ECE G313: Pattern Recognition
Spring 2007

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Office Hours: TF 3:15-4:00 pm

Class Schedule: TF 1:35-3:15 pm, 424 Hayden

Course Objective

Pattern recognition problems arise in many areas of practical importance such as character recognition, computer vision, biomedical pattern classification and speech recognition. This course emphasizes the probabilistic foundations to prepare students for research in pattern recognition and machine learning. The subjects covered include: Bayes decision theory, maximum likelihood and Bayesian parameter estimation, model selection, mixture density estimation, discriminant analysis, feature selection, dimensionality reduction, neural networks, decision trees, support vector machines, ensemble methods: boosting and bagging, and unsupervised learning algorithms.

Prerequisite

ECE G204 or equivalent, knowledge of linear algebra

Programming Requirement

C/C++ and matlab

Recommended Textbook

Pattern Classification, Second Edition, by R. O. Duda, P. E. Hart, D. Stork, Wiley and Sons, 2001.

Supplementary Texts

The Elements of Statistical Learning : Data Mining, Inference, and Prediction, by T. Hastie, R. Tibshirani, J. H. Friedman, Springer, 2001.

Introduction to Statistical Pattern Recognition, 2nd Edition, by Keinosuke Fukunaga, Academic Press, 1990.

Grading Policy

Homeworks and Computer Projects:	30%
One Exam:	30%
Final Project:	40%

Class Policies

- Homeworks will be collected in class. Late homeworks will NOT be accepted.
- There will be no makeup exam.
- Graded homeworks and handouts will be distributed at the beginning of the lecture. Please be on time to receive this material
- We will be using Blackboard. To learn more about Blackboard see http://www.edtech.neu.edu/blackboard.

Tentative Class Outline

Topics	Date	Reading	Presentations
Introduction	1/9	Chapter 1	
Bayesian Decision Theory	1/12, 1/16, 1/19	Chapter 2	
Maximum-Likelihood and Bayesian Parameter Estimation (ML, MAP, full Bayesian)	1/23 (HW 1), 1/26, 1/30 (HW 2 due)	Chapter 3	
Midterm Exam	2/6		
Mixture Models (Mixture of Gaussians, EM algorithm)	2/2, 2/9	Chapter 10.1-10.4.2, 10.5	
Unsupervised Learning: k-means clustering, criterion functions, hierarchical clustering	2/13, 2/16 (HW 3)	Chapter 10	
Model Selection	2/20		
Decision Trees	2/23	Chapter 8.2-8.4	
Linear Discriminant Functions and Support Vector Machines	2/27, 3/2 (proposal)	Chapter 5	
Spring Break (3/4-3/11)			
Component Analysis, Discriminants, and feature selection	3/13, 3/16	Chapter 3.8	
K-nn classifiers	3/20 (HW 4)	Chapter 4	
Neural Networks	3/23	Chapter 6	
Combining Classifiers: Bagging and Boosting	3/27	Chapter 9	
Bayesian Networks	3/30, 4/3	Chapter 2.11	
Hidden Markov Models	4/6, 4/10	Chapter 3.10	
Special Topics/Paper Presentations	4/13		
Project Presentations	4/17, 20, Finals		