**Caleb Belth**

2913 Languages and Communications Building

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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 2021

Awarded to the outstanding graduate student in each degree program

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**

(Upcoming) LING 6300: Graduate Computational Linguistics Spring 2024

Head Instructor; seminar on comp. phonology, focusing on contributions to Phonological Theory

LING 5981/6080: Python for Linguists Fall 2023

Head Instructor; teaching programming in Python to linguistics students

LING 111: Lenses into Language Winter/Spring 2023

Graduate Student Instructor for undergraduate, introductory linguistics course

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**

*The Interaction Between Learning Algorithms and Formal Language Theory* 2024

LSA Conference Organized Session on Formal Language Theory in Morphology and Phonology

*Historical Contingency in Language,* College of Humanities, University of Utah 2023

*ThinkB1G: Your Roadmap to Landing a Role at a Startup,* Purdue University 2017

**Guest Lectures**

*In Charles Yang’s Graduate Seminar on Discovery Procedures,* UPenn2023

*In Kyle Gorman’s Graduate Seminar on Computational Linguistics,* CUNY2022

**Non-Peer-Reviewed Poster Presentations**

MIDAS Symposium Poster Session, University of Michigan 2019

*What is Normal, What is Strange, and What is Missing in a Knowledge Graph:*

*Unified Characterization via Inductive Summarization*

Michigan AI Symposium Poster Session, University of Michigan 2019

*When to remember where you came from: Node representation learning in higher-order networks*

Purdue Undergraduate Research & Poster Symposium 2017

*Deep Learning for Protein Binding Ligand Prediction*

**Reviewing**

CogSci Conference 2021

Reviewer

ACM The Web Conference (WWW)2021

Subreviewer

ACM International Conference on Information and Knowledge Management (CIKM) 2020

PC member, posters and demos session

SIAM Workshop on Network Science (NS20) 2020

Subreviewer

ACM The Web Conference (WWW)2020

Subreviewer

ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (KDD) 2019

Subreviewer

IEEE International Conference on Data Science and Advanced Analysis (DSAA) 2019

Subreviewer

**Grants**

Facebook Research Award 2020

$50,000; Based on my research, and contributed to writing.

**Industry Experience**

*Applied Science Intern,* Amazon, Seattle, WA (Remote; COVID-19) Summer 2020

Created an approach for discovering product attributes

*Software Engineer Intern,* Sift, San Francisco, CA Summer 2018

Developed and deployed a gradient tree-boosting algorithm for automated fraud detection

*Software Engineer Intern,* Handshake, San Francisco, CA Summer 2017

Developed a web platform for university students to find their ideal employers

*Software Engineer Intern,* Iris, Owosso, MI Summer 2016

Developed Android code to run computer vision inference on mobile

*Software Engineer Intern,* Iris, Owosso, MI Summer 2015

Developed Android code

*Software Development Intern,* Enspire Software, Fort Wayne, IN Summer 2014

Developed Android code

**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 2017-2018

Researched jointly embedding text and social network nodes into the same embedding space

Deep Learning for Protein Binding Ligand Prediction, Purdue University 2015-2018

Used deep learning to predict protein binding ligands for drug design