Course Outline

Course Code : DBA4712
Course Title : Causal Analytics for Managerial Decisions
Class Date : From 10/8/2026 To 9/11/2026
Semester : Semester 1, Academic Year 2026/2027
Faculty : Adjunct Lecturer, Bin Huang
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Overview

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 ads recommendation algorithm generates higher revenue. Based on such solid causal relationships, one could make sensible managerial decisions.

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

Course Objectives

1. Develop a systematic understanding to differentiate between correlational relationships and true causal links
2. Apply causal analysis techniques to diverse scenarios, including public health (e.g., vaccine effectiveness), economic policy, and business strategies (e.g., ads recommendations)
3. Use solid causal relationships to inform and make sensible decisions in business contexts
4. Build an intuitive grasp of 'like vs. like' comparisons as a method for deriving causal relationships, moving beyond reliance on linear regression
5. Critically evaluate and understand the basis for expert confidence in causal claims, such as the effectiveness of COVID-19 vaccine
6. Learn to design and construct causal experiments using existing real-world events and data, rather than relying on artificial experimental setups.

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. Hence assignment 1's deadline is in the same week as quiz 1.

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

Project 1: Real-World Causal Inference Challenge

This project requires you to establish a causal relationship within a complex, real-world dataset. The goal is to move from raw data to a defensible causal claim, interpret its impact, and propose actionable decisions based on your findings. Its practical nature means that theoretical guidelines alone will not suffice; you will need to critically evaluate various approaches, understand trade-offs, make informed decisions, and potentially develop code.

Project 2: Self-Selected Causal Investigation

You will choose a topic of interest that can be investigated using the causal methodologies taught in this course. This allows for exploration of diverse areas such as business analytics, social sciences, or health and wellness. You will be responsible for defining a clear causal question, identifying relevant data sources, applying appropriate causal inference techniques, interpreting the results, and outlining the practical implications. Based on causal findings, sensible decisions on business strategy or public policy can be made.

Schedule and Outline

Lesson/ Week	Date	Session (lesson summary or outline / learning objectives / preparation / cases & assignments / follow-up readings & resources)
1	Aug 10	Introduction to Causal Analytics (video recording due to public holiday)
2	Aug 17	Causal Graphs & Potential Outcomes
3	Aug 24	Random Controlled Trials (Assignment 1 release)
4	Aug 31	A/B Test
5	Sep 7	Multi-Armed Bandit 1 (In-class quiz 1; Assignment 1 due)
6	Sep 14	Multi-Armed Bandit 2 (Project 1 release)
-	Sep 21	Recess Week
7	Sep 28	Matching (Project 1 presentation)
8	Oct 5	Event & Regression Discontinuity Design (Assignment 2 release)
9	Oct 12	Instrumental Variable
10	Oct 19	Panel Data & Difference-in-Differences (Assignment 2 Due)
11	Oct 26	Machine Learning in Causality
12	Nov 2	Course Review (Project 2 presentation)
13	Nov 9	Advanced topics (In-class quiz 2)

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.

Additional guidance is available at:

- Administrative Policies
- http://www.nus.edu.sg/registrar/administrative-policies-procedures/acceptance-record#NUSCodeofStudentConduct
- http://nus.edu.sg/osa/resources/code-of-student-conduct