



The University of Toledo
Department of Mathematics

SHOEMAKER LECTURE SERIES

Professor Lijian Yang
Michigan State University

Applications of Splines in Statistics

Lecture 1: Polynomial spline confidence bands for regression curves

4:00-5:00pm, Wednesday, March 17th in Stranahan Hall (North) Room 3140- new bldg. addition

Abstract. In this first of 3 talks, I will introduce the concept of confidence band as an extension of confidence interval. I will then describe asymptotic confidence bands for a nonparametric regression function, using piecewise constant and piecewise linear spline estimation, respectively. The confidence bands have the same width order as the Nadaraya-Watson bands of Hardle (1989), and the local polynomial bands of Xia (1998) and Claeskens and Van Keilegom (2003). Simulation experiments corroborate the asymptotic theory. The linear spline band has been used to identify an appropriate polynomial trend for fossil data. This talk is based on Wang, J. and Yang, L. (2009) Polynomial spline confidence bands for regression curves. *Statistica Sinica* 19 (1), 325-342.

Light refreshments will be served before the talk in UH2040 at 3:00pm.

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Lecture 2: Spline confidence bands for variance function

5:10-6:00pm, Wednesday, March 17th in Stranahan Hall (North) Room 3140- new bldg. addition

Abstract. In this second talk, I will highlight the concept of oracle efficiency and its importance in variance estimation. Asymptotic confidence bands are obtained for possibly heteroscedastic variance functions, using piecewise constant and piecewise linear spline estimation, respectively. The variance estimation is as efficient as an infeasible estimator when the conditional mean function is known, and the widths of the confidence bands are of optimal order. Simulation experiments provide strong evidence that corroborates the asymptotic theory while the computing is extremely fast. A slower bootstrap band is also proposed, with much higher accuracy. As illustrations, the bootstrap spline band has been applied to test for heteroscedasticity in fossil data and in motorcycle data. This talk is based on Song, Q. and Yang, L. (2009) Spline confidence bands for variance function. *Journal of Nonparametric Statistics* 21 (5), 589-609.

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Lecture 3: A simultaneous confidence band for sparse longitudinal regression.

3:00-4:00pm, Friday, March 19th in UH4010

Abstract. In this last talk, I will present some latest, not yet published works on sparse longitudinal regression. Functional data analysis has received considerable recent attention and a number of successful applications have been reported. In this paper, asymptotically simultaneous confidence bands are obtained for the mean function of the functional regression model, using piecewise constant spline estimation. Simulation experiments corroborate the asymptotic theory. The confidence band procedure is illustrated by analyzing the CD4 cell counts of HIV infected patients. This talk is based on Ma, S., Yang, L. and Carroll, R. (2010) A simultaneous confidence band for sparse longitudinal regression.

Light refreshments will be served after the talk in UH2040 at 4:00pm.