The Chinese University of Hong Kong

ECON5170 Computational Methods in Economics
Spring, 2017-2018

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1 Lecture Hours and Location

Time: January 10th - April 18th, every Wednesday 14:30 - 17:15, except public holidays
Venue: Wong Foo Yuan Building (FYB) 107A
Office hours: By appointment

2 Course Description

In modern economic research, computers enhance our capacity of solving complex problems. Computation is particularly important in fields involving massive data. The objective of this course is to introduce graduate students to computational approaches for solving economic models, with an emphasis on dynamic programming and simulation-based econometric methods. We will formulate economic problems in computationally tractable form and use techniques from numerical analysis to solve them. The substantive applications will cover a wide range of problems including labor, industrial organization, macroeconomics, and international trade.

3 Learning outcomes

Computational economics has not been part of the core curriculum of postgraduate-level economics education, whereas programming skill is critical for a postgraduates success in academia and industry. This course intends to teach students computational methods for solving economic problems, and expose students to extensive programming exercises. We expect that at the end of the course a student would proficiently use at least one programming language (Stata, Matlab, R, etc). Moreover, we aim to equip the students with the computational ability to tackle problems of their own research areas.

4 Assessment

Midterm	30%	A small take-home exercise.
Final	70%	A group project. Form a group of 2-3 people. Write a computer program to solve one of the three problems (micro, macro, or metrics). Present the results on April 18th or later (TBA). Hand in the final codes by May 6th.

5 Class Schedule

Date	Content
10 Jan	Basic R
17 Jan	Advanced R
24 Jan	Basic Stata (in Undergraduate Computer Lab ELB 916)
31 Jan	Advanced Stata (in Undergraduate Computer Lab ELB 916)
7 Feb	Monte Carlo Simulation
14 Feb	Numerical Integration
28 Feb	Numerical Optimization
7 Mar	Machine Learning
14 Mar	Linear Equations
21 Mar	Nonlinear Equations
28 Mar	Approximation methods
4 Apr	Dynamic programming
(TBA)	Presentation of group projects

6 Required Readings

Judd, Kenneth (1998): Numerical Methods in Economics, the MIT Press
Efron and Hastie (2016): Computer Age Statistical Inference: Algorithms, Evidence, and Data Science, Cambridge University Press

References

[AJ03] Peter Arcidiacono and John Bailey Jones. Finite mixture distributions, sequential likelihood and the em algorithm. *Econometrica*, 71(3):933–946, 2003.

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[CH03] Victor Chernozhukov and Han Hong. An mcmc approach to classical estimation. *Journal of Econometrics*, 115(2):293–346, 2003.

[FHT08] Jerome Friedman, Trevor Hastie, and Robert Tibshirani. *The elements of statistical learning*. Springer, 2 edition, 2008.

[FL01] Jianqing Fan and Runze Li. Variable selection via nonconcave penalized likelihood and its oracle properties. *Journal of the American statistical Association*, 96(456):1348–1360, 2001.

[GKT17] Matthew Gentzkow, Bryan T Kelly, and Matt Taddy. Text as data. Technical report, National Bureau of Economic Research, 2017.

[GLP17] Domenico Giannone, Michele Lenza, and Giorgio E Primiceri. Economic predictions with big data: The illusion of sparsity. Technical report, SSRN, 2017.

[GMR93] Christian Gourieroux, Alain Monfort, and Eric Renault. Indirect inference. *Journal of applied econometrics*, 8(S1):S85–S118, 1993.

[Jud98] Kenneth L Judd. *Numerical methods in economics*. MIT press, 1998.

[Nas14] John C Nash. On best practice optimization methods in r. *Journal of Statistical Software*, 60(2):1–14, 2014.

[PP89] Ariel Pakes and David Pollard. Simulation and the asymptotics of optimization estimators. *Econometrica: Journal of the Econometric Society*, pages 1027–1057, 1989.

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[Shi16] Zhentao Shi. Econometric estimation with high-dimensional moment equalities. *Journal of Econometrics*, 195(1):104–119, 2016.

[SSP16] Liangjun Su, Zhentao Shi, and Peter CB Phillips. Identifying latent structures in panel data. *Econometrica*, 84(6):2215–2264, 2016.

[SW12] James H Stock and Mark W Watson. Generalized shrinkage methods for forecasting using many predictors. *Journal of Business & Economic Statistics*, 30(4):481–493, 2012.

[Tad18] Matt Taddy. The technological elements of artificial intelligence. Technical report, National Bureau of Economic Research, 2018.

[Tib96] Robert Tibshirani. Regression shrinkage and selection via the lasso. *Journal of the Royal Statistical Society. Series B (Methodological)*, pages 267–288, 1996.

[Zou06] Hui Zou. The adaptive lasso and its oracle properties. *Journal of the American Statistical Association*, 101(476):1418–1429, 2006.