

Caleb Belth

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Positions

Assistant Professor of Linguistics, University of Utah, Salt Lake City, UT 2023-Present

Education

PhD, Computer Science, University of Michigan, Ann Arbor, MI 2018-2023
Advisors: Andries Coetzee, Danai Koutra
Thesis: *Towards an Algorithmic Account of Phonological Rules and Representations*
Committee: Andries Coetzee (LING), Danai Koutra (CS), Charles Yang (LING, UPenn), Richard Lewis (Psychology), Lu Wang (CS)

M.S., Computer Science, University of Michigan, Ann Arbor, MI 2018-2019

B.S., Computer Science, Purdue University, West Lafayette, IN 2014-2018
Minors: Philosophy, Mathematics
Research Advisors: Jennifer Neville, Dan Goldwasser, Daisuke Kihara

Research Interests

Phonology, Linguistic Representations, Language Acquisition, Psycholinguistics, Linguistic Variation

Awards and Honors

Rackham Graduate School Travel Award	2022
Weinberg Institute of Cognitive Science Travel Award	2022
Rackham Graduate School Travel Award	2022
Weinberg Institute of Cognitive Science Travel Award	2021
Richard F. and Eleanor A. Towner Prize for Distinguished Academic Achievement Awarded to the outstanding graduate student in each degree program	2021
Best paper candidate, IEEE ICDM	2020
NSF Graduate Research Fellowship	2020
NDSEG Fellowship (declined for NSF GRF)	2020
Rackham Graduate School Travel Award	2019
ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (KDD) Travel Award	2019
Dean's List, Purdue	2015-2018
Semester Honors, Purdue	2015-2018

Journal Publications

3. **Caleb Belth**. Accepted. A Learning-Based Account of Phonological Tiers. *Linguistic Inquiry*.
2. **Caleb Belth**. In Press. A Learning-Based Account of Local Phonological Processes. *Phonology*.

1. **Caleb Belth**, Alican Büyükçakır, and Danai Koutra. 2022. A Hidden Challenge of Link Prediction: Which Pairs to Check? *Knowledge and Information Systems*. 64(3), 743-771.

Peer-Reviewed Conference and Workshop Papers and Presentations

19. **Caleb Belth**. Accepted. Experimental Evidence that Learning of Morphophonological Alternations Starts Local. *North East Linguistics Society*.
18. **Caleb Belth**. 2023. A Learning-Based Account of Non-Productivity in Dutch Voicing Alternations. *Boston University Conference on Language Development*.
17. **Caleb Belth**. 2023. A Learning-Based Account of Non-Productivity in Dutch Voicing Alternations. *Morris Halle Centenary Conference*.
16. **Caleb Belth**. 2023. Towards a Learning-Based Account of Underlying Forms: A Case Study in Turkish. *Society for Computation in Linguistics*.
15. **Caleb Belth**. 2023. A Learning-Based Account of Phonological Tiers. *Penn Linguistics Conference*.
14. **Caleb Belth**. 2022. Learning Non-Local Phonological Alternations via Automatic Creation of Tiers. *Linguistic Society of America*.
13. **Caleb Belth**. 2022. How a Proclivity for Adjacency can Drive the Learning of Non-Local Alternations. *MidPhon*.
12. **Caleb Belth**. 2022. Learning Non-Local Phonological Alternations via Automatic Creation of Tiers. 2022. *Cognitive Modeling and Computational Linguistics workshop at ACL*.
11. Sarah Payne, **Caleb Belth**, Jordan Kodner, and Charles Yang. 2022. Searching for Morphological Productivity. *Linguistic Society of America*.
10. **Caleb Belth**, Sarah Payne, Deniz Beser, Jordan Kodner, and Charles Yang. 2021. The Greedy and Recursive Search for Morphological Productivity. *CogSci*.
9. {**Caleb Belth**, Sarah Payne}, Jordan Kodner, and Charles Yang. 2021. Searching for Morphological Productivity. *Boston University Conference on Language Development*.
8. Sarah Payne, **Caleb Belth**, Jordan Kodner, and Charles Yang. 2021. The Recursive Search for Morphological Productivity. *American International Morphological Meeting*.
7. **Caleb Belth**, Alican Büyükçakır, and Danai Koutra. 2020. A Hidden Challenge of Link Prediction: Which Pairs to Check? *IEEE International Conference on Data Mining (ICDM)*.
Selected as one of the best papers at ICDM'20. Invited for publication at the KAIS Journal, Springer.
6. **Caleb Belth**, Xinyi Zheng, Danai Koutra. 2020. Mining Persistent Activity in Continually Evolving Networks. *ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (KDD)*.
5. **Caleb Belth**, Xinyi Zheng, Jilles Vreeken, and Danai Koutra. 2020. What is Normal, What is Strange, and What is Missing in a Knowledge Graph: Unified Characterization via Inductive Summarization. *ACM The Web Conference (WWW)*.
4. **Caleb Belth**, Xinyi Zheng, Danai Koutra. 2020. Mining Persistent Activity in Continually Evolving Networks. *ACM SIGKDD Workshop on Mining and Learning with Graphs (MLG)*.
3. Tara Safavi, **Caleb Belth**, Lukas Faber, Davide Mottin, Emmanuel Muller, and Danai Koutra. 2019. Personalized Knowledge Graph Summarization: From the Cloud to Your Pocket. *IEEE International Conference on Data Mining (ICDM)*.
2. **Caleb Belth**, Fahad Kamran, Donna Tjandra, and Danai Koutra. 2019. When to remember where you came from: Node representation learning in higher-order networks. *IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (ASONAM)*.
1. **Caleb Belth**, Fahad Kamran, Donna Tjandra, and Danai Koutra. 2019. When to remember where you came from: Node representation learning in higher-order networks. *ACM SIGKDD Workshop on Mining and Learning with Graphs (MLG)*.

Teaching

LING 5981/6080: Python for Linguists
Head Instructor; teaching programming in Python to linguistics students

Fall 2023

LING 111: Lenses into Language
Graduate Student Instructor for undergraduate, introductory linguistics course

Winter/Spring 2023

LING 347 / PSYCH 349: Talking Minds	Fall 2022
Graduate Student Instructor for undergraduate course in psycholinguistics	
International Summer School on Data Science	2020
Tutorial Instructor	
MIDAS Data Science Summer Camp for High School Students, University of Michigan	2019
Instructor, week-long summer camp	

Outreach and Service

Department of Linguistics Undergraduate Committee Member	2023-Present
Diversity Initiative in Graduate Applications, University of Michigan	2022-2023
Founder, program to connect students from underrepresented communities to UM research groups	
M-DICE, City of Detroit, World Economic Forum, The Knight Foundation	2019-2021
Graduate student lead, project to make access to transportation more equitable	
CSEG Wellness, University of Michigan	2019-2021
Co-founder, organization to improve graduate student wellness	
Explore Graduate Studies, University of Michigan	2019
Volunteer, workshop to broaden participation in computer science graduate programs	

Student Mentoring

Mohammed Al-Ariqy	2023-Current
Dissertation Committee Member	
Xueming Xu, Undergraduate, University of Michigan	2020-2021
Now: M.S. student, University of Michigan CSE	
Xinyi Zheng, Undergraduate, University of Michigan	2019-2020
Now: PhD student, Carnegie Mellon University CS	

Invited Talks

<i>The Interaction Between Learning Algorithms and Formal Language Theory</i>	2024
LSA Conference Organized Session on Formal Language Theory in Morphology and Phonology	
<i>Historical Contingency in Language</i> , College of Humanities, University of Utah	2023
<i>ThinkBIG: Your Roadmap to Landing a Role at a Startup</i> , Purdue University	2017

Guest Lectures

<i>In Charles Yang's Graduate Seminar on Discovery Procedures</i> , UPenn	2023
<i>In Kyle Gorman's Graduate Seminar on Computational Linguistics</i> , CUNY	2022

Non-Peer-Reviewed Poster Presentations

MIDAS Symposium Poster Session, University of Michigan	2019
<i>What is Normal, What is Strange, and What is Missing in a Knowledge Graph: Unified Characterization via Inductive Summarization</i>	
Michigan AI Symposium Poster Session, University of Michigan	2019
<i>When to remember where you came from: Node representation learning in higher-order networks</i>	

Purdue Undergraduate Research & Poster Symposium <i>Deep Learning for Protein Binding Ligand Prediction</i>	2017
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Reviewing

CogSci Conference Reviewer	2021
ACM The Web Conference (WWW) Subreviewer	2021
ACM International Conference on Information and Knowledge Management (CIKM) PC member, posters and demos session	2020
SIAM Workshop on Network Science (NS20) Subreviewer	2020
ACM The Web Conference (WWW) Subreviewer	2020
ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (KDD) Subreviewer	2019
IEEE International Conference on Data Science and Advanced Analysis (DSAA) Subreviewer	2019

Grants

Facebook Research Award \$50,000; Based on my research, and contributed to writing.	2020
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Industry Experience

<i>Applied Science Intern</i> , Amazon, Seattle, WA (Remote; COVID-19) Created an approach for discovering product attributes	Summer 2020
<i>Software Engineer Intern</i> , Sift, San Francisco, CA Developed and deployed a gradient tree-boosting algorithm for automated fraud detection	Summer 2018
<i>Software Engineer Intern</i> , Handshake, San Francisco, CA Developed a web platform for university students to find their ideal employers	Summer 2017
<i>Software Engineer Intern</i> , Iris, Owosso, MI Developed Android code to run computer vision inference on mobile	Summer 2016
<i>Software Engineer Intern</i> , Iris, Owosso, MI Developed Android code	Summer 2015
<i>Software Development Intern</i> , Enspire Software, Fort Wayne, IN Developed Android code	Summer 2014

Programming Languages in order of Proficiency

Python (expert), Java (proficient), C (proficient), C++ (proficient), Bash (proficient), Scala (familiar)

Professional Membership

Linguistic Society of America (LSA) Member	Present
Association of Computing Machinery (ACM) Student Member 2018	Graduate School
Institute of Electrical and Electronics Engineers (IEEE) Student Member	Graduate School

Other Projects

Machine Learning Text and Network Joint Embeddings, Purdue University Researched jointly embedding text and social network nodes into the same embedding space	2017-2018
Deep Learning for Protein Binding Ligand Prediction, Purdue University Used deep learning to predict protein binding ligands for drug design	2015-2018