EECS 545 001 FA 2017 Syllabus

- Introduction
  - Overview
  - Linear Algebra Review
  - Probability Review
  - Convex Optimization
  - Newton's Method, Gradient Descent, Stochastic Gradient Descent

- Classification
  - K-nearest neighbors (KNN)
  - Bayes Classifiers
  - Discriminant Analysis
  - The Naive Bayes
  - Logistic Regression

- Regression
  - Linear Regression
  - Least Squares
  - Probabilistic Interpretation (connection to MLE)
  - Ridge Regression
  - Robust Regression

- Kernel Methods
  - Positive Definite Symmetric (PSD) Kernels
  - Kernel Ridge Regression
  - Kernel Density Estimation
  - Separating Hyperplanes
  - Support Vector Machine (SVM)
  - Gaussian Processes

- Regularization
  - L2 Regularization
  - L1 Regularization, Sparsity and Feature Selection
  - Bias-Variance Tradeoff
  - Empirical Risk Minimization
  - Cross Validation, Model Selection

- Unsupervised Learning
  - Principle Components Analysis (PCA)
  - Independent Components Analysis (ICA)
  - Clustering, K-Means
  - Spectral Clustering
  - Gaussian Mixture Models
  - The Expectation Maximization Algorithm
  - Factor Analysis
  - Dimensionality Reduction

- Neural Networks
  - Perceptron
  - MLP and back-propagation

- Ensemble Methods

- Boosting

- Decision Trees

- Advanced Topics:
  - On-Line Learning
  - Learning Theory
    * Sample Complexity
    * VC-Dimension
  - Graphical Models
    * Bayesian Networks
    * Structure Learning
    * Hidden Markov Models (HMM)
    * Markov Networks
  - Reinforcement Learning
  - Markov Decision Processes