

SOC577
COMPUTATIONAL SOCIOLOGY
Rutgers University

Syllabus

Thomas Davidson

Spring 2024

CONTACT AND LOGISTICS

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Website: <https://github.com/t-davidson/computational-sociology>

Class meetings: Thursday 2:00-4:40 pm, Davison 129 (Douglass Campus)

Office hours: Monday 4:00-5:00 pm, Davison 109, or by appointment.

COURSE DESCRIPTION

This course is designed to introduce students to computational methods and their applications to sociological research. We will discuss the computational toolkit from the bottom up, beginning with the fundamentals of programming and data analysis and management. To motivate the sociological applications of these techniques, we will explore social network analysis and agent-based modeling, two of the earliest areas of computational innovation in the discipline. Once these fundamentals are in place, we will consider different methods for collecting data from online sources including application programming interfaces, web-scraping, and online experiments. The remainder of the course will focus on computational methods for analyzing texts, images, and other types of data. First, we will cover various methods for the quantitative analysis of texts including word embeddings, topic modeling, and supervised learning. Second, we will discuss machine learning in more depth, assessing the relationship between prediction and explanation in social science, discussing bias and other limitations of these methods, as well as the opportunities these techniques present to work with images and multimodal data. Throughout the course students will gain hands-on experience with these different techniques and an understanding of their applications in cutting-edge sociological research. Overall, this course will provide students with a strong conceptual foundation in computational sociology and the ability to apply various techniques for data collection and analysis in their own research. All assignments will be conducted using the R programming language.

PREREQUISITES AND PREPARATION

This course is designed for students without any experience using computational methods or advanced statistics. Nonetheless, the course will proceed more efficiently if students without any such experience are willing to undertake some independent learning prior to the beginning of the course. In particular, I recommend students familiarize themselves with the R programming language, the RStudio computing environment, and RMarkdown documents, as we will be using these tools throughout the course. We will review these topics over the first few weeks of class, but the more familiar students are with these tools, the more time we can spend focusing on their sociological applications. Information on learning resources is provided on the course website.

ASSESSMENT

There will be four homework assignments designed to help students to become familiar with the various methodological techniques covered in the course. A schedule of these assignments can be found in the course outline below. Students will also write an empirical paper over the course of the semester, worth 60% of the final grade. The paper will involve the collection of original data and preliminary analyses using one or more of the approaches covered in the course. I intend for the paper to be an opportunity for students to develop the basis for a qualifying exam, master's thesis, or dissertation chapter. Students are expected to make progress on the paper over the course of the semester. There will be three preliminary submissions related to the final paper: a proposal, initial data collection and descriptive analysis, and the implementation of methodological approach (see course outline for a timeline). Each of these stages will be an opportunity to gain feedback on the final paper. The results will be presented during the last meeting and a final paper will be due at the end of the semester.

Grade breakdown

- Homework assignments: 40% (10% each)
- Final project (60%)
 - Proposal (5%)
 - Data collection and descriptive analysis (5%)
 - Preliminary results (5%)
 - Presentation (5%)
 - Final paper (40%)

CHAT-GPT AND AI TOOLS

Over the course of the semester we will consider how generative artificial intelligence tools can be used to advance computational research and will situate these tools in the context of earlier techniques. Not only can these technologies contribute to methodological advances, but they are a valuable pedagogical resource. I encourage you to draw on these tools to help you to learn to code and learn various computational methods. At the same time, however, these tools come with risks. For example, they can produce misleading or incorrect results, and hence must be used with caution. I am also concerned that overreliance on AI can undermine your learning. I strongly recommend trying to solve problems yourself or by consulting the course materials before resorting to AI for assistance.

AI tools can also be used in ways that violate academic integrity policies and undermine your learning. As such, you are prohibited for using ChatGPT or other AI tools to complete homework assignments or to write your final paper. Of course, the definition of AI tools becomes somewhat blurred when we think about tools like Grammarly, which uses similar technologies to help you improve your writing. Google Docs now has similar functionality and Microsoft is rolling this out in Office. I will permit you to use these tools to

help you edit your work, but you may not use them to generate sentences or paragraphs of text. Similarly, I will permit you to use AI to help edit and debug code in your final project, but you may not use them to generate entire chunks of code. *You will be asked to provide a statement in assignments and your final project detailing any ways that AI tools were used.* Please contact me if you are unsure about whether a particular use case is acceptable.

READINGS

There are weekly reading assignments for this course. Please complete these before each class. These readings include methodological texts, reviews articles, and examples of how sociologists and other social scientists apply computational approaches in their research.

Required texts

All texts are available for free online.

- Matthew Salganik. 2017. *Bit by Bit*. Princeton University Press. ISBN: 0691196109
- Wickham, Hadley, and Garrett Grolemund. 2016. *R for Data Science: Import, Tidy, Transform, Visualize, and Model Data*. (R4DS). O'Reilly Media, Inc. ISBN: 1491910399
- Martin, James H., and Daniel Jurafsky. 2020. *Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition*. 3rd edition. Prentice Hall. ISBN: 0131873210
- Silge, Julia, and David Robinson. 2017. *Text Mining with R: A Tidy Approach*. O'Reilly Media. ISBN: 1491981652

RESOURCES

The course website contains all slides and resources used in class and is hosted on Github. Students will also use Github to submit assignments. We will be using Slack to communicate with one another during this course, all enrolled students will receive an invite to join the Slack channel. Please use your Rutgers email account for any email correspondence.

COURSE POLICIES

The Rutgers Sociology Department strives to create an environment that supports and affirms diversity in all manifestations, including race, ethnicity, gender, sexual orientation, religion, age, social class, disability status, region/country of origin, and political orientation. This class will be a space for tolerance, respect, and mutual dialogue. Students must abide by the Code of Student Conduct at all times, including during lectures and in participation online.

All students must abide by the university's Academic Integrity Policy. Violations of academic integrity will result in disciplinary action.

In accordance with University policy, if you have a documented disability and require accommodations to obtain equal access in this course, please contact me during the first week of classes. Students with disabilities must be registered with the Office of Student Disability Services and must provide verification of their eligibility for such accommodations.

COURSE OUTLINE

Week 1, 1/18

Introduction to Computational Sociology

Readings

- R4DS: Preface, C2-6, 21
- *Bit by Bit*, C1
- Lazer, David, et al. 2009. [“Life in the Network: The Coming Age of Computational Social Science.”](#) *Science* 323 (5915): 721–23.
- Golder, Scott A., and Michael W. Macy. 2014. [“Digital Footprints: Opportunities and Challenges for Online Social Research.”](#) *Annual Review of Sociology* 40 (1): 129–52.
- Edelman, Achim, Tom Wolff, Danielle Montagne, and Christopher A. Bail. 2020. [“Computational Social Science and Sociology.”](#) *Annual Review of Sociology* 46 (1)

Further reading

- Bail, Christopher A. 2014. [“The Cultural Environment: Measuring Culture with Big Data.”](#) *Theory and Society* 43 (3–4): 465–82.
- Golder, Scott A., and Michael W. Macy. 2011. [“Diurnal and Seasonal Mood Vary with Work, Sleep, and Daylength Across Diverse Cultures.”](#) *Science* 333(6051):1878–81.

Week 2, 1/25

Data Structures & Networks

Readings

- R4DS: C7-10, 16
- Bearman, Peter S., James Moody, and Katherine Stovel. 2004. [“Chains of Affection: The Structure of Adolescent Romantic and Sexual Networks.”](#) *American Journal of Sociology* 110(1):44–91.
- Shi, Feng, Yongren Shi, Fedor A. Dokshin, James A. Evans, and Michael W. Macy. 2017. [“Millions of Online Book Co-Purchases Reveal Partisan Differences in the Consumption of Science.”](#) *Nature Human Behaviour* 1(4):0079.

Further reading

- Granovetter, Mark. 1973. [“The Strength of Weak Ties.”](#) *American Journal of Sociology* 78(6):1360–80.
- Breiger, Ronald L. 1974. [“The Duality of Persons and Groups.”](#) *Social Forces* 53(2):181–90.
- Burt, Ronald S. 2004. [“Structural Holes and Good Ideas.”](#) *American Journal of Sociology* 110(2):349–99.
- McPherson, Miller, Lynn Smith-Lovin, and James M. Cook. 2001. [“Birds of a Feather: Homophily in Social Networks.”](#) *Annual Review of Sociology* 415–44.
- Block, Per, Christoph Stadtfeld, and Tom Snijders. 2019. [“Forms of Dependence: Comparing SAOMs and ERGMs From Basic Principles.”](#) *Sociological Methods & Research* 48 (1): 202–39.

Week 3, 2/1

Programming Fundamentals & Agent-based Modeling

Readings

- R4DS: C14-15, 17
- Macy, Michael, and Robert Willer. 2002. [“From Factors to Actors: Computational Sociology and Agent-Based Modeling.”](#) *Annual Review of Sociology* 28 (1): 143–66.

- Bruch, Elizabeth, and Jon Atwell. 2015. [“Agent-Based Models in Empirical Social Research.”](#) *Sociological Methods & Research* 44 (2): 186–221.
- Centola, Damon, and Michael Macy. 2007. [“Complex Contagions and the Weakness of Long Ties.”](#) *American Journal of Sociology* 113(3):702–34.
- DellaPosta, Daniel, Yongren Shi, and Michael Macy. 2015. [“Why Do Liberals Drink Lattes?”](#) *American Journal of Sociology* 120 (5): 1473–1511.

Further reading

- Watts, Duncan. 1999. [“Networks, Dynamics, and the Small-World Phenomenon.”](#) *American Journal of Sociology* 105 (2): 493–527.
- Centola, Damon. 2015. [“The Social Origins of Networks and Diffusion.”](#) *American Journal of Sociology* 120 (5): 1295–1338.
- Goldberg, Amir, and Sarah K. Stein. 2018. [“Beyond Social Contagion: Associative Diffusion and the Emergence of Cultural Variation.”](#) *American Sociological Review* 83 (5): 897–932.

Assignment 1 released: Applying the computational toolkit. Due 2/9 at 5pm.

Week 4, 2/8

Collecting Data Using Application Programming Interfaces

Readings

- R4DS: C11 (“Strings with stringr”), 13 (“Dates and Times with lubridate”)
- *Bit by Bit*, C2
- Askin, Noah, and Michael Mauskopf. 2017. [“What Makes Popular Culture Popular? Product Features and Optimal Differentiation in Music.”](#) *American Sociological Review* 82 (5): 910–44.
- Freelon, Deen. 2018. [“Computational Research in the Post-API Age.”](#) *Political Communication* 35 (4): 665–68.

Week 5, 2/15

Collecting Data Using Webscraping

Readings

- *Bit by Bit*, C6
- Li, Fumin, Yisu Zhou, and Tianji Cai. 2021. [“Trails of Data: Three Cases for Collecting Web Information for Social Science Research.”](#) *Social Science Computer Review* 39(5):922–42.
- Tjaden, Jasper. 2023. [“Web Scraping for Migration, Mobility, and Migrant Integration Studies: Introduction, Application, and Potential Use Cases.”](#) *International Migration Review*.
- Fiesler, Casey, Nate Beard, and Brian C Keegan. 2020. [“No Robots, Spiders, or Scrapers: Legal and Ethical Regulation of Data Collection Methods in Social Media Terms of Service.”](#) In *Proceedings of the Fourteenth International AAAI Conference on Web and Social Media*, 187–96.
- Dahlke, Ross, Deepak Kumar, Zakir Durumeric, and Jeffrey T. Hancock. 2023. [“Quantifying the Systematic Bias in the Accessibility and Inaccessibility of Web Scraping Content From URL-Logged Web-Browsing Digital Trace Data.”](#) *Social Science Computer Review*.

Further reading

- Haber, Jaren R. 2020. [“Sorting Schools: A Computational Analysis of Charter School Identities and Stratification.”](#) *Sociology of Education* 94(1): 43–64.

Assignment 2: Collecting and storing data released. Due 2/23 at 5pm.

Week 6, 2/22

Online Experiments and Surveys

Readings

- *Bit by Bit*, C3-5
- Salganik, Matthew J., and Duncan J. Watts. 2008. "Leading the Herd Astray: An Experimental Study of Self-Fulfilling Prophecies in an Artificial Cultural Market." *Social Psychology Quarterly* 71 (4): 338–55.
- Wang, Wei, David Rothschild, Sharad Goel, and Andrew Gelman. 2015. "Forecasting Elections with Non-Representative Polls." *International Journal of Forecasting* 31 (3): 980–91.
- Kramer, Adam D. I., Jamie E. Guillory, and Jeffrey T. Hancock. 2014. "Experimental Evidence of Massive-Scale Emotional Contagion through Social Networks." *Proceedings of the National Academy of Sciences* 111 (24): 8788–90.
- Munger, Kevin. 2016. "Tweetment Effects on the Tweeted: Experimentally Reducing Racist Harassment." *Political Behavior*, November.
- Bail, Christopher A., Lisa P. Argyle, Taylor W. Brown, John P. Bumpus, Haohan Chen, M. B. Fallin Hunzaker, Jaemin Lee, Marcus Mann, Friedolin Merhout, and Alexander Volfovsky. 2018. "Exposure to Opposing Views on Social Media Can Increase Political Polarization." *Proceedings of the National Academy of Sciences* 115(37):9216–21.

Further reading

- Guess, Andrew M., Neil Malhotra, Jennifer Pan, Pablo Barberá, Hunt Allcott, Taylor Brown, Adriana Crespo-Tenorio, Drew Dimmery, Deen Freelon, Matthew Gentzkow, Sandra González-Bailón, Edward Kennedy, Young Mie Kim, David Lazer, Devra Moehler, Brendan Nyhan, Carlos Velasco Rivera, Jaime Settle, Daniel Robert Thomas, Emily Thorson, Rebekah Tromble, Arjun Wilkins, Magdalena Wojcieszak, Beixian Xiong, Chad Kiewiet de Jonge, Annie Franco, Winter Mason, Natalie Jomini Stroud, and Joshua A. Tucker. 2023. "How Do Social Media Feed Algorithms Affect Attitudes and Behavior in an Election Campaign?" *Science* 381(6656):398–404.
- Bail, Christopher A., D. Sunshine Hillygus, Alexander Volfovsky, Maxwell B. Allamong, Fatima Alqabandi, Diana Jordan, Graham Tierney, Christina Tucker, Andrew Trexler, and Austin van Loon. 2023. "Do We Need a Social Media Accelerator?"

Week 7, 2/29

Fundamentals of Natural Language Processing

Readings

- *Text Mining with R*, C1, 3-5
- *Speech and Language Processing*, C6, pages 1-13.
- Evans, James, and Pedro Aceves. 2016. "Machine Translation: Mining Text for Social Theory." *Annual Review of Sociology* 42 (1): 21–50.
- Nelson, Laura. 2017. "Computational Grounded Theory: A Methodological Framework." *Sociological Methods & Research*.

Further reading

- Grimmer, Justin, and Brandon Stewart. 2013. "Text as Data: The Promise and Pitfalls of Automatic Content Analysis Methods for Political Texts." *Political Analysis* 21 (3): 267–97.
- Flores, René D. 2017. "Do Anti-Immigrant Laws Shape Public Sentiment? A Study of Arizona's SB 1070 Using Twitter Data." *American Journal of Sociology* 123(2):333–84.

- Srivastava, Sameer B., Amir Goldberg, V. Govind Manian, and Christopher Potts. 2018. [“Enculturation Trajectories: Language, Cultural Adaptation, and Individual Outcomes in Organizations.”](#) *Management Science* 64(3):1348–64.

Week 8, 3/7

Word Embeddings and Computational Semantics

Readings

- *Text Mining with R*: C5.
- *Speech and Language Processing*, C6, pages 17-30.
- Hvitfeldt, Emil and Julia Silge. 2020 *Supervised Machine Learning for Text Analysis in R*. [“Chapter 5: Word Embeddings”](#).
- Kozlowski, Austin, Matt Taddy, and James Evans. 2019. [“The Geometry of Culture: Analyzing the Meanings of Class through Word Embeddings.”](#) *American Sociological Review*, September.
- Stoltz, Dustin S., and Marshall A. Taylor. 2021. [“Cultural Cartography with Word Embeddings.”](#) *Poetics* 101567.
- Arseniev-Koehler, Alina, and Jacob G. Foster. 2022. [“Machine Learning as a Model for Cultural Learning: Teaching an Algorithm What It Means to Be Fat.”](#) *Sociological Methods & Research* 51(4):1484–1539.
- Zhou, Di. 2022. [“The Elements of Cultural Power: Novelty, Emotion, Status, and Cultural Capital.”](#) *American Sociological Review* 000312242211230.

Further reading

- Mikolov, Tomas, Ilya Sutskever, Kai Chen, Greg Corrado, and Jeff Dean. 2013. [“Distributed Representations of Words and Phrases and Their Compositionality.”](#) In *Advances in Neural Information Processing Systems*, 3111–3119.
- Hamilton, William, Jure Leskovec, and Dan Jurafsky. 2016. [“Diachronic Word Embeddings Reveal Statistical Laws of Semantic Change.”](#) In *Proceedings of the 54th Annual Meeting of the Association for Computational Linguistics*, 1489–1501.
- Rodriguez, Pedro L., and Arthur Spirling. 2021. [“Word Embeddings: What Works, What Doesn’t, and How to Tell the Difference for Applied Research.”](#) *The Journal of Politics*.
- Rodman, Emma. 2019. [“A Timely Intervention: Tracking the Changing Meanings of Political Concepts with Word Vectors.”](#) *Political Analysis*, July, 1–25.
- Gonen, Hila, and Yoav Goldberg. 2019. [“Lipstick on a Pig: Debiasing Methods Cover up Systematic Gender Biases in Word Embeddings But Do Not Remove Them.”](#) In *Proceedings of NAACL-HLT*, 609–14.
- De-Arteaga, Maria, Alexey Romanov, Hanna Wallach, Jennifer Chayes, Christian Borgs, Alexandra Chouldechova, Sahin Geyik, Krishnaram Kenthapadi, and Adam Tauman Kalai. 2019. [“Bias in Bios: A Case Study of Semantic Representation Bias in a High-Stakes Setting.”](#) In *Proceedings of the Conference on Fairness, Accountability, and Transparency*, 120–28.

Paper proposals due 3/8 at 5pm.

SPRING BREAK

Week 9, 3/21

Topic Modeling

Readings

- *Text Mining with R*: C6.
- Blei, David. 2012. [“Probabilistic Topic Models.”](#) *Communications of the ACM* 55 (4): 77.

- Mohr, John, and Petko Bogdanov. 2013. "Introduction—Topic Models: What They Are and Why They Matter." *Poetics* 41 (6): 545–69.
- DiMaggio, Paul, Manish Nag, and David Blei. 2013. "Exploiting Affinities between Topic Modeling and the Sociological Perspective on Culture: Application to Newspaper Coverage of U.S. Government Arts Funding." *Poetics* 41 (6): 570–606.
- Roberts, Margaret, Brandon M. Stewart, Dustin Tingley, Christopher Lucas, Jetson Leder-Luis, Shana Kushner Gadarian, Bethany Albertson, and David Rand. 2014. "Structural Topic Models for Open-Ended Survey Responses: Structural Topic Models for Survey Responses." *American Journal of Political Science* 58 (4): 1064–82.
- Karell, Daniel, and Michael Freedman. 2019. "Rhetorics of Radicalism." *American Sociological Review* 84 (4): 726–53.

Further reading

- Eshima, Shusei, Kosuke Imai, and Tomoya Sasaki. 2023. "Keyword-Assisted Topic Models." *American Journal of Political Science* 1-21.
- Grootendorst, Maarten. 2022. "BERTopic: Neural Topic Modeling with a Class-Based TF-IDF Procedure." *ArXiv*.
- Pham, Chau Minh, Alexander Hoyle, Simeng Sun, and Mohit Iyyer. 2023. "TopicGPT: A Prompt-Based Topic Modeling Framework." *ArXiv*.

Assignment 3: Natural language processing released. Due 3/29 at 5pm.

Week 10, 3/28

Supervised Machine Learning and Prediction

Readings

- Molina, Mario, and Filiz Garip. 2019. "Machine Learning for Sociology." *Annual Review of Sociology* 45: 27–45.
- Grimmer, Justin, Margaret E. Roberts, and Brandon M. Stewart. 2021. "Machine Learning for Social Science: An Agnostic Approach." *Annual Review of Political Science* 24 (1)
- Hofman, Jake, Amit Sharma, and Duncan Watts. 2017. "Prediction and Explanation in Social Systems." *Science* 355 (6324): 486–488.
- Salganik, Matthew, Ian Lundberg, Alexander Kindel, et al. 2020. "Measuring the Predictability of Life Outcomes with a Scientific Mass Collaboration." *Proceedings of the National Academy of Sciences*.
- Garip, Filiz. 2020. "What Failure to Predict Life Outcomes Can Teach Us." *Proceedings of the National Academy of Sciences*.

Further reading

- Mullainathan, Sendhil, and Jann Spiess. 2017. "Machine Learning: An Applied Econometric Approach." *Journal of Economic Perspectives* 31 (2): 87–106.
- Watts, Duncan J. 2014. "Common Sense and Sociological Explanations." *American Journal of Sociology* 120 (2): 313–51.
 - Turco, Catherine J., and Ezra W. Zuckerman. 2017. "Verstehen for Sociology: Comment on Watts." *American Journal of Sociology* 122 (4): 1272–91.
 - Watts, Duncan. 2017. "Response to Turco and Zuckerman's 'Verstehen for Sociology.'" *American Journal of Sociology* 122 (4): 1292–99.
- Davidson, Thomas. 2020. "Black-Box Models and Sociological Explanations: Predicting High School Grade Point Average Using Neural Networks." *Socius: Sociological Research for a Dynamic World* 5 (January).

Paper initial data collection report due 4/5 at 5pm.

Week 11, 4/4

Supervised text classification

Readings

- Hanna, Alex. 2013. [“Computer-Aided Content Analysis of Digitally Enabled Movements.”](#) *Mobilization: An International Quarterly* 18 (4): 367–388.
- Nelson, Laura K., Derek Burk, Marcel Knudsen, and Leslie McCall. 2018. [“The Future of Coding: A Comparison of Hand-Coding and Three Types of Computer-Assisted Text Analysis Methods.”](#) *Sociological Methods & Research*.
- Barberá, Pablo, Amber E. Boydstun, Suzanna Linn, Ryan McMahon, and Jonathan Nagler. 2020. [“Automated Text Classification of News Articles: A Practical Guide.”](#) *Political Analysis*, June, 1–24.
- Dixon, Lucas, John Li, Jeffrey Sorensen, Nithum Thain, and Lucy Vasserman. 2018. [“Measuring and Mitigating Unintended Bias in Text Classification.”](#) In *Proceedings of the 2018 AAAI/ACM Conference on AI, Ethics, and Society* 67–73.

Further reading

- Davidson, Thomas, Debasmita Bhattacharya, and Ingmar Weber. 2019. [“Racial Bias in Hate Speech and Abusive Language Detection Datasets.”](#) In *Proceedings of the Third Workshop on Abusive Language Online*, 25–35.
- Miller, Blake, Fridolin Linder, and Walter R. Mebane, Jr. 2019. [“Active Learning Approaches for Labeling Text: Review and Assessment of the Performance of Active Learning Approaches.”](#) *Political Analysis* 28(4): 532–551.
- King, Gary, Patrick Lam, and Margaret E. Roberts. 2017. [“Computer-Assisted Keyword and Document Set Discovery from Unstructured Text.”](#) *American Journal of Political Science* 61 (4): 971–88.

Assignment 4: Machine learning and text classification released. Due 4/12 at 5pm

Week 12, 4/11

(Large) Language Models

Readings

- Danescu-Niculescu-Mizil, Cristian, Robert West, Dan Jurafsky, Jure Leskovec, and Christopher Potts. 2013. [“No Country for Old Members: User Lifecycle and Linguistic Change in Online Communities.”](#) In *Proceedings of the 22nd International Conference on World Wide Web*, 307–318.
- Manning, Christopher D. 2022. [“Human Language Understanding & Reasoning.”](#) *Daedalus* 151(2):127–38.
- Wankmüller, Sandra. 2022. [“Introduction to Neural Transfer Learning With Transformers for Social Science Text Analysis.”](#) *Sociological Methods & Research*.
- Bender, Emily M, Timnit Gebru, Angelina McMillan-Major, and Shmargaret Shmitchell. 2021. [“On the Dangers of Stochastic Parrots: Can Language Models Be Too Big?”](#) In *Conference on Fairness, Accountability, and Transparency (FAccT '21)*.

Further reading

- Vaswani, Ashish, Noam Shazeer, Niki Parmar, Jakob Uszkoreit, Llion Jones, Aidan N. Gomez, Łukasz Kaiser, and Illia Polosukhin. 2017. [“Attention Is All You Need.”](#) in *Advances in Neural Information Processing Systems*.
- Devlin, Jacob, Ming-Wei Chang, Kenton Lee, and Kristina Toutanova. 2019. [“BERT: Pre-Training of Deep Bidirectional Transformers for Language Understanding.”](#) in *Proceedings of NAACL-HLT*.

- Brown, Tom B., and many others. 2020. "Language Models Are Few-Shot Learners." *ArXiv*
- Widmann, Tobias, and Maximilian Wich. 2022. "Creating and Comparing Dictionary, Word Embedding, and Transformer-Based Models to Measure Discrete Emotions in German Political Text." *Political Analysis* 1–16.
- Jensen, Jeffrey L., Daniel Karell, Cole Tanigawa-Lau, Nizar Habash, Mai Oudah, and Dhia Fairus Shofia Fani. 2022. "Language Models in Sociological Research: An Application to Classifying Large Administrative Data and Measuring Religiosity." *Sociological Methodology* 52(1):30–52.
- Bonikowski, Bart, Yuchen Luo, and Oscar Stuhler. 2022. "Politics as Usual? Measuring Populism, Nationalism, and Authoritarianism in U.S. Presidential Campaigns (1952–2020) with Neural Language Models." *Sociological Methods & Research* 51(4):1721–87.

Paper preliminary results due 4/19 at 5pm.

Week 13, 4/18

Computer Vision and Multimodal Models

Readings

- Krizhevsky, Alex, Ilya Sutskever, and Geoffrey Hinton. 2012. "Imagenet Classification with Deep Convolutional Neural Networks." In *Advances in Neural Information Processing Systems*, 1097–1105.
- Torres, Michelle, and Francisco Cantú. 2021. "Learning to See: Convolutional Neural Networks for the Analysis of Social Science Data." *Political Analysis* 1–19.
- Zhang, Han, and Jennifer Pan. 2019. "CASIM: A Deep-Learning Approach for Identifying Collective Action Events with Text and Image Data from Social Media." *Sociological Methodology* 49 (1): 1–57.
- Hwang, Jackelyn, Nima Dahir, Mayuka Sarukkai, and Gabby Wright. 2023. "Curating Training Data for Reliable Large-Scale Visual Data Analysis: Lessons from Identifying Trash in Street View Imagery." *Sociological Methods & Research* 004912412311719.

Further reading

- Jean, N., M. Burke, M. Xie, W. M. Davis, D. B. Lobell, and S. Ermon. 2016. "Combining Satellite Imagery and Machine Learning to Predict Poverty." *Science* 353 (6301): 790–94.
- Gebru, Timnit, Jonathan Krause, Yilun Wang, Duyun Chen, Jia Deng, Erez Lieberman Aiden, and Li Fei-Fei. 2017. "Using Deep Learning and Google Street View to Estimate the Demographic Makeup of Neighborhoods across the United States." *Proceedings of the National Academy of Sciences* 114 (50): 13108–13.
- Buolamwini, Joy, and Timnit Gebru. 2018. "Gender Shades: Intersectional Accuracy Disparities in Commercial Gender Classification." In *Proceedings of Machine Learning Research*, 81:1–15.
- Olah, Chris, Alexander Mordvintsev, and Ludwig Schubert. 2017. "Feature Visualization." *Distill*.
- Radford, Alec, Jong Wook Kim, Chris Hallacy, Aditya Ramesh, Gabriel Goh, Sandhini Agarwal, Girish Sastry, et al. 2021. "Learning Transferable Visual Models From Natural Language Supervision." OpenAI.
- Torres, Michelle. 2023. "A Framework for the Unsupervised and Semi-Supervised Analysis of Visual Frames." *Political Analysis* 1–22.

Week 14, 4/25

Student presentations

- 10 minute presentation, plus Q&A.

Final paper

Final paper due via email on 5/3 at 5pm