PubH 8422 Modern Nonparametrics

Fall 2003, 2 credits, A/F or S/N

Title: Modern Nonparametrics

Course Description: This course seeks to intorduce students to the many developments in nonparametric, semiparametric and robust statistics that have occurred over the last several decades. While the course will focus on applications, time will be devoted to derivations and theoretical justifications of methods. First we will discuss the sorts of problems that are encountered in modern nonparametrics. Then, after a brief review of classical nonparametrics, the course will first survey popular computational approaches, such as the bootstrap, jackknife and cross-validation. Then we will consider several more general tools and approaches: the empirical process, quasi-likelihood, robustness (frequentist and Bayesian) and Bayesian nonparametrics. Applications will include density estimation, nonparametric regression, robust regression, cumulative hazard estimation and survival curve estimation. S-plus will be used for the homework exercises.

Course Instructor:

- Dr Cavan Reilly email: cavanr@biostat.umn.edu, phone: (612)624-9644, office: Mayo A440.

For whom intended: This course is designed for second-year biostatistics/statistics graduate students.

Prerequisites: PubH 5466 or Stat 5102 or permission from instructor.

Objective: After taking the course, the student should have a working statistical knowledge in modern nonparametrics.

Evaluations: Course evaluation will be based on homework assignments (70%) and a final exam (30%).

Course web site: http://www.biostat.umn.edu/ cavanr/pubh8422.html.

Textbooks: There is no required textbook. The material will largely be drawn from the following texts:

1. Cox, D. and Hinkley, D. (1974), *Theoretical Statistics*, Chapman and Hall, London. (Classical nonparametrics.)

2. Ghosh, and Ramamoorthy, M. (2003), *Bayesian Nonparametrics*, Springer, New York. (Bayesian nonparametrics.)

3. Heyde, C. (1997), *Quasi-likelihood and its Applications*, Springer, New York. (Quasi-likelihood.)

4. Huber, P. (1981), *Robust Statistics*, Wiley, New York. (Frequentist Robustness.)

5. Rios Insua, D. and Ruggeri, F. eds., (2000), *Robust Bayesian Analysis*, Springer, New York. (Bayesian Robustness.)

6. Shorak, G. and Wellnor, J. (1986), *Empirical Processes with applications to Statistics*, Wiley, New York. (Empirical Process.)

7. van der Vaart, A. (1998), *Asymptotic Statistics*, Cambridge University Press, Cambridge. (Classical nonparametrics, empirical process.)

Weekly Schedules:

Week	Topic
1	Course introduction; scope and typical applications
2	More on typical applications
3	Classical nonparametrics: quick review of basic ideas
4	Computational techniques: bootstrap, jackknife and cross-validation
5	Computational techniques: applications-bandwidth selection
6	Empirical process: introduction, censoring, asymptotics
7	Empirical process: applications-cumulative hazard, Kaplan Meier
8	Robustness: influence function, M-estimates and L-estimates
9	Bayesian Robustness: global and local robustness, computational aspects
10	Robustness: applications in regression
11	Quasi-likelihood: introduction, asymptotics, linear Bayes methods
12	Quasi-likelihood: applications-generalized linear models, mean of a stationary process
13	Bayesian non-parametrics: introduction, Dirichlet processes, Polya tree priors
14	Bayesian non-parametrics: neutral to the right processes, exchangeability
15	Bayesian non-parametrics: applications