HW1

1. Bias variance decomposition
   1. Graph and interpretation
2. Interpreting Multiple Linear Regression
3. Multiple Linear Regression
   1. Fitting linear regression model

HW2

1. Properties of least squares estimators via simulations
   1. Unbiased estimator B
2. Review of regression concepts
3. Expected test MSE

HW3

1. Statistical Inference
   1. F test/hypothesis test
   2. Confidence intervals
2. The challenge of multiple testing
3. Diagnostics for MLR

HW4

1. Best subset selection
2. Simulation studies
   1. Test error vs complexity
3. Cross-Validation
   1. K-fold
   2. LOOCV
4. Concept Review
   1. Model selection

HW5

1. Multiple Linear Regression
2. Forward and Backward Selection
3. Puzzling Problem
   1. Multicollinearity
4. Interaction Terms

HW6

1. Follow up to in class activity
   1. Interaction terms
2. Predictions in the presence of multicollinearity
3. Regularized Regression
   1. Ridge, lasso

HW7

1. Concept Review
   1. Effects of increasing lambda in lasso
2. Regularized Regression Models
   1. Lambda in ridge and lasso
3. Bootstrap
   1. Pop mean, se, confidence interval, 10th percentile
4. Properties of bootstrap
   1. Probability of observation

HW8

1. Concept Review
   1. LDA misclassification
   2. Logistic regression
   3. QDA
2. Email Spam
   1. Logistic regression
3. Weekly data set
   1. Logistic regression, LDA, QDA, Naïve Bayes

HW9

1. MNIST database
   1. KNN
   2. K fold cv to pick k
2. Fashion MNIST
3. Concept Review
   1. KNN vs large p
4. KNN
   1. Bias variance tradeoff
5. Email Spam part 2
   1. ROC curve
   2. Logistic, LDA, QDA, Naïve Bayes, KNN

HW10

1. Conceptual Review
   1. Classification trees
2. Basics of Decision Trees
   1. Tree size
3. Bagging and Random Forests
   1. Cross validation for tree complexity
   2. OOB error

HW11

1. Survey
2. Boosting
   1. Grid cv for tree number, lambda, and depth
   2. Random forest
3. Bias of Trees
4. Understanding K-Means clustering
5. Dendrogram sketch

HW12

1. Concept review
   1. Cluster validation
   2. Hierarchical clustering linkage
   3. PVE
   4. SVD
2. Simulations for Unsupervised Learning
   1. PCA
   2. K-means clustering
3. Matrix Completion
4. Hierarchical clustering and classification
   1. High dim setting