University of California, Santa Barbara
Department of Statistics and Applied Probability

PSTAT 262SP
Smoothing Spline Models and Their Applications

Course Description: This course is about a particular class of modern nonparametric regression methods called spline smoothing for estimating functions of one and several variables. Special models such as polynomial, periodic, thin plate, partial and tensor product smoothing splines for Gaussian data will be covered. The general form of smoothing spline models using reproducing kernel Hilbert space will also be discussed, however, no prior knowledge of these spaces is assumed. The relationships between smoothing spline estimates and Bayesian estimates will be studied. Data based methods for estimating the optimal amount of smoothing such as cross validation, generalized cross validation, generalized maximum likelihood will be explored. Applications in medicine and other areas will be used to motivate and demonstrate these methods. Numerical methods as well as the use of publicly available software will be discussed. Upon completing the course the student should be able to apply modern multivariate smoothing spline and related methods to real data. This course should also provide comprehensive background knowledge for students who are interested in studying the areas of nonparametric regression methods and kernel methods for machine learning, perhaps with the intention of undertaking research in the field. Graduate students in mathematics, physical and social sciences, engineering and economics may find some of the techniques studied here useful and are welcome to sit in, or take the course for credit if they have sufficient math and statistical background.

Prerequisites: PSTAT 207ABC and 220A or consult instructor. Otherwise, the development will be self-contained. Familiarity with programming languages such as R/Splus would be helpful.

Time: Tuesday and Thursday 12:30 - 1:45

Place: North Hall 1109

Instructor: Dr. Yuedong Wang
South Hall, Room 5509
E-mail: yuedong@pstat.ucsb.edu
Web: http://www.pstat.ucsb.edu/~yuedong
Phone: 893-4870
Office hour: TR 3:00pm - 4:00pm, or by prior appointment

Text:

1. Wahba, G. (1990), *Spline Models for Observational Data*, SIAM.
2. Notes are provided by instructor.

Additional Reference:

1. Eubank, R. (1988), *Spline Smoothing and Nonparametric Regression*,Dekker.
2. Hastie, T. and Tibshirani, R. (1990), *Generalized Additive Models*, Chapman and Hall.
3. Green, P. J. and Silverman, B. W. (1994), *Nonparametric Regression and Generalized Linear Models: A Roughness Penalty Approach*, Chapman and Hall.
4. Gu, C. (2002), Smoothing Spline ANOVA Models, Springer.

Course Grading: This is a seminar-type course. There will be no sit-down exams. Grades will be based on occasional assignments and course projects involving real data analysis, simulation and/or report on a recent paper.