Economics 285F, Spring 2015
Topics in Advanced Econometrics

Instructor: Tae-Hwy Lee
Lecture: W 1:15 – 3:55 pm, SPR 2206
Office hours: Open door and by appointment on MWF, SPR 3103

Course Requirement and Grading: The course grade will be based on the many homework problems raised during the lectures, a research paper, and a presentation. All submission of the homeworks, paper, and slide should be typed and submitted electronically via email.

1. Homeworks (30%) on problems raised during the lectures. You will have one week (7 days) for each homework.
2. Paper (40%) can be either theoretical, applied, empirical, Monte Carlo, or a literature review on a specific topic related to the course.
    a. A draft for the paper will be due by 11:59 pm, May 24 (5%),
    b. a revised draft due by 11:59 pm, May 31 (5%), and
    c. the final paper due by 11:59 pm, June 14 (30%).
3. Presentation (30%, 20 minutes), June 3

Course Outline

1. Entropy and Maximum Entropy

Entropy
Kullback-Leibler divergence
Logarithmic probability score
Maximum entropy
Applications of information theory for theory-coherent estimation and forecasting
Applications of information theory for model averaging, forecast combination, and portfolio theory

References: MacKay (2003), Cover and Thomas (2006), Golan et al (1996)

2. Model Selection

Derivation of AIC and TIC (generalized AIC)
Derivation of BIC
Properties of AIC and BIC: AIC vs BIC, Can the Strengths of AIC and BIC Be Shared?
Cross-validation: properties, cross-validation vs AIC
Mallow criterion

References: Hastie et al (2009), Yang (2005)

3. Model Averaging

Stein estimator
Mallow model averaging
Bayesian model averaging
Applications

References: Hansen (2007, 2008, 2010, 2014a,b,c,d)

4. Ensemble Methods in Regression and Classification: Tricks in Machine Learning

Bagging: Asymptotic properties, Rao-Blackwellization, Applications of bagging in regression models with constraints
Random forecast
Boosting

References: Hastie et al (2009), Varian (2014), Lee and Yang (2006), Lee, Tu and Ullah (2014, 2015), Buhlman and Yu (2002), Murphy (2012), James et al (2012), Bai and Ng (2009), Ng (2014), Leek (2013), Hirano and Wright (2015)

5. Regularization Methods in Regression and Classification: Factor Models

Pricipal component regression
Sieve regression
Partial least squares regression
Sliced inverse regression
Three pass regression filter
Principal forecast components

References: Bai (2003), Bai and Ng (2002, 2006), Stock and Watson (2002, 2006, 2012), Diebold and Li (2005), Hillebrand, Huang, Lee, and Li (2014), Hillebrand and Lee (2012), Tu and Lee (2015), Kelly and Pruitt (2015)

6. Regularization Methods in Regression and Classification: Variable Selection

Ridge regression
Lasso regression
Least angular regression

References: Hastie et al (2009)

7. Regularization Methods in Nonlinear Models

Artificial neural network (ANN) models
Testing for neglected nonlinearity with randomly activated neural networks
Consistent specification testing with nuisance parameters present only under the alternative
Extreme learning machines (ELM)
Quck Nets and least angular regression
Boosting ANN and ELM
Kernel ridge regression (KRR)

References: Hastie et al (2009), Liu et al (2015), Lin et al (2015), Exterkate et al (2013), Bai and Ng (2009), Ng (2014), Lee, Xi, and Zhang (2014b), Lee, Granger and White (1993), Hong and Lee (2003), White (2006)

8. Estimation of a Loss Function

GMM estimation of loss/preference given the revealed forecasts
Overidentifying testing of forecast optimality under estimated loss function
Encompassing test for counter-factual evaluation of forecasts

References: Hansen and Singleton (1982), Elliott, Komunjer, and Timmermann (2005), Wang and Lee (2014), Lee and Wang (2015)

More topics if time permits:

9. Simulation Methods in Econometrics

Simulating specific distribution: Direct methods (probability integral transform, Box-Muller algorithm)
Simulating specific distribution: Indirect methods (Motivating example for Accept-Reject algorithm)
Classical simulation: Accept-Reject algorithm , Important sampling, Multivariate simulation
Markov Chain Monte Carlo: Theory of Markov Chains, Gibbs sampling, Metropolis-Hastings algorithm
Applications in regression models in econometrics
Simulated method of moments

10. Topics in Bootstrap Methods

Consistency of the bootstrap
Bootstrap when a parameter is on the boundary of the parameter space
Bootstrap with heavy-tailed distribution
Bootstrap for the maximum/minimum of a sample
Bootstrap for the square of the sample mean
Bootstrap confidence intervals for continuous and discontinuous functions of parameters
Bootstrap for heteroskedastic data
Bootstrap for weakly dependent data
Bootstrap for unit root tests for autoregressive time series
Bootstrap with non-smooth estimators, LAD, quantile regression
Subsampling methods

References: Horowitz (2001), Andrews (2000), Woutersen and Ham (2013), Wasserman (2004, p . 234), Politis and Romano (),

11. Quantile and Expectile Regressions

Quantile regression: estimation, asymptotic distribution
Expectile regression: estimation, asymptotic distribution
Estimation of expected shortfall
Extensions: autogressive model, varying coefficient model

References: Koenker and Bassett (1978), Newey and Powell (1987), Kuan et al (2009), Xie et al (2014)

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