DECSCI 101: Fundamentals of Decision Science

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Time: WF 10:05 am – 11:20 am
Location: Social Sciences 311

Overview

The Decision Science certificate (DECSCI) at Duke University focuses on how humans make decisions in a variety of contexts – including economic, political, and social choices. This course is the gateway to the certificate and will cover topics from behavioral economics, game theory, machine learning and neuroeconomics. The goal is to introduce methods and substantive topics that will enable communication and collaboration across disciplinary boundaries and will allow you to engage in research with a broader perspective than that provided by any single major. For more details on the certificate, see:
https://decisionsciences.trinity.duke.edu/

Grading and Assignments

Final project (33%): This will be a small-group or individual project that will allow students to get their feet wet doing research. You will have an opportunity to meet with me before the projects are due to get feedback.

Final exam (33%): The exam will cover the main topics in the class and ask you to apply the readings to novel problems. The parameters of the exam will be decided on Nov. 2.

Participation and quizzes (34%): Different students have different preferences when it comes to participation, but engagement with the material and with your colleagues in class is essential. Accordingly, both in-class, out-of-class, and email participation will

be considered in determining this portion of the grade. There will also be random quizzes (thought problems) to help insure everyone does the reading.

Reading: Some of the articles in this course are challenging and contain mathematical notation you may be unfamiliar with. This is by design! If you are going to pursue further studies in this area, reading papers that contain mathematical models is a crucial skill to learn. Take time with the reading and come to class with questions. Be comfortable with the fact that you may not understand every step in these models and that multiple attempts may be required. This course is designed to get your feet wet without drowning you, so don't panic. Also: while the bulk of readings are journal articles you can access online, there are a few books in this course you should consider buying (or splitting with a class mate). These book titles are highlighted in green; order them now from Amazon (or wherever).

Practicums: There are three special sessions in this course where we will conduct experiments or play games as a group. This will provide you with hands-on experience that will help suggest topics / approaches for your research projects.

Schedule

Topic 1: Choosing alone – learning from data and rational choice

Jan 10: Rational Choice Theory and Utility

Osborne, *Introduction*: https://www.economics.utoronto.ca/osborne/igt/

Jan 15: Game Theory 1, Players, Strategies, and Payoffs

Osborne, *Nash Equilibrium: Theory*, sections 2.1 – 2.7: https://www.economics.utoronto.ca/osborne/igt/ -- note that you will want to read this at least twice! A good idea would be once before this class and again before Sep 12.

Jan 17: Game Theory 2, Canonical games and extensions

Jan 22: Statistics, Bayes' Law, and Decision-making

Overview of topics at http://www.cs.duke.edu/courses/spring15/compsci216/lectures/04-stats.pdf

Jan 24, *no class*

Jan 29: *Practicum 1*, Playing Ultimatum and Bargaining Games

Topic 2: Different models of choosing alone: Bounded Rationality

Jan 31: Limits on cognition + Algorithms

Simon, Sciences of the Artificial, Chapters 2, 3, and 4

Feb 5: Prospect theory

Kahneman and Tversky, *Prospect Theory*: http://www.jstor.org/stable/1914185?seq=1#page_scan_tab_contents

Feb 7: Prospect theory (cont.)

Feb 12: Risk and the St. Petersburg Paradox

Platt and Huettel, *Risky Business*: http://www.nature.com/neuro/journal/v11/n4/full/nn2062.html

Feb 14: ACT-R, Affect, and Political Choice

Kim, Lodge, and Taber, A Computational Model of the Citizen as a Motivated Reasoner: http://www.researchgate.net/profile/Charles_Taber/publication/225583676_A_Computational_Model_of_the_Citizen_as_Motivated_Reasoner_Modeling_the_Dynamics_of_the_2000_Presidential_Election/links/0deec5203de8684bfb000000.pdf

Topic 3: Different models of choosing alone: Neuroscience and Choice

Feb 19: Neuroscience 1

Levallois, Clithero, Wouters, Smidts and Huettel, *Translating Upwards*: http://www.nature.com/nrn/journal/v13/n11/full/nrn3354.html

Feb 21: Neuroscience 2

Venkatraman, Dimoka, Pavlou, Vo, Hampton, Bollinger, Hershfield, Ishihara, and Winer, Predicting Advertising Success Beyond Traditional Measures: http://journals.ama.org/doi/abs/10.1509/jmr.13.0593

Topic 4: Choosing in groups and markets

Feb 26: Markets and Irrationality

Akerloff and Shiller, Phishing for Phools, Chapters 1-5

Feb 28: Networks and Identity

Akerloff and Shiller, Phishing for Phools, Chapters 6-8

Mar 4: Failure and Paradox 1: Markets and Bargaining

Miller, Managerial Dilemmas, Chapters 1 and 2.

Mar 6, *no class*

Mar 18: Failure and Paradox 2: Voting

Munger and Munger, Choosing in Groups, Chapters 1, 3, and 7

Mar 20, *no class*

Mar 25: Cooperation and Sorting

Schelling, Micromotives and Macrobehavior, Chapters 1 and 4.

Riolo, Cohen, and Axelrod, *Evolution of cooperation without reciprocity*: http://www.nature.com/nature/journal/v414/n6862/full/414441a0.html

Mar 27: *Practicum 2*, "Voting rules and the final exam"

Apr 1: *Practicum 3*, "All the applied stats you need for now" + final project assignment

Topic 5: Institutions

Apr 3: Institutions, Collective Action, and Behavior

Ostrom, Governing the Commons, Chapters 1, 2, and pages 58-65 from Chapter 3.
de Marchi, Computational Modeling in the Social Sciences, Chapter 3 (pdf will be emailed to class).

Topic 6: Poker

Apr 8: Gambling and Poker 1

Siler, *Social and Psychological Challenges of Poker*: http://link.springer.com/article/10.1007/s10899-009-9168-2 Clark, Lawrence, Astley-Jones, and Gray, *Gambling Near-Misses*:
http://www.sciencedirect.com/science/article/pii/S0896627309000373

Apr 10: Gambling and Poker 2

Bowling, Burch, Johanson, and Tammelin, *Heads-up limit hold'em poker is solved*:
http://www.sciencemag.org/content/347/6218/145.abstract
Gilpin and Sandholm, *Better Automated Abstraction Techniques for Imperfect Information Games*:
http://www.cs.cmu.edu/~./sandholm/gs2.aamas07.pdf

Apr 15: *Practicum 4*, Omaha (a hold'em variant on steroids)

Final Items

Apr 17 – Apr 22: *Meetings for final project*

Apr 26: *Final Projects due*

Apr 28: *Final Exam due**