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## 13.1 Informal Course Overview

### 13.1.1 Unsupervised

#### Clustering

- K-Means
- Gaussian Mixture Model (GMM), learned with EM
- Spectral Clustering

#### Dimensionality Reduction

- PCA (and Probabilistic PCA)
- Kernel PCA

### 13.1.2 Supervised

#### Binary Classification

- K-Nearest Neighbors
- Naïve Bayes
- Hyperplane Classifiers:
  - Perceptron (and Margin Perceptron)
  - Winnow
  - SVM:
    - \* Hard Margin and Soft Margin SVM
    - \* Kernel SVM: Polynomial and Gaussian Kernels, others
- Decision Tree (e.g. with Decision Stumps)

- Boosting:
  - AdaBoost (e.g. with Decision Stumps)
  - Bagging, Stacking
  - Random Forest

### **Multiclass Classification**

- K-Nearest Neighbors
- Naïve Bayes
- Multiclass SVM: One vs. All, One vs. One

### **Regression**

- K-Nearest Neighbors Regression
- Linear Regression
- Linear Regression with Regularization:
  - Ridge Regression
  - Lasso Regression
- Logistic Regression

## **13.1.3 Tools and Theory**

### **Model Selection**

- Train vs. Test, k-fold Cross Validation
- Penalty (e.g. SRM)

### **Statistics**

- Maximum Likelihood Estimators
- Maximum A posteriori Estimators

**Optimization**

- Gradient Descent (and Coordinate Gradient Descent)
- Linear Programming, Quadratic Programming
- Expectation-Maximization (EM)

**Others**

- PAC Framework
- Singular Value Decomposition (SVD)