

# CS478 - Machine Learning

## Tentative Syllabus - Spring 2002

**M = Mithcel, D = Duda, Hart & Stork**

- Introduction  
**M chap. 1, D chap. 1** (Week 1)
  - What is machine learning?
- Non-metric methods, inductive inference  
**D chap. 8, M chap. 2-3** (Week 1-3)
  - Concept learning
  - Decision trees
  - Strings based methods (maybe)
- Bayesian Learning  
**D chap. 2-3, M chap. 6** (Weeks 3-7)
  - Bayesian decision theory
  - ML, MAP and Bayesian Parameter Estimation
  - Sufficient statistics (maybe)
  - Hypothesis evaluation using Bayes Theorem
  - Bayes optimal classifier and Naive Bayes
  - Gibbs algorithm
  - Bayesian belief networks
  - The EM algorithm
  - Hidden Markov models
- Nonparametric Techniques  
**D chap. 4, M chap. 8** (Week 7-8)
  - Density Estimation
  - Parzen Windows
  - The nearest neighbor algorithm
- Linear discriminant functions  
**D chap. 5, M chap. 4** (Weeks 8-9)
  - LD functions and decision surfaces
  - The perceptron function
  - Relaxation and MSE procedures
  - Support vector machines (maybe..)
- Artificial neural networks  
**D chap. 6, M chap. 4** (Weeks 9-10)
  - Feedforward operation
  - Backpropagation algorithm
  - Feature mapping
  - Improving performance
- Stochastic methods  
**D chap. 7, M chap. 9** (Week 10-11)
  - Genetic algorithms
  - Genetic programming
  - Simulated annealing
- Hypothesis evaluation and model selection  
**D chap. 9, M chap. 5** (Week 11-12)
  - Sample error vs. true error
  - Confidence intervals
  - Comparing hypotheses
  - K-fold cross validation
  - The no free lunch theorem
  - MDL principle
- Unsupervised Learning  
**D chap. 10** (Weeks 12-14)
  - Mixture densities
  - The maximum likelihood estimates
  - The iterative EM clustering algorithm
  - The K-means clustering algorithm
  - Hierarchical clustering
  - Principal component analysis
  - Multidimensional scaling
  - Kohonen networks