Instructor: Abdullah Almaatouq <amaatouq@mit.edu>

Lectures: Tuesday 1–4pm

Prerequisites: Research methods coursework

Location: E62-350 + online

Office hours: By appointment

Overview

The recent availability of massive digital traces on human behavior and the ubiquity of computational approaches have both extended and changed classical social science inquiry. The goal of this course is to introduce students to new computational social science methods and to use those techniques to explore classic investigations or pose novel questions. We will review fundamental research designs and focus on how new data sources and computational opportunities can enhance them.

Structure of the Course:

The course will be discussion based and will meet once per week for three hours. Prior to each class, students will be expected to have read all the mandatory readings for the week and will be required to submit weekly "reading reports."

Course Goals and Learning Objectives

By the end of the Computational Social Science course, students will be able to:

1. *Evaluate* the appropriateness of different computational techniques to answer social science questions of interest, along with describing the methods' underlying assumptions and limitations.
2. *Debate* recent computational social science research from the perspective of computational science and social science.
3. *Formulate* modern research proposals that combine ideas from computational science and social science.

Evaluation and Grading

- **30% Class participation:** You should consider that your participation in the discussion will be the key to your learning and benefiting from the class. You are also expected to present and lead the discussion on some papers. The number of people in the class will affect the implementation of this requirement.

- **35% Reading reports (due 11:59pm on Mondays):** Each week, you will be asked to write a short reflection on the readings for that week. The basic idea is to begin an intellectual discussion about the thoughts that the reading inspired in you with regard to research. The conversation could be about what you thought to be the most important contribution of the paper and why; what you found rather confusing, unclear, or that could be done in a better way; or, supposing that you are giving the chance to work with the authors on the topic of the paper (with access to the data/experiment), what are the question(s)/problem(s) that you would like to tackle?

- **35% Final project:** You will be required to complete a final term paper and presentation, which involves proposing a research study with substantial use of computational methods to investigate particular social phenomena (this could be in your research area, a literature review of a field, or something else that catches your interest).

Schedule

S1 [online]	2/16	Class introduction: Social science in a computational era
S2 [online]	2/23	Causation and prediction in the social sciences
S3 [in-person]	3/02	Theory building and evaluation
No class	3/09	Monday schedule of classes to be held
S4 [in-person]	3/16	Descriptions, predictions, and prescriptions
No class	3/23	Student holiday
S5 [in-person]	3/30	Guest lecture by Moshe Hoffman on modeling human behavior
S6 [in-person]	4/06	Answering “what if” questions with experiments
S7 [in-person]	4/13	Reproducibility, Replication, and Generalization
No class	4/20	Student holiday
S8 [in-person]	4/27	Should social science be more…?
S9 [in-person]	5/04	Random cool ideas
S10 [in-person]	5/11	Guest lecture by Dan Williams and Bethany Burum on evaluating “ultimate” explanations
S11 [in-person]	5/18	Final presentations

Week 1: Social science in a computational era

1. Lazer, David, et al. "Life in the network: the coming age of computational social science." *Science (New York, NY)* 323.5915 (2009): 721.
2. Evans, James, and Jacob G. Foster. "Computation and the sociological imagination." Contexts 18.4 (2019): 10-15.
3. Edelmann, Achim, et al. "Computational social science and sociology." Annual Review of Sociology 46 (2020): 61-81.

Optional

1. Salganik, Matthew J. *Bit by bit: Social research in the digital age*. Princeton University Press, 2019.
2. Hilbert, Martin, and Priscila López. "The world's technological capacity to store, communicate, and compute information." *science* 332.6025 (2011): 60-65.
3. Griffiths, Thomas L. "Manifesto for a new (computational) cognitive revolution." *Cognition* (2015)

Week 2: Causation and prediction in the social sciences

1. Hedström, Peter, and Petri Ylikoski. "Causal mechanisms in the social sciences." *Annual review of sociology* 36 (2010).
2. Gelman, Andrew, and Guido Imbens. "Why ask why? Forward causal inference and reverse causal questions." No. w19614. *National Bureau of Economic Research*, 2013.
3. Yarkoni, Tal, and Jacob Westfall. "Choosing prediction over explanation in psychology: Lessons from machine learning." *Perspectives on Psychological Science* 12.6 (2017): 1100-1122.
4. Dowding, Keith, and Charles Miller. "On prediction in political science." *European Journal of Political Research* 58.3 (2019): 1001-1018.
5. Hofman, Jake M., Amit Sharma, and Duncan J. Watts. "Prediction and explanation in social systems." *Science* 355.6324 (2017): 486-488.

Optional

1. Pearl, Judea. *Causality*. Cambridge university press, 2009. **Epilogue only (almost core)**
2. Shmueli, Galit. "To explain or to predict?." *Statistical science* 25.3 (2010): 289-310. **(almost core)**
3. Breiman, Leo. "Statistical modeling: The two cultures (with comments and a rejoinder by the author)." *Statistical science* 16.3 (2001): 199-231.
4. Gelman, Andrew. "Causality and statistical learning." (2011): 955-966.
5. Watts, Duncan J., et al. "Explanation, prediction, and causality: Three sides of the same coin?"
6. Athey, Susan. "Beyond prediction: Using big data for policy problems." *Science* 355.6324 (2017).
7. Sanders, Nathan. "A balanced perspective on prediction and inference for data science in industry." *Harvard Data Science Review* 1.1 (2019).
8. Rocca, Roberta, and Tal Yarkoni. "Putting psychology to the test: Rethinking model evaluation through benchmarking and prediction." (2020).
9. DellaVigna, Stefano, and Devin Pope. "Predicting experimental results: who knows what?." *Journal of Political Economy* 126.6 (2018): 2410-2456.

Week 3: Theory building and evaluation

1. Watts, Duncan J. "Common sense and sociological explanations." *American Journal of Sociology* 120.2 (2014): 313-351.
2. Turco, Catherine J., and Ezra W. Zuckerman. "Verstehen for sociology: Comment on Watts." *American Journal of Sociology* 122.4 (2017): 1272-1291.
3. Watts, Duncan. "Response to Turco and Zuckerman's "Verstehen for Sociology"." *American Journal of Sociology* 122.4 (2017): 1292-1299.
4. Healy, Kieran. "Fuck nuance." *Sociological Theory* 35.2 (2017): 118-127.

Optional

1. Dienes, Zoltan. *Understanding psychology as a science: An introduction to scientific and statistical inference*. Macmillan International Higher Education, 2008. **Chapters 1-2 (almost core)**
2. Eronen, Markus I., and Laura F. Bringmann. "The theory crisis in psychology: How to move forward." *Perspectives on Psychological Science* (2021): 1745691620970586.
3. Watts, Duncan J. *Everything is obvious:* Once you know the answer*. Currency, 2011.
4. Gopnik, Alison. 1998. "Explanation as Orgasm." *Minds and Machines* 8 (1): 101–18.
5. Lombrozo, Tania. "Explanatory preferences shape learning and inference." *Trends in Cognitive Sciences* 20.10 (2016): 748-759.
6. DeJesus, Jasmine M., et al. "Generic language in scientific communication." *Proceedings of the National Academy of Sciences* 116.37 (2019): 18370-18377.
7. Domingos, Pedro. 1999. "The Role of Occam's Razor in Knowledge Discovery." *Data Mining and Knowledge Discovery* 3 (4): 409–25.

Week 4: Descriptions, predictions, and prescriptions

1. Vosoughi, Soroush, Deb Roy, and Sinan Aral. "The spread of true and false news online." *Science* 359.6380 (2018): 1146-1151.
2. Salganik, Matthew J., et al. "Measuring the predictability of life outcomes with a scientific mass collaboration." *Proceedings of the National Academy of Sciences* 117.15 (2020): 8398-8403.
3. Ward, Michael D., Brian D. Greenhill, and Kristin M. Bakke. "The perils of policy by p-value: Predicting civil conflicts." *Journal of peace research* 47.4 (2010): 363-375.
4. Obermeyer, Ziad, et al. "Dissecting racial bias in an algorithm used to manage the health of populations." Science 366.6464 (2019): 447-453.

Optional

1. Risi, Joseph, et al. "Predicting history." *Nature human behaviour* 3.9 (2019): 906-91
2. Blumenstock, Joshua, Gabriel Cadamuro, and Robert On. "Predicting poverty and wealth from mobile phone metadata." *Science* 350.6264 (2015): 1073-1076.
3. Ginsberg, Jeremy, et al. "Detecting influenza epidemics using search engine query data." *Nature* 457.7232 (2009): 1012-1014.
4. Lazer, David, et al. "The parable of Google Flu: traps in big data analysis." *Science* 343.6176 (2014): 1203-1205.
5. Aral, Sinan, and Christos Nicolaides. "Exercise contagion in a global social network." *Nature communications* 8.1 (2017): 1-8.
6. Mehr, Samuel A., et al. "Universality and diversity in human song." *Science* 366.6468 (2019).
7. Obermeyer, Ziad, et al. "Dissecting racial bias in an algorithm used to manage the health of populations." *Science* 366.6464 (2019): 447-453.
8. Holtz, David, et al. "Interdependence and the cost of uncoordinated responses to COVID-19." *Proceedings of the National Academy of Sciences* 117.33 (2020): 19837-19843.
9. Schulz, Jonathan F., et al. "The Church, intensive kinship, and global psychological variation." *Science* 366.6466 (2019).
10. Wu, Lingfei, Dashun Wang, and James A. Evans. "Large teams develop and small teams disrupt science and technology." *Nature* 566.7744 (2019): 378-382.
11. Kozlowski, Austin C., Matt Taddy, and James A. Evans. "The geometry of culture: Analyzing the meanings of class through word embeddings." *American Sociological Review* 84.5 (2019): 905-949.

Week 5: Guest lecture by Moshe Hoffman

1. Using game theory to uncover the primary motives behind what we feel, think, say, and do. (preprint available here)
2. Categorical distinctions are needed for coordination (preprint available here)
3. Twitter Thread: https://twitter.com/Moshe_Hoffman/status/1142160534210588673?s=20

Optional

1. Hoffman, Moshe, Erez Yoeli, and Martin A. Nowak. "Cooperate without looking: Why we care what people think and not just what they do." *Proceedings of the National Academy of Sciences* 112.6 (2015): 1727-1732.
2. Hoffman, Moshe, Christian Hilbe, and Martin A. Nowak. "The signal-burying game can explain why we obscure positive traits and good deeds." *Nature human behaviour* 2.6 (2018): 397-404.

Week 6: Answering “what if” questions with experiments

1. Salganik, Matthew J., Peter Sheridan Dodds, and Duncan J. Watts. "Experimental study of inequality and unpredictability in an artificial cultural market." *science* 311.5762 (2006): 854-856.
2. Bail, Christopher A., et al. "Exposure to opposing views on social media can increase political polarization." *Proceedings of the National Academy of Sciences* 115.37 (2018): 9216-9221.
3. Awad, Edmond, et al. "The moral machine experiment." *Nature* 563.7729 (2018): 59-64.
4. Balietti, Stefano, Brennan Klein, and Christoph Riedl. "Optimal design of experiments to identify latent behavioral types." *Experimental Economics* (2020): 1-28.

Optional

1. Matias, J. Nathan. "Preventing harassment and increasing group participation through social norms in 2,190 online science discussions." *Proceedings of the National Academy of Sciences* (2019).
2. Matias, J. Nathan, and Kevin Munger. "The Upworthy Research Archive: A Time Series of 32,488 Experiments in US Advocacy." (2019).
3. Shirado, Hirokazu, and Nicholas A. Christakis. "Locally noisy autonomous agents improve global human coordination in network experiments." *Nature* 545.7654 (2017): 370-374.
4. Stewart, Alexander J., et al. "Information gerrymandering and undemocratic decisions." *Nature* 573.7772 (2019): 117-121.
5. Manzi, Jim. *Uncontrolled: The surprising payoff of trial-and-error for business, politics, and society*. Basic Books (AZ), 2012.
6. Newell, Allen. "You can't play 20 questions with nature and win: Projective comments on the papers of this symposium." (1973).
7. Luca, Michael, and Max H. Bazerman. 2020. The Power of Experiments: Decision Making in a Data-Driven World. MIT Press.
8. Dunning, Thad. 2012. Natural Experiments in the Social Sciences: A Design-Based Approach. Cambridge University Press.
9. Gerber, Alan S., and Donald P. Green. 2012. Field Experiments: Design, Analysis, and Interpretation. WW Norton.

Week 7: Reproducibility, Replication, and Generalization

1. Freese, Jeremy, and David Peterson. "Replication in social science." Annual Review of Sociology 43 (2017): 147-165.
2. Nosek, Brian A., et al. "The preregistration revolution." *Proceedings of the National Academy of Sciences* 115.11 (2018): 2600-2606.
3. Camerer, Colin F., et al. "Evaluating the replicability of social science experiments in Nature and Science between 2010 and 2015." *Nature Human Behaviour* 2.9 (2018): 637-644.

Optional

1. King, Gary. "Replication, replication." *PS: Political Science and Politics* 28.3 (1995): 444-452.
2. Dwork, Cynthia, et al. "The reusable holdout: Preserving validity in adaptive data analysis." *Science* 349.6248 (2015): 636-638.
3. Billheimer, Dean. "Predictive inference and scientific reproducibility." *The American Statistician* 73.sup1 (2019): 291-295.

Week 8: Should social science be more…?

1. Watts, Duncan J. "Should social science be more solution-oriented?." *Nature Human Behaviour* 1.1 (2017): 1-5.
2. Muthukrishna, Michael, and Joseph Henrich. "A problem in theory." *Nature Human Behaviour* 3.3 (2019): 221-229.
3. Yarkoni, Tal. "The generalizability crisis." The Behavioral and brain sciences (2021): 1-37.

Optional

1. Takens, Daniel. 2020. "Review of 'The Generalizability Crisis' by Tal Yarkoni" http://daniellakens.blogspot.com/2020/01/review-of-generalizability-crisis-by.html
2. Yarkoni, Tal. 2020. "Induction is not optional if you're using inferential statistics. https://www.talyarkoni.org/blog/2020/05/06/induction-is-not-optional-if-youre-using-inferential-statistics-reply-to-lakens/

Week 9: Random cool ideas

1. Rahwan, Iyad, et al. "Machine behaviour." *Nature* 568.7753 (2019): 477-486.
2. Baribault, Beth, et al. "Metastudies for robust tests of theory." *Proceedings of the National Academy of Sciences* 115.11 (2018): 2607-2612.
3. Agrawal, Mayank, Joshua C. Peterson, and Thomas L. Griffiths. 2020. "Scaling up Psychology via Scientific Regret Minimization." *Proceedings of the National Academy of Sciences of the United States of America* 117 (16): 8825–35.
4. DellaVigna, Stefano, Devin Pope, and Eva Vivalt. "Predict science to improve science." *Science* 366.6464 (2019): 428-429.

Optional

1. Smaldino, Paul E. "How to translate a verbal theory into a formal model." *Social Psychology* 51.4 (2020): 207. + Smaldino On Turning Theories Into Models (Blog post)

Week 10: Guest lecture by Dan Williams and Bethany Burum

1. Burum, Bethany, Martin A. Nowak, and Moshe Hoffman. "An evolutionary explanation for ineffective altruism." *Nature Human Behaviour* (2020): 1-13.
2. Williams, Daniel. "Socially adaptive belief." *Mind & Language* (2020).
3. Funkhouser, Eric. "A tribal mind: Beliefs that signal group identity or commitment." Mind & Language (2020).

Open access

The prohibitive cost of academic journals means that many of the readings for this course are not available to everyone. Fortunately, some of the more recent scholarship in this area is freely available to everyone in the world. If you do not have access to a university library, copies of many of the closed access articles can be found through Google Scholar.

Further guidelines and policies

I intend to follow all relevant policies. Let me know if you think I'm missing something.
MIT Sloan Values (https://mysloan.mit.edu/offices/deans/values/Pages/default.aspx)