Wayne State University - Department of Economics
ECO 7100 - Econometrics I (Winter 2020)

Instructor: Vitor Kamada
Class: TT, 12:30 - 2:10 pm at 2072 FAB
Office: 2139 Faculty Administration Building (FAB)
Send all e-mails to: econometrics.methods@gmail.com
Cel: 678 644 5511
Office hours: MW, 12:00 – 12:20 pm and 4:10 – 5:20 pm in my office, or by appointment.

1) Course Description

Typical econometric study or empirical research involves the following process: 1) Formulating a research question; 2) Acquiring and cleaning data; 3) Conducting exploratory data analysis; and 4) Modelling and inferring conclusions from data. Over majority of econometrics courses and textbooks focus on step 4. However, in a real complex research, the most part of time is spent in data cleaning; whereas econometric modelling usually takes less than 20% of total time.

Other overlooked aspect in the whole process is coding. The ability to translate Math and Statistical language to computer language. Solid background in Math and Statistics helps to understand the logic of econometrics methods, but the implementation of the whole process relies heavily on coding skills. This course was primary designed to fix these two problems, but all steps of empirical research will be covered, including deployment of Machine Learning algorithms.

2) Learning Outcomes

After this course students will become proficient in using Python to access, process, visualize, understand, and extract insights from data. Students are expected to produce econometric analysis and not only being consumers of econometric studies or results. Another goal of this course is to provide a solid foundation to ECO 7110 Econometrics II, in which I will teach advanced methods in Causal Inference and Deep Learning.

3) Textbooks

All textbooks below are open source or available online for free via Wayne Library website. Check the links:

Adhikari, A., DeNero, J. (2020). Computational and Inferential Thinking: The Foundations of Data Science. https://www.inferentialthinking.com/chapters/intro.html

Angrist, Joshua D. and Pischke, Jörn-Steffen (2009). Mostly Harmless Econometrics: An Empiricist's Companion. Princeton University Press: https://ebookcentral.proquest.com/lib/wayne/detail.action?docID=475846

Hansen, B. R. (2019). Econometrics. https://www.ssc.wisc.edu/~bhansen/econometrics/

Hastie, T., Tibshirani, R., Friedman, J. (2017). The Elements of Statistical Learning. Springer, 2ed. https://web.stanford.edu/~hastie/ElemStatLearn/

James, G., Witten, D., Hastie, T., Tibshirani, R. (2017). An Introduction to Statistical Learning with Applications in R. Springer. Available for free in the Author website: http://faculty.marshall.usc.edu/gareth-james/ISL/

Lau, S., Gonzalez, J., Nolan, D. (2020). Principles and Techniques of Data Science. https://www.textbook.ds100.org/intro

Siegel, E. (2016). Predictive analytics: the power to predict who will click, buy, lie, or die. Wiley. https://elibrary.wayne.edu/record=b5588358~S47

Wooldridge, Jeffrey (2010). Econometric Analysis of Cross Section and Panel Data, 2ed, Cambridge: MIT Press. https://elibrary.wayne.edu/record=b4326785~S47

4) Required Software

4.1) Python

Python is an open-source programming language. It tends to be the dominant language in many branches of Data Science, such as: Machine Learning, Deep Learning, Natural Language Processing, Network Analysis, and deployment of Big Data infrastructure; etc.

There are several ways to run Python Code. I will use the Google Colab, a free Jupyter notebook environment that runs entirely in the cloud.

If you don't have a Google Account, you will need to create one, before accessing Google Colab at: https://colab.research.google.com/

5) Course Schedule

Part 1 – Data Cleaning and Machine Learning with Python

*= non mandatory complementary reference if you want to go deeper in your future studies

Date	Topics
Week 1 **Jan 7**	**1) Data Science** Adhikari & DeNero (2020): Ch 1
Week 1 **Jan 9**	**2) The Experimental Ideal** Angrist and Pischke (2009): Ch 2 Adhikari & DeNero (2020): Ch 2 *Athey, S., Imbens, G. W. (2017). The Econometrics of Randomized Experiments. Handbook of Economic Field Experiments, Vol 1, 73-140.
Week 2 **Jan 14**	**3.1) Programming in Python, Data Types, Sequences** Adhikari & DeNero (2020): Ch 3, Ch 4, Ch 5 **3.2) Data Design** Lau et al. (2020): Ch 2
Week 2 **Jan 16**	**4.1) Tabular Data and Pandas** Lau et al. (2020): Ch 3 **4.2) Tables** Adhikari & DeNero (2020): Ch 6
Week 3 **Jan 21**	**5.1) Principles of Visualization** Lau et al. (2020): Ch 6 **5.2) Data Visualization** Adhikari & DeNero (2020): Ch 7
Week 3 **Jan 23**	**6.1) The Data Science Lifecycle** Lau et al. (2020): Ch 1 **6.2) Functions and Tables** Adhikari & DeNero (2020): Ch 8
Week 4 **Jan 28**	**7.1) Data Cleaning** Lau et al. (2020): Ch 3 **7.2) Drawing Maps, OpenStreetMap, Latitude, Longitude** Adhikari & DeNero (2020): Ch 8.5
Week 4 **Jan 30**	**8) Conditional Statements, Iteration, and Simulation** Adhikari & DeNero (2020): Ch 9
Week 5 **Feb 4**	**9.1) Working with Text** Lau et al. (2020): Ch 8 **9.2) Sampling and Empirical Distributions** Adhikari & DeNero (2020): Ch 10
Week 5 **Feb 6**	**10) Testing Hypotheses** Adhikari & DeNero (2020): Ch 11

	*Hansen (2018): Ch 9
Week 6 **Feb 11**	**11) A/B Testing and Causality** Adhikari & DeNero (2020): Ch 12 **Siroker & Koomen (2013). A/B testing: the most powerful way to turn clicks into customers. Wiley
Week 6 **Feb 13**	**12) Bootstrap and Confidence Intervals** Adhikari & DeNero (2020): Ch 13 James et al. (2017): Ch 5.2 *Hansen (2018): Ch 10
Week 7 **Feb 18**	**13.1) Random Variables, Expectation, Variance, and Risk** Lau et al. (2020): Ch 12 **13.2) Why the Mean Matters** Adhikari & DeNero (2020): Ch 14 *Hansen (2018): Ch 6
Week 7 **Feb 20**	**14.1) Modeling and Estimation** Lau et al. (2020): Ch 10 **14.2) Correlation and Regression Line** Adhikari & DeNero (2020): Ch 15 *Hansen (2018): Ch 2
Week 8 **Feb 25**	**15.1) Bias-Variance Tradeoff** Lau et al. (2020): Ch 15 James et al. (2017): Ch 5.1 **15.2) Least Squares Regression and Visual Diagnostics** Adhikari & DeNero (2020): Ch 15 *Hansen (2018): Ch 3
Week 8 **Feb 27**	**16) K-Nearest Neighbors** Adhikari & DeNero (2020): Ch 17 James et al. (2017): Ch 2.2.3, 3.5 *Hastie et al. (2017): Ch 2.3, 6.6, 13.3 *Hansen (2018): Ch 20
Week 9 **Mar 3**	**17) Implementing the Classifier** Adhikari & DeNero (2020): Ch 17 *Hastie et al. (2017): Ch 6.1 to 6.5
Week 9 **Mar 5**	**Midterm** **All material**
Week 10 **Mar 10**	**Holiday - No Classes** **(Spring Break)**
Week 10 **Mar 12**	**Holiday - No Classes** **(Spring Break)**
Week 11 **Mar 17**	**18) Ridge Regression, and Least Absolute Shrinkage and Selection Operator (LASSO)** James et al. (2017): Ch 6.2 Lau et al. (2020): Ch 16

	*Hastie et al. (2017): Ch 3.3 to 3.4
Week 11 **Mar 19**	**19) Logistic Regression** Lau et al. (2020): Ch 17 James et al. (2017): Ch 4.3 *Wooldridge (2010): Ch 15
Week 12 **Mar 24**	**20) Regression and Classification Trees** James et al. (2017): Ch 8.1 *Hastie et al. (2017): Ch 9.2
Week 12 **Mar 26**	**21) Bagging, Random Forests, Boosting** James et al. (2017): Ch 8.2 *Hastie et al. (2017): Ch 10 and 15
Week 13 **Mar 31**	**22) Principal Components Analysis** James et al. (2017): Ch 10.2 *Hastie et al. (2017): Ch 14.5 *Hansen (2018): Ch 11.12 and 11.13
Week 13 **Apr 2**	**23) K-Means Clustering and Hierarchical Clustering** James et al. (2017): Ch 10.3 *Hastie et al. (2017): Ch 13.2, and 14.3

Part II – Student Presentations based on Siegel (2016)

Week 14 **Apr 7**	**Chapter 2: With Power Comes Responsibility: Hewlett-Packard, Target, the Cops, and the NSA Deduce Your Secrets** **Chapter 3: The Data Effect: A Glut at the End of the Rainbow**
Week 14 **Apr 9**	**Chapter 4: The Machine That Learns: A Look inside Chase's Prediction of Mortgage Risk** **Chapter 5: The Ensemble Effect: Netflix, Crowdsourcing, and Supercharging Prediction**
Week 15 **Apr 14**	**Chapter 6: Watson and the Jeopardy! Challenge** **Chapter 7: Persuasion by the Numbers: How Telenor, U.S. Bank, and the Obama Campaign Engineered Influence**

Part III - Final Exam

Week 15 **Apr 16**	**Draft: Empirical Report** No lecture, but I will be available in my office for feedback.
Week 16 **Apr 21**	**Study Day**
Week 16 **Apr 23**	**Final** **Students can decide between Empirical Report or Final Exam**

6) Grading

6.1) Your final grade will be assessed as follows:

Assignment*	Composition**	Weight	Date
Surveys*	Individual	1%	Thursday, Feb 6 (at 12:30 pm)
Quizzes	Individual	20%	Check on Canvas
Labs	Group	39%	Check on Canvas
Midterm	Individual	15%	Thursday, Mar 5 (at 12:30 pm)
Presentation	Group	10%	Apr 7, Apr 9, and Apr 14
Final	Individual	15%	Thursday, Apr 23 (at 12:30 pm)
Total		100%	

* Guidelines and detailed instructions for Assignments are on Canvas
** For Group Assignment, you must learn how to work in team, communicate properly, and negotiate with others. If you work alone, I will not accept the assignment and your grade will be automatically 0.

Grading Scale

94+ = A   74+ = C
90+ = A-   70+ = C-
87+ = B+   67+ = D+
84+ = B   64+ = D
80+ = B-   61+ = D-
77+ = C+   Below 61 = F

6.2) Makeup Policy for any Assignment

If you miss any Assignment, I will provide a makeup activity in the case of an excused and unavoidable absence. Then it is YOUR RESPONSIBILITY to provide satisfactory written documentation of an excused and unavoidable absence as soon as possible. For example, if you are ill – the accompanying doctor's note must say that you cannot (or could not) do the Exam or Lab. If the doctor's note does not state this clearly, your score will be zero.

7. Course Expectations

7.1) Prerequisite

Official prerequisite stipulated by Department of Economics for this course is: ECO 6100 Introduction to Econometrics, and ECO 7020 Fundamentals of Economic Analysis I.

7.2) Clarifying Expectations

To succeed in this course, you'll need to invest a good amount of time and energy doing exercises outside the class time. If at any time you feel you're investing the required time and energy but aren't learning the material or improving your skills, contact me and I'll do my best to help you and to suggest additional resources and options. If you have questions or concerns that you believe can be handled via e-mail, feel free to contact me that way. If I cannot adequately respond to your question via e-mail, I'll ask you to come to my regular office hours or make an appointment.

7.3) Academic Integrity

Wayne State University aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Student Code of Conduct, please see https://doso.wayne.edu/conduct/codeofconduct.pdf. Students who commit or assist in committing dishonest acts are subject to sanctions described in the Student Code of Conduct.

7.4) Special Accommodations

If you have a documented disability that requires accommodations, you will need to register with Student Disability Services (SDS) for coordination of your academic accommodations. The Student Disability Services (SDS) office is located at 1600 David Adamany Undergraduate Library in the Student Academic Success Services department. SDS telephone number is 313-577-1851 or 313-577-3365 (TDD only). Once you have your accommodations in place, I will be glad to meet with you privately during my office hours to discuss your special needs. Student Disability Services' mission is to assist the university in creating an accessible community where students with disabilities have an equal opportunity to fully participate in their educational experience at Wayne State University.