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## EDUCATION

Ph.D. (Computer Science), **University of Southern California**, 2024

*Dissertation:* Measuring and Mitigating Exposure Bias in Online Social Networks

*Committee:* Kristina Lerman (chair), Fred Morstatter, Emilio Ferrara, Mike Ananny

M.Sc. (Computer Science), **University of Chicago**, 2015

B.A. (General Honors) (Biology and Computer Science), **University of Chicago**, 2013

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## RESEARCH EXPERIENCE

**Information Sciences Institute**, University of Southern California

Los Angeles, CA

*Graduate Researcher*

August 2017 – Present

- Led a multi-year project analyzing biases in ranking algorithms on online social networks
  - Measured impact of ranking algorithms on exposure bias on 4 million Twitter users (ASONAM '24)
  - Ran a multi-year audit on X/Twitter to analyze exposure to pro-/anti- science (ICWSM '24)
  - Used agent-based modeling with 170K agents to test dynamics of exposure under various timeline algorithms (SIGIR '24)
- Used distributed word embeddings to analyze 900,000 Pastebin pastes and identify malicious pastes as part of Defence
- Analyzing time series data of Google query trends and geospatial Uber/rideshare adoption in cities
- Analyzing performance of classifier built on top of word embedding models
- Learning embeddings of nodes based on information diffusion cascades

**Computation Institute**, University of Chicago

Chicago, IL

*NLP/Machine Learning Engineer*

June 2015 – June 2017

*Research Assistant*

August 2013 - June 2015

- Analyzed 100,000 scientific articles with distributed word embeddings
- Developed new database schema for scientific publication repositories
- Built a Django website to hook into Amazon MechanicalTurk to run custom experiments
- Managed student research assistants
- Pulled, processed, and analyzed publication data for understanding non-profit research grants and their influence in establishing new areas of research

*Research Assistant*

August 2013 – June 2015

Analysis of *in vitro* bacterial growth through individual based modeling  
Classification of bacteria genomes using a Naive Bayes and Decision Tree classifier  
Built a multi-target text classifier and developing an interface through which to refine its accuracy  
Analyzed GitHub repositories with NLP and machine learning to discern the problems the repositories address and built a software suite in Python to enable further analysis

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## PROFESSIONAL EXPERIENCE

**Office of Safety, Health and Working Conditions**, Bureau of Labor Statistics

Remote

*Civic Digital Fellow*

May – August 2021

Wrote a Google Colab tutorial for making use of a Huggingface Q&A model

Automated the extraction of information from death certificate data and matching to an existing database

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## PROJECTS

**Mitigation of Exposure Bias in Online Social Networks** *Professional*

- Utilizing agent-based models to assess how different recommendation algorithms affect bias over time

**Content Exposure Bias in Online Social Networks** *Professional*

- Comparing several metrics in empirical data and simulated social network data to assess impact of recommendation algorithms on different measures of bias

**Auditing Bias in Twitter** *Professional*

- Using webscraping techniques to gather actual information about how timelines bias exposure to social networks

**Learning Node Embeddings from Information Diffusion Cascades** *Professional*

- Using the structural information from diffusion cascades to reconstruct underlying social networks

**The Network Evolutionary Forces of Online Gaming Communities** *Professional*

- Using network features derived from co-play and friendship networks from *World of Tanks* to assess how clans behave and evolve over time

**Using Social Role Detection in Online Cyberbullying** *Coursework*

- Using linguistic and network features from Instagram and ASK.fm comments to identify and characterize cyberbullying

**Homeless Youth Protective Behaviors** *Coursework*

- Using network features and behavior features derived from homeless youth surveys to understand effects of group norms on risky sexual behavior

**Academic Discourse** *Coursework*

- Using topic modeling and function-word analysis to characterize signatures of influential authors with full-text and abstracts of scientific publications from Elsevier and JSTOR.
- Analyzing how interdisciplinary influential authors are over time, and how they relate to other authors within their discipline

**Smith Influence** *Professional*

- Using word embedding models and computational linguistics to understand the influence of seminal social science works and the dynamics of field development around these seminal works.

**Portal Project** *Professional*

- Using word embedding models and topic models to match potential grants to author profiles, and likewise matching authors to potential collaborators
- Managed the backend design of the process that serves the match information to the web server hosting the site

**Keck Grants** *Professional*

- Calculating historical h-index and basic bibliometrics to predict/rank likelihood of faculty of winning Keck grants based on historical keck grant data

**Anatomy of a Research Paper** *Professional*

- Using Word2Vec and similar word embedding algorithms to embed 100,000 scientific articles
- Analyzing distance matrices of these embeddings to track and characterize the conventions of scientific discourse in different disciplines

**Tree-based Pipeline Optimization Tool** *Open-Sourced Side Project*

- Implemented ability to pass in abstract scoring functions
- Coordinated early experiments for testing on HPC clusters at UPenn

**Latin Object Annotator** *Professional*

Stage 1: made use of scikit-learn implementations of Naïve Bayes and Perceptrons as classifiers for identifying individual categories of Latin n-grams

Stage 2: Implementing a GUI in Java and using WEKA implementations of classifier chains to classify multiple targets, each of which is a multi-label class

**Agent-based Modeling of In-Vitro Microbial Ecology** *Professional*

Built NetLogo agent-based models of bacteria growing in various *in-vitro* environments to compare against existing mathematical models

Made use of the NetLogo API to write Java programs to automate the simulations and data generation

Wrote custom visualization scripts in Python for visualizations that are non-trivial in Excel

**Bioinformatics (and Big Data)** *Class*

Implemented scripts on Google Compute Engine to download PDB files, parse them into Thrift structures, serialize them into HDFS, and process them using complex Pig and Cassandra queries to hold results in Cassandra column families.

**Advanced Data Analysis** *Class*

Implemented a Naïve Bayesian classifier and k-Means clustering algorithm using MRJob scripts on AWS EMR instances

### The Topology of GitHub Repositories Class

Built a pipeline to filter and explore characteristics of active public GitHub repositories  
With a subset of active repositories, exploring clustering and NLP techniques to induce the problem that the codebase is addressing

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### JOURNAL PAPERS

- N. Bartley, K. Burghardt, K. Lerman. Measuring the Echo-chamber Phenomenon Through Exposure Bias. Edited book in the Lecture Notes in Social Networks. 2024.
- Li, Yiqi, Nathan Bartley, Jingyi Sun, and Dmitri Williams. "The larger, the fitter, the better: clans' evolution, social capital and effectiveness." *Internet Research* 33, no. 3 (2023): 1053-1078.
- Palash Goyal, Tozammel Hossein, Ashok Deb, Nazgol Tavabi, Nathan Bartley, Andres Abeliuk, Emilio Ferrara, and Kristina Lerman. Discovering Signals From Web Sources to Predict Cyber Attacks. (*Submitted*)
- Nathan Bartley and James Evans. Anatomy of a Research Article (*In preparation*)

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### CONFERENCE PAPERS AND PRESENTATIONS

- Bartley, N., Burghardt, K., & Lerman, K. (2024). Impacts of Personalization on Social Network Exposure. ASONAM 2024. (*accepted*)
- Bartley, N., Burghardt, K., & Lerman, K. (2024). Bias Reduction in Social Networks through Agent-Based Simulations. SIGIR. (*accepted*)
- Bartley, N., Burghardt, K., & Lerman, K. (2024). Auditing Exposure Bias on Social Media for a Healthier Online Discourse. ICWSM. <https://doi.org/10.36190/2024.12>
- Bartley, N., Burghardt, K., & Lerman, K. Evaluating Content Exposure Bias in Social Networks. Ph.D. Symposium at ASONAM 2023.
- Bartley, N., Abeliuk, A., Ferrara, E., & Lerman, K. Auditing Timeline Bias on Twitter. In 13<sup>th</sup> ACM Web Science Conference 2021 (WebSci '21).
- Tavabi, N., Bartley, N., Abeliuk, A., Soni, S., Ferrara, E., & Lerman, K. (2019, May). Characterizing Activity on the Deep and Dark Web. In Companion Proceedings of The 2019 World Wide Web Conference (pp. 206-213). ACM.
- Randal S. Olson, Nathan Bartley, Ryan J. Urbanowicz, and Jason H. Moore (2016). Evaluation of a Tree-based Pipeline Optimization Tool for Automating Data Science. *Proceedings of GECCO 2016*, pages 485-492.
- Nathan Bartley, Ricardo Colasanti, Christopher Henry. Estimating Kinetic Growth Parameters of Microbial Communities with Agent-Based Models. (*In preparation*)

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### ABSTRACTS AND POSTERS

- Mitigating Exposure Biases in Personalized Timelines through Agent-based Models. ICML 2024 Workshop on Humans, Algorithmic Decision-Making and Society: Modeling Interactions and Impact. Poster.
- Bartley, N., Burghardt, K., & Lerman, K. Measuring Impact of Personalized Timeliens in Agent-based Simulations of Social Networks. IC2S2 2024. Poster.
- Bartley, N., Burghardt, K., & Lerman, K. Majority Illusion in Partially-observed Personalized Timelines. Conference on Network Science 2024. Presentation.
- Nathan Bartley. Proxy Servers for Facilitating Data Donations. Post-API Conference II. 2024
- Nathan Bartley. Social Network Timeline Bias and Amplification. User AI Auditing Workshop at CSCW 2023.
- Nathan Bartley, Keith Burghardt, Kristina Lerman. Social Network Timeline Exposure and Attention Bias. Politics & Computational Social Science pre-conference at APSA 2023.

- Nathan Bartley, Rachel Moran, ASM Rizvi, Sarah Myers West. Technical Approaches to Combating “Fake News”: Assessing Current Typologies of Information Disorder. USC Annenberg Graduate Fellowship Research and Creative Project Symposium 2018. Poster.
- Andres Abeliuk, Nathan Bartley, Kristina Lerman. Uber's Impact on Flu Infections: An Exploratory Analysis. International Conference on Computational Social Science 2018. Poster.
- Matt Baucum, Nathan Bartley, Mohammad Atari, Andreas Aristidou (2018). Immortal words of the Prominent Researchers: Semantic Analysis of Academic Discourse. Society for Personality and Social Psychology 2018. Poster.

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## AWARDS

### USC Viterbi School Best Viterbi Mentor Award

Spring 2019

- Chosen by faculty as best mentor for incoming PhD and MS students in the Viterbi School of Engineering

### USC Annenberg Graduate Fellowship Research and Creative Project Symposium

Spring, 2018 & 2019

- Granted to students performing creative work pertaining to communications, within the School of Cinematic Arts, Annenberg School for Communication & Journalism, and the Viterbi School of Engineering.

### Computer Science Graduate Student Teaching Prize

Computer Science Department

Spring, 2015

- Granted to teaching assistants who were nominated by the students taking the course and accepted by the faculty within the Computer Science Department
- Nominated for the Physical Sciences Division-wide best Annual Teaching Assistant award

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## TEACHING EXPERIENCE / ORAL PRESENTATIONS

### Teaching Assistant

August 26, 2019 – August 19, 2020, August 26, 2021 – Present

- Taught a discussion section, held office hours, managed undergraduate graders and administrivia, proctored and helped grade exams.

### The Network Evolutionary Forces of Online Gaming Communities

August 22, 2019

CKIDS Summer Symposium

- Detailed project about examining fitness of clans based on network properties in *World of Tanks*, an online video game

### What is the Knowledge Lab?

June 28, 2017

Computation Institute Summer Research Introductions

- Introduced summer students to the Knowledge Lab, and computational social science

### The Topology of GitHub Repositories

Practicum Final Presentation

March 13, 2015

Presented my work done throughout the academic quarter on the GitHub project

### Teaching Assistant

Networks and Distributed Systems

January 5, 2015 – March 21, 2015

Holding office hours, assisting in grading exams and working on projects

### Student Research Talk

Into the Discovery Cloud series

October 15, 2014

One of a few students to summarize their work in the Computation Institute to prospective student researchers

### Agent-based Modeling with NetLogo

Hack@UChicago Fall Hackathon

November 14, 2014

Delivered a workshop in what agent-based modeling is, and ran a tutorial with 6-8 students

### Camp Instructor, Course Instructor

June – August 2011, June –

August 2013

InternalDrive Tech Camps

Taught basic game design to 7-10 year olds  
Taught C++, Java, and Robotics to teenagers  
Led development of games for campers

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## LEADERSHIP EXPERIENCE

**First Floor Theater** Chicago, IL  
*Production Manager* September 2013 – December 2013

Managed and organized staff responsible for the technical aspects of the show  
Led budgeting, ran meetings, arranged staff deadlines

**University Theater**, University of Chicago Chicago, IL  
*Production Manager* January 2011 – June 2013

Managed and organized staff responsible for the technical aspects of 10 stage productions  
Led budgeting, ran meetings, arranged staff deadlines

**Genkikai-Ki Aikido Club**, University of Chicago Chicago, IL  
*Secretary* October 2009 – October 2011

Worked with the board to manage club events and club member paperwork  
Club representative on Sports Club Financial Committee

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## OTHER EXPERIENCE

**ACM WSDM 2018**, University of Southern California Los Angeles, CA  
*Student Volunteer* February 5 – 9 2018

Checked attendees into the conference, and directed speakers to their appropriate locations

**University Theater**, University of Chicago Chicago, IL  
*Student Tech Staff* September 2012 – June 2013

Organized and taught techniques for set construction, light hangs, technical aspects of theater  
General responsibility for technical problem solving

**Business of Science Center**, UCLA Los Angeles, CA  
*Intern* June 2010 – September 2010

Consolidated financial information of pharmaceutical companies from the Internet

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## SKILLS

**Proficient in:** C, Python, Java SE/EE, MySQL

**Familiar with:** C++, MATLAB, R, HTML & CSS, Hive, Jcasalog, Scala, Haskell, Pig

**Computational:** Classification, Regression, MapReduce, NLP, Text Mining, Big Data, Visualization

**Analytical:** Basic Numerical Analysis, Exploratory & Predictive Modeling, Experimental Design

**Languages:** Spanish (proficient), Japanese (intermediate)