36-713
Nonparametric Methods
Fall 2003

Time: Tuesdays and Thursdays, 3:00 - 4:20
Place: PH 225B
Web page: http://www.stat.cmu.edu/~larry/=stat713
Book: All of Nonparametric Statistics
Available on the web page

This course will cover modern nonparametric statistical methods. The course is mainly aimed at Master's Statistics students but anyone is welcome as long as you have the prerequisties.

PREREQUISITES

You should have taken Intermediate Statistics or at least be comfortable with the topics in that class, including:

- central limit theorem
- law of large numbers
- convergence in probability
- convergence in distribution
- maximum likelihood
- Fisher information
- the delta method
- confidence intervals
- hypothesis testing
- p-values
- linear regression

Here is an outline of the topics.

1. Estimating the Distribution Function
2. Estimating Statistical Functionals
   (a) Statistical Functionals and Plug-in Estimators
   (b) Influence Functions
   (c) The Jackknife
   (d) The Bootstrap
   (e) Bootstrap Confidence Intervals
3. Smoothing
   (a) The Bias-Variance Trade-off
   (b) Histograms
   (c) Kernel Density Estimation
   (d) Nonparametric Kernel Regression
   (e) Splines
   (f) Confidence Sets and Bias
4. Normal Means and Minimax Theory
   (a) L_2 Theory
   (b) Connection to Regression and Density Estimation
   (c) Risk, Minimax and Bayes
   (d) Pinsker's theorem
   (e) Stein's Unbiased Risk Estimator (SURE)
   (f) The James-Stein Estimator
   (g) Linear Shrinkage Estimators
   (h) Minimaxity of the James-Stein Estimator
   (i) Pinsker's Theorem for Ellipsoids and Sobolev Spaces
5. Estimation Using Orthogonal Bases
   (a) modulators

   (b) wavelets

6. Classification
   (a) Bayes classifiers
   (b) empirical risk minimization
   (c) Vapnik-Chervonenkis theory
   (d) support vector machines
   (e) other classifiers

7. Other Topics
   (a) Measurement error
   (b) Inverse problems
   (c) Computational issues
   (d) Nonparametric Bayes