Course Outline

Course Code : DBA4712
Course Title : Causal Analytics for Managerial Decisions
Class Date : From 17/1/2024   To 17/4/2024
Semester : 2, Academic Year 2023-2024
Faculty : Assistant Professor, Long Zhao
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Overview & Course Objectives

We often use machine learning to find the association of two events, such as: the frequency to the hospital is strongly negatively correlated with life expectancy; or the number of bedrooms strongly positively correlates with HDB price. Such strong associations might lead to non-sensible decisions like not seeing a doctor when getting sick or building a wall to create a new bedroom. Other than the warning "correlation is not causation," can we have a systematic way to disentangle correlation from causation?

This course will enable you to apply causal analysis to various problems, such as why the experts are confident that the COVID-19 vaccine is effective, what business policy boosts the economy, and which ad recommendation algorithm generates higher revenue. Based on such solid causal relationships, one could make sensible life and business decisions.

Compared with Econometrics I & II, this course depends much less on linear regression. Instead, we will focus much more on intuition of 'like v.s. like' comparison to derive causal relationship.

Assessment

Assessment Components	Weightage
2 Individual assignments	20%
2 Group Projects	40%
2 Quizzes	30%
Class participation	10%

Individual assignments & Quizzes

Individual assignments help you to prepare for the quizzes. All of them are conceptual. Here is one example.

An Asian flush reaction is a condition that a person develops flushes on the face, neck, and sometimes entire body after consuming alcoholic beverages. A gene mutation on chromosome 12 causes this reaction. About 30-50% of east Asians carry this mutation, while quite rare among Europeans and Sub-Saharan Africans. The gene mutation is random and has no other known effect. However, we found that the people with the mutation have a lower risk of heart disease than those without. Which method should you use to obtain a causal estimation of drinking on heart disease? Please provide the rationale for the answer.

Projects

The first project is quite challenging despite of having detailed instructions. There are two reasons.

1. The setting is so practical that theory cannot tell you what to do. You need to carefully think about the tradeoff and try to strike a balance.
2. Sometimes, you need to write certain parts of code from scratch.

You could choose the second project. The topic shall be interesting and could be investigated using the methodologies taught in this course.

Schedule and Outline

Lesson/ Week	Date	Session (lesson summary or outline / learning objectives / preparation / cases & assignments / follow-up readings & resources)
1	Jan. 17th	Introduction to Causal Analytics
2	Jan. 24th	Potential Outcomes
3	Jan. 31st	Random controlled trials
4	Feb. 7th	A/B Test (Assignment 1 Due)
5	Feb. 14th	Multi-Armed Bandit (In-class quiz 1)
6	Feb. 21st	Project 1
-	Feb. 28th	Recess Week
7	Mar. 7th	Matching (Project 1 Due)
8	Mar. 14th	Event & Regression discontinuity design
9	Mar. 21st	Instrumental variable
10	Mar. 28th	Difference in differences
11	Apr. 3rd	Machine learning in Causality (Assignment 2 Due)
12	Apr. 10th	No class (Hari Raya Puasa)
13	Apr. 17th	Project 2 (In-class quiz 2)
-	Apr. 24th	Reading week (Project 2 Due)

General Guide & Reading (e.g. Case preparation guide, project report guide, main textbook & supplementary materials, etc)

There is no textbook for this course. I highly recommend the YouTube series Mastering Econometrics with Joshua Angrist and Causal Inference Bootcamp by Matt Masten.

Academic Honesty & Plagiarism

Academic integrity and honesty is essential for the pursuit and acquisition of knowledge. The University and School expect every student to uphold academic integrity & honesty at all times. Academic dishonesty is any misrepresentation with the intent to deceive, or failure to acknowledge the source, or falsification of information, or inaccuracy of statements, or cheating at examinations/tests, or inappropriate use of resources.

Plagiarism is 'the practice of taking someone else's work or ideas and passing them off as one's own' (The New Oxford Dictionary of English). The University and School will not condone plagiarism. Students should adopt this rule - You have the obligation to make clear to the assessor which is your own work, and which is the work of others. Otherwise, your assessor is entitled to assume that everything being presented for assessment is

being presented as entirely your own work. This is a minimum standard. In case of any doubts, you should consult your instructor.

<u>Additional guidance is available at:</u>
- [Administrative Policies](#)
- http://www.nus.edu.sg/registrar/administrative-policies-procedures/acceptance-record#NUSCodeofStudentConduct
- http://nus.edu.sg/osa/resources/code-of-student-conduct