ICS 663: Pattern Recognition (Fall 2015)

Times and Location

MW 10:30 AM – 11:45 AM in HOLM 243

Instructor: Kyungim Baek

Office: POST 314F
Office Hours: Monday 1:30 PM – 3:00 PM or by appointment
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General Description

This course introduces the fundamental issues of statistical pattern recognition. It attempts to focus on general theoretical foundations of clustering, classification and learning algorithms for pattern recognition rather than problem-dependent details. A tentative list of topics includes Bayesian decision theory, parameter estimation, hidden Markov models, nonparametric techniques, supervised and unsupervised learning, linear discriminant functions, support vector machines, and neural networks. Students are expected to implement some algorithms using their choice of programming language and have some background in linear algebra and probability theory.

Prerequisites

MATH 371 or equivalent, basic knowledge of calculus, linear algebra and probability theory, good programming skills.

Course Learning Outcomes

- Understand theoretical and mathematical background of common statistical pattern recognition algorithms/models
- Gain the knowledge needed to read and understand the more advanced topics and current research literature of pattern recognition
- Explain parametric and non-parametric density estimation techniques and use them to design and implement classifiers
- Describe supervised vs. unsupervised learning algorithms and their application to prediction and data analysis problems
- Apply the learned pattern recognition methods to the real world problems – identify the problem, develop systems/algorithms to address the problem, design and carry out the computational experiments, analyze and report the results

Textbooks

- R. O. Duda, P. E. Hart and D. G. Stork, *Pattern Classification*, 2nd Edition, John Wiley & Sons, 2001.
- Optional Reference: C. Bishop, *Pattern Recognition and Machine Learning*, 1st Edition, Springer, 2007.

Schedule (tentative)

Date	Topics
Week 1	Introduction
Week 2	Bayesian Decision Theory
Week 3	Maximum Likelihood Estimation
Week 4	Bayesian Parameter Estimation
Week 5	Nonparametric Techniques, **Project Proposal Due**
Week 6	**Proposal presentation**
Week 7	Component Analysis and Discriminants, **Exam I**
Week 8	Expectation-Maximization
Week 9	Hidden Markov Models
Week 10	Linear Discriminant Functions
Week 11	**Interim Presentation**
Week 12	Support Vector Machines
Week 13	Unsupervised Learning & Clustering
Week 14	**Exam II**
Week 15	Neural Networks
Week 16	**Project Presentation, Final Project Report Due**

Grading

- Homework assignments: 25%
- Exams: 30%
- Course project: 45%
  - Written proposal (5%) and oral presentation (10%)
  - Interim presentation (10%)
  - Final report (10%) and presentation (10%)

Course Policies

- **No makeup exams** will be given unless the instructor is provided with official documented proof of an emergency that prevented you from attending the exam. In the case of an emergency, the instructor must be contacted within 48 hours after the absence.
- **Homework** is due at **5:00 PM** on the assigned due date. If you hand in late work without approval of the instructor you may receive zero credit. Late submission may be accepted on a case by case basis, but with few exceptions and with a possible penalty for lateness.
- **Cooperation on Assignment**

  Cheating and plagiarism as defined in the University Catalog will result with an F for the class and the incident will be reported to the ICS Department Chair and the Academic Dean for further action. This policy will be applied to those who copy other's work and who allow their work to be copied.

  You are allowed to discuss strategies for solving assignments with other students, however collaboration on solutions/codes, sharing or copying of solutions/codes is not allowed. This policy will be strictly enforced.

  You may consult public literature (books, articles, etc.) for information, but you must cite each source of ideas you adopt.

Class materials will be posted on the course web page at laulima.hawaii.edu. **It is strictly prohibited to post and/or upload any of the course materials on any website.**