Luther King Jr. Day (no class)**
- **1/18/23**: ridge regression
- **1/20/23**: nonparametric regression, regression trees
- **1/23/23**: pruning regression trees, random forests for regression
- **1/25/23**: LASSO regression
- **1/27/23**: geometry of the LASSO and general coordinate descent algorithm
- **1/30/23**: computing the LASSO solution with coordinate descent
- **2/1/23**: nonconvex (folded concave) penalties for linear regression
- **2/3/23**: logistic regression, Fisher scoring algorithm
- **2/6/23**: ℓ_1-regularized logistic regression
- **2/8/23**: multiclass classification and multinomial logistic regression
- **2/10/23**: classification trees, random forests for classification

Optimization Algorithms for Big Data

- **2/13/23**: properties of convex sets and convex functions
- **2/15/23**: gradient descent algorithm
- **2/17/23**: accelerated gradient descent
- **2/20/23**: gradient boosting machine (GBM) for regression
- **2/22/23**: GBM for classification
- **2/24/23**: proximal gradient descent
- **2/27/23**: stochastic gradient descent (SGD) and mini-batch SGD
- **3/1/23**: methods for accelerating SGD
- **3/3/23**: constrained optimization and Karush-Kuhn-Tucker (KKT) conditions

Spring break 3/6/23-3/10/23

- **3/13/23**: duality in constrained optimization
- **3/15/23**: alternating direction method of multipliers (ADMM)

Unsupervised Learning

- **3/17/23**: overview of unsupervised learning, matrix completion and recommender systems
- **3/20/23**: matrix completion and recommender systems
- **3/22/23**: principal component analysis (PCA)
- **3/24/23**: robust PCA
- **3/27/23**: sparse PCA
- **3/29/23**: graphical models
- **3/31/23**: graph selection with the graphical lasso

Deep Learning and Generative Models

- **4/3/23**: feedforward neural networks
- **4/5/23**: supervised learning with deep neural networks (DNN)
- **4/7/23**: SGD for training a neural network, backpropagation algorithm
- **4/10/23**: vanishing and exploding gradients, adaptive learning rates, regularization in DNNs
- **4/12/23**: density estimation, generative models, Gaussian mixture model
- **4/14/23**: deep generative models, generative adversarial networks (GANs)
- **4/17/23**: fitting GANs, mode collapse, Wasserstein GANs

Student Project Presentations

- **4/19/23**: group project presentations
  - small object detection with faster R-CNN
  - distance-based regularization for offline reinforcement learning
  - feature selection in high-dimensional clustering
- **4/21/23**: group project presentations
  - induced matrix completion with general structured side information
  - composite likelihood method for big spatial data
  - intent recognition for conversational AI with roBERTa
- **4/24/23**: group project presentations
  - penalized methods for bi-level variable selection
  - functional random forests for curved response
  - functional data analysis for human activity recognition