Pattern Recognition
Winter 2013
Andrew Cohen
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What is this course about?

This course will study state-of-the-art techniques for analyzing data. The goal is to extract meaningful information from feature data. This includes statistical and information theoretic concepts relating to machine learning, data mining and pattern recognition, with applications using MATLAB.

This course is intended for computer science and engineering graduate students, but is open to any student with a background in probability and calculus. One additional requirement is some background in programming (preferably including courses on data structures and algorithms) and the willingness and ability to learn MATLAB.

Course meeting time

Tuesday/Thursday 5-6:20, Curtis Hall 352A

Course website

All course information including lecture notes and homework (found as the last slide in the weekly lecture notes) will be posted on the course website :

http://bioimage.coe.drexel.edu/courses/PatternRecognition

Important: prior to the second lecture you must verify that you can access this syllabus document on the course website.

Textbook

The required text for this course is

> Theodoridis, S. and K. Koutroumbas, Pattern recognition. 4th ed. 2009, San Diego, CA: Academic Press.

There is an additional MATLAB reference available for this text that you may find helpful.

Note that you also need access to the MATLAB software, including the image processing and statistics toolkits.

Instructor information

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TA information

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Course Topics

(subject to change based on schedule / pace of lectures)

- Bayes Decision Theory
    - Discriminant Functions and Services
    - the Normal Distribution
    - Bayesian Classification
    - Estimating Probability Density Functions
    - Nearest Neighbor Rules
    - Bayesian Networks
- Linear Classifiers
    - the Perceptron Algorithm
    - Least-Squares Methods
- Nonlinear Classifiers
    - Multilayer Perceptron's
    - Back Propagation Algorithm

    - Decision Trees
    - Combinations of Classifiers
    - Boosting
- Feature Selection
    - Data Preprocessing
    - ROC Curves
    - Class Separability Measures
    - Feature Subset Selection
    - Bayesian Information Criterion
- Dimensionality Reduction
    - Basis Vectors
    - Singular Value Decomposition
    - Independent Component Analysis
    - Kernel PCA
    - Wavelets
- Additional Features And Template Matching
    - Texture, Shape and Size Characterization
    - Fractals
    - Features For Audio
    - Template Matching Using Dynamic Time Warping and Edit Distance
- Context Dependent Classification
- Clustering
    - Sequential Algorithms
    - Hierarchical Algorithms
    - Functional Optimization-Based Clustering

    - Graph Clustering
    - Learning Clustering
    - Clustering High Dimensional Data
        - Subspace Clustering
- Cluster Validity Measures

Grading

- Assignments (roughly one per week) – 50%
- Term Project – 40%
- Class Participation – 10%
- Generous reward for effort

Term Projects

The lectures are designed to give you a broad understanding of the subject. The term project is designed to give you an in-depth understanding of a selected topic that relates your research to a topic from the course. The final project will include a written proposal. At the end of the semester, each student will give a short oral presentation on their final project. Finally, due on the date of the scheduled final exam will be a research paper describing your project. All of the requirements for the term projects will be detailed later in the semester.

Attendance

Attendence is mandatory. Please do not attend if you are ill. Excused absences must be reported via e-mail. If you're not ill, you are expected to attend and participate in the lectures. Discussion is a key aspect of learning, class participation is expected and will be tracked as part of your grade.

Academic conduct

University policy on academic conduct can be found here:

http://drexel.edu/studentaffairs/community_standards/studentHandbook/general_information/code_of_conduct/

IMPORTANT: PRIOR TO THE NEXT LECTURE BE SURE TO READ THIS POLICY