Econometrics 227

Department of Economics, UCSD Winter 2010

Instructor: Andres Santos	Email: a2santos@ucsd.edu
Economics $#210$	Office Hours: Friday afternoons.

Course Outline

The goal of Econ 227 is to provide an introduction to nonparametric and semiparametric methods in econometrics. Nonparametric statistics is often concerned with the study of infinite dimensional objects, and as a result modern theory relies heavily on areas of topology and functional analysis. I will try to provide additional background on these topics as necessary, but you should expect a high level of mathematical analysis considerably beyond what is used in the core courses 220A-220C.

PART I: BASIC NONPARAMETRIC ESTIMATORS.

<u>Kernel Estimators</u>: (i) Density estimation: bias, variance and asymptotic normality; (ii) Conditional Expectations: Nadaraya-Watson and Local Polynomial Estimators.

References: Chapters 2 and 3 in Pagan and Ullah (1999), Chapters 1 and 2 in Yixiao's notes.

<u>Series Estimators</u>: (i) Rates of covergence and asymptotic normality for functionals. *References:* Andrews (1991), Newey (1997), Huang (1998, 2003).

PART II: EMPIRICAL PROCESS THEORY.

<u>Math Overview:</u> (i) Measurability; (ii) Topology; (iii) Metric and Hilbert Spaces; (iv) Compactness. *References:* Chapter 1.1-1.3 in Durrett (1996), Chapter 2.1-2.4, 2.7-2.10 in Aliprantis and Border (2006), Chapters 2 and 3.1-3.4 in Luenberger (1969).

Weak Convergence: (i) Measurability issues (basic overview); (ii) General Theory of Weak Convergence; (iii) Weak Convergence in the Space of Bounded Functions; (iv) Convergence in Outer Probability. *References:* Chapters 1.2, 1.3, 1.5, 1.9 and 1.10 in van der Vaart and Wellner (1996).

Empirical Process Theory: (i) Maximal Inequalities and Covering Numbers; (ii) Symmetrization; (iii) Glivenko-Cantelli Theorems; (iv) Donsker Theorems; (v) Uniform Entropy and Bracketing Numbers; (vi) Permanence of the Donsker Property.

References: Chapters 2.1-2.7, 2.10 and 2.13 in van der Vaart and Wellner (1996).

PART III: APPLICATIONS OF EMPIRICAL PROCESS THEORY.

<u>Semiparametric Methods</u> (i) Simulation estimators; (ii) The maximum score estimator and cube root asymptotics; (iii) Conditional Moment Models with possible endogeneity.

References: Pakes and Pollard (1989), Kim and Pollard (1990), Ai and Chen (2003, 2007).

Additional Topics: (i) Bootstrap Methods; (ii) General Sieve Estimation; (iii) Nonparametric IV. *References:* Chapters 2.9 and 3.6 in van der Vaart and Wellner (1996), Gine and Zinn (1990), Ma and Kosorok (2005), Chen and Pouzo (2008), van de Geer (2000), Hall and Horowitz (2005), Santos (2009).

Web Page and Grading

The course materials will be posted on webct.ucsd.edu. You will be evaluated through your performance in the problem sets.

Textbook

There are no required textbooks for the course, although the following will be useful references. If you are planning to specialize in econometric theory you should probably add to your library at some point.

"Nonparametric Econometrics" by Pagan A. and Ullah A. Cambridge University Press, 1999.

"Asymptotic Statistics" by van der Vaart A. W. Cambridge University Press, 2000.

"Weak Convergence and Empirical Processes" by van der Vaart A. W. and Wellner J. A. Springer, 1996. "Introduction to Empirical Processes and Semiparametric Inference" by Kosorok M. R. Springer, 2008.

References

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- (2007): "Estimation of Possibly Misspecified Semiparametric Conditional Moment Restriction Models with Different Conditioning Variables," *Journal of Econometrics*, 141, 5–43.
- ALIPRANTIS, C. D., AND K. C. BORDER (2006): Infinite Dimensional Analysis A Hitchhiker's Guide. Springer-Verlag, Berlin.
- ANDREWS, D. W. K. (1991): "Asymptotic Normality of Series Estimators for Nonparametric and Semiparametric Regression Models," *Econometrica*, 59(2), 307–345.
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- DURRETT, R. (1996): Probability: Theory and Examples. Duxbury Press, Belmont, United States.
- GINE, E., AND J. ZINN (1990): "Bootstrapping General Empirical Measures," *The Annals of Probability*, 18(2), 851–869.
- HALL, P., AND J. HOROWITZ (2005): "Nonparametric Methods for Inference in the Presense of Instrumental Variables," Annals of Statistics, 33, 2904–2929.

HUANG, J. Z. (1998): "Projection Estimation in Multiple Regression with Applications to Functional Anova Models," Annals of Statistics, 26, 242–272.

KIM, J., AND D. POLLARD (1990): "Cube Root Asymptotics," Econometrica, 18(1), 191–219.

LUENBERGER, D. G. (1969): Optimization by Vector Space Methods. Wiley, New York.

- MA, S., AND M. R. KOSOROK (2005): "Robust Semiparametric M-estimation and the Weighted Bootstrap," *Journal of Multivariate Analysis*, 96, 190–217.
- NEWEY, W. K. (1997): "Convergence Rates and Asymptotic Normality for Series Estimators," Journal of Econometrics, 79, 147–168.
- PAGAN, A., AND A. ULLAH (1999): Nonparametric Econometrics. Cambridge University Press, Cambridge.
- PAKES, A., AND D. POLLARD (1989): "Simulation and the Asymptotics of Optimization Estimators," *Econometrica*, 57(5), 1027–1057.
- SANTOS, A. (2009): "Inference in Nonparametric Instrumental Variables with Partial Identification," Working paper, University of California - San Diego.
- VAN DE GEER, S. (2000): Empirical Processes in M-Estimation. Cambridge University Press, Cambridge.
- VAN DER VAART, A. W., AND J. A. WELLNER (1996): Weak Convergence and Empirical Processes: with Applications to Statistics. Springer, New York.

^{(2003): &}quot;Local Asymptotics for Polynomial Spline Regression," Annals of Statistics, 31, 1600–1635.