Statistical Foundations of Data Analysis [Spring 2009]

CIS 8590.002 Topics in Computer Science / PSYCH 8110.001 Topical Seminar in Experimental Psychology

Additional information about this course may be found on the Web at http://www.ist.temple.edu/~hbling/8590.002/.

Lecture Time: Thursday 4:40-7:10 PM in TL0403B

Instructor: Haibin Ling & Thomas Shipley
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- Office Hours (for all instructors and TAs): Thursday 2:30-3:30pm or by appointment.

PREREQUISITES

A general familiarity and basic level of comfort with probability and statistics is essential, and will be assumed. Any of the following courses, or specific permission of the instructor, should be enough: CIS 8525, 8526, 8527, 9603, 9664.

TEXT

The major textbook for the class is:

Recommended textbooks:
- Pattern Theory: From Representation to Inference, by U. Grenander and M. Miller, Publisher: Oxford University Press, ISBN 0199297061.

DESCRIPTION

In this course we will study the statistical methods that are widely used in computer science and psychology. The first part of the class will give an introduction to popular statistical approaches as well as some elementary knowledge base. After learning these tools, we will advance to interdisciplinary research topics, e.g., in computer science and psychology. Students are encouraged to select the project topics related to their current
research. Instructors will also provide some candidate topics. This is an ideal first course for graduate level data analysis, even though experienced students will benefit from taking it.

The course will cover the following topics:

- **Statistical foundations:**
  - Elemental statistical concepts: random variables, probability distributions
  - Bayesian inference
  - Advanced statistical methods:
    - Factor analysis and dimensional analysis (e.g., PCA, ICA, MDS)
    - Analysis of variance (e.g., ANOVA)
    - Supervised learning (e.g., LDA, AdaBoost, SVM)
    - Unsupervised learning (e.g., clustering)
    - Graphical models (e.g., Bayesian Net, MRF, CRF)

- **Potential research tools**
  - Using Psychophysics Matlab Toolbox
  - Using EEG signal analysis Matlab Toolbox
  - Other tools related to chosen research topics.

- **Potential research topics**
  - Student chosen topics
  - Candidate topics:
    - Object recognition
    - Visual attention and saliency
    - Human perception (e.g., gestalt rules, spatial perception)
    - Machine perception (e.g., contour grouping)

**GRADING**

- Class participation: 30%
- Presentations: 30%
- Projects: 40%

**EXAMS**

The final exam will be given only to those students who did not complete their projects and did not give their presentations, in which case it will account for 70% of the grade.

**FINAL PROJECT**

Several project ideas will be suggested during the course of the semester, but students are free to suggest their own, especially if they relate to their current research. Students will be expected to come up with innovative, novel solutions to problems in interdisciplinary areas, e.g., computer science and psychology, human computer interaction.

Course projects will be undertaken in small teams (2-3 students), or individually (as agreed with the instructor). Each team member will receive the same grade for the project; it is up to the team members to divide the work fairly. More information on course projects will be provided soon.