

# Alexander Metzger

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My research aims to bridge gaps in information access for underserved languages and communities through a combination of algorithm design, machine learning, and edge device technology.

## EDUCATION

**University of Washington – 3.85 GPA, 3.97 in CS**

09/22 – 06/26

Joint BS/MS Computer Science and BS Mathematics, Graduate Compilers & Cloud Security Teaching Assistant, UWSO First Violin, Accelerated Honors Math, Guest Lecturer [T7, T8, T9], NeurIPS reviewer, COM<sup>2</sup> Mentor.

## AWARDS

[H4] CRA Outstanding Undergraduate Researcher Award: Honorable Mention

2025

[H3] NCWIT AiC Collegiate Award: National Finalist (Top 63)

2025

[H2] Departmental Honors and Dean's List: Annual and Quarterly

2022-2025

[H1] Akvelon Mentor's Choice: Outstanding Leadership

2023

## FUNDING

[F6] Mozilla Builders Accelerator – \$39K research grant, \$35K cloud credits

2024

Youngest out of 14 founders and researchers selected from 44 countries & 100s of applicants. Featured on the Stack Overflow podcast with more than 2 million viewers. Praised as “most promising” by Silicon & Pulse.

[F5] Microsoft Imagine Cup: International Semifinalist, \$5K cloud credits

2025

[F4] Facebook AI for Health Challenge: 1st Place, \$1K Prize

2025

[F3] Google Research: Special Google TPU Research Cloud Access

2025

[F2] Nvidia Inception: Accepted Startup Founder, GPUs

2025

[F1] Clean Energy Institute: TARs Research Grant

2025

## RESEARCH EXPERIENCE

**Ubiquitous Computing Lab – Advisor: Dr. Shwetak Patel**

Jun. 2024 – Present

**Battery-Free DL on MCUs via Agentic Model and System Optimization.** Embedded ML. [Link](#).

**Goal:** Automatically adapt Deep Learning models to ultra-low-power hardware/microcontrollers.

- Developed a novel model compression framework for hardware constraints in MCU accelerators.
- Co-first-authored paper submitted to ACM IMWUT [P6] analyzing applications including animal monitoring to prevent crop destruction, and wearables to assess linguistic development in toddlers.
- Created SoTA speech2ipa models that retain top performance with 600x smaller memory footprint.

**CS 4 The Environment – Advisor: Dr. Vikram Iyer**

Jun. 2024 – Present

**Multi-modal automated lifecycle assessments of consumer electronics.** ML for sustainability. [Link](#).

**Goal:** Democratize access to environmental impact estimates and empower sustainable consumption.

- Co-authored study design and research papers [P2, P4] and presented the work at top events [T10, T13].
- Industry adoption of our work by Google and Amazon as well as a publicly accessible Chrome Extension.
- Designed the multi-modal pipeline, enabling agents to consolidate information from many fragmented sources and departments (online tear downs, FCC records, environmental reports, company data).

**ICTD Lab – Advisor: Dr. Richard Anderson**

Sep. 2022 – May 2024

**eKichabi v2: Digital phone directory for subsistence farmers in rural Tanzania.** ICTD. [Link](#).

**Goal:** Study the economic impacts of digital agricultural information systems in Sub-Saharan Africa.

- Co-first-authored the paper [P5] accepted to ACM CHI 2024. Presented talks [T7, T12].

- Led team of 4 developers for the USSD server and later also the Android App optimizing latency by 40%.
- Designed a binary protocol reducing data costs by 70%, making the platform accessible to 10K farmers.

**UBC NLP Group – Advisor: Dr. Jian Zhu**

Sep. 2024 – Present

**Transcribing in Context: Temporal Trends in ASR Biases.** Inclusive Speech Technology. [Link](#).

**Goal:** Re-evaluate the claim that speech models are becoming more universal in context of dialects.

- First-authoring the ACM FAccT submission, mentoring an undergrad and a high school student.
- First comprehensive evaluation of ASR model regressions over time for minority speaker profiles.
- Assembled a diverse research team from Korea, England, Denmark, Japan, India, Canada, and the US.
- Quantifying real world impact on immigration processes, job acquisition, and information access.

**ChangeLing Lab – Advisor: Dr. David R. Mortensen**

Sep. 2025 – Present

**PhoneBench: Towards Universal Phoneme Recognition.** Computational Linguistics. [Link](#).

**Goal:** Device an inclusive benchmark for phoneme recognition and plan for a universal model.

- Established the current standard phoneme recognition leaderboard and trained the top model.
- Mentoring a high school student and collaborating with the PhD/MS students at the lab on a unique method to evaluate phonetic model bias against underserved dialects through representation learning.
- Pioneering a new approach to universal phoneme transcription using in-context learning.

**University of Washington – Advisor: Dr. Stefan Steinerberger**

Sep. 2024 – Present

**Practical algorithms for graph embedding.** Graph Theory, Algorithms, Combinatorics. [Link](#).

**Goal:** Compute the genus of the previously intractable  $(3, 12)$ -cage graph (turns out it is 17).

- Invented and implemented SoTA algorithm in C with visualization and verification in Python.
- Started as independent research and then reached out to Professor Steinerberger and Brinkmann.
- Co-first authored paper submitted to Discrete Mathematics, published thesis, and gave talks [T4, T6].
- Taking a novel approach to extend prior work on shortcuts to characterize higher genus obstructions.

## PUBLICATIONS

**[P6] – Submitted to ACM IMWUT**

[Embedded ML, Wearables, Agents](#)

Alexander Metzger\*, Jiuyang Lyu\*, Chun-Cheng Chang, Jiayi Shao, Emmanuel Azuh, Yujia Liu, Zachary Englhardt, Ethan Schwartz, Devin Mackenzie, Gregory D. Abowd, Edward Wang, Tingyu Cheng, Kurtis Heimerl, Shwetak Patel, Vikram Iyer, Zhihan Zhang. Battery-Free Deep Learning on MCUs via Agentic Model and System Co-Optimization.

**[P5] – ACM CHI**

[HCI, ICTD](#)

Ananditha Raghunath\*, Alexander Metzger\*, Hans Easton, XunMei Liu, Fanchong Wang, Yunqi Wang, Yunwei Zhao, Hosea Mpogole, and Richard Anderson. 2024. eKichabi v2: Designing and Scaling a Dual-Platform Agricultural Technology in Rural Tanzania.

**[P4] – ACM IMWUT**

[ML for Sustainability, CV, HCI](#)

Zhihan Zhang, Puvarin Thavikulwat, Alexander Metzger, Yuxuan Mei, Felix Hähnlein, Zachary Englhardt, Gregory D. Abowd, Shwetak Patel, Adriana Schulz, Tingyu Cheng, and Vikram Iyer. 2025. Living Sustainability: In-Context Interactive Environmental Impact Communication.

**[P3] – Pre-print, submitted to Discrete Mathematics**

[Algorithms, Graph Combinatorics](#)

Alexander Metzger\* and Austin Ulrigg\*. An Efficient Genus Algorithm Based on Graph Rotations.

**[P2] – Pre-print, submitted to Nature Electronics**

[ML for Sustainability, CV, Agents](#)

Zhihan Zhang, Alexander Metzger, Yuxuan Mei, Felix Hähnlein, Zachary Englhardt, Tingyu Cheng, Gregory D. Abowd, Shwetak Patel, Adriana Schulz, Vikram Iyer. Towards Autonomous Sustainability Assessment via Multimodal AI Agents.

**[P1] – University of Washington Student Research Paper**

[Topology, Graph Theory, Algorithms](#)

Alexander Metzger. A Practical Algorithmic Approach to Graph Embedding. University of Washington.

Department of Mathematics. Honors Thesis. <https://hdl.handle.net/1773/53829>.

## TALKS

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[T13] – <i>In-Context Interactive Environmental Impact Communication</i>	Oct. 2025
DUB Research Day, Seattle, WA [100s of attendees, only undergrad of 8 invited speakers]	
[T12] – <i>eKichabi v2: Designing and Scaling a Dual Platform Technology in Rural Tanzania</i>	May 2024
DUB Para.chi Event, Seattle, WA [100s of attendees, youngest invited speaker]	
[T11] – <i>Deploying Speech Technology at Scale</i>	Aug. 2025
Interspeech Conference, Rotterdam, Netherlands [2K attendees, 1 of 4 speakers invited for the science slam]	
[T10] – <i>In-Context Interactive Environmental Impact Communication</i>	Oct. 2025
Paul G. Allen's Annual Research Showcase, Seattle, WA [100s of attendees, 3 posters and a talk]	
[T9] – <i>Embedded ML - Computer Vision Demo</i>	Oct. 2025
University of Washington Embedded Systems Capstone Guest Talk, Seattle, WA [20 students]	
[T8] – <i>Computational Linguistics for Machine Aided Pronunciation Learning</i>	Oct. 2024
University of Washington Computational Linguistics Group Guest Talk, Seattle, WA [30 PhD attendees]	
[T7] – <i>Designing and Deploying Digital Information Systems in Sub-Saharan Africa</i>	Oct. 2023
University of Washington CHANGE Seminar Guest Talk, Seattle, WA [40 PhD attendees]	
[T6] – <i>Graph Algorithms and Optimization</i>	Nov. 2025
Northwest Undergraduate Mathematics Symposium, Bothell, WA [30 attendees]	
[T4&T5] – <i>Graph Embedding and Genus   Speech Technology Built For Everyone, Everywhere</i>	May. 2025
University of Washington Research Symposium, Seattle, WA [60 attendees]	
[T2&T3] – <i>The Future of Language Learning</i>	Sep. & Dec. 2024
Mozilla Builders, New York, NY   Mozilla Builders, San Francisco, CA [500 attendees]	
[T1] – <i>Building Inclusive Speech Technology</i>	Apr. 2025
DubHacks Next Demo Day, Seattle, WA [100 attendees]	

## WORK EXPERIENCE

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Koel Labs – <i>Founder and CEO</i>	Aug. 2024 – Present
○ Raised \$100K in funding (Mozilla, Microsoft, Google, Nvidia) for computational linguistics research.	
○ Trained SoTA NLP models, cutting streaming latency by 60% and doubling accuracy.	
○ Managed open-source team of 4 engineers and 6 researchers from CMU, UToronto, UT Austin, and UBC.	
○ Established strategic partnerships and research collaborations with 5 companies and 5 institutions.	
Gooey.AI – <i>Software Engineer</i>	Jun. 2023 – Sep. 2024
○ Led client communication and 4-member intern team, merging 70+ PRs across production ML pipelines.	
○ Deployed ML solutions to 10M+ farmers across 5+ countries, demoed to 193 world leaders at the UN.	
Akvelon, Inc. – <i>Software Development Intern</i>	Jun. 2023 – Aug. 2023
○ Led team of 4 to make 200K open-source contributions to 7 Microsoft repos across 27 pull requests.	

## LEADERSHIP

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Seattle Tutoring Partners – <i>Founder and Research Mentor</i>	May 2022 – Present
○ Mentoring research projects for High Schoolers, and collaborating on internationally recognized projects.	
○ Developed software for 500+ youth musicians and antenna software for 10K+ aspiring scientists.	
Cascade Enrichment – <i>Technical Lead</i>	Sep. 2022 – Sep. 2024
○ Managing certification and curriculum for 30+ tutors; developed online platform for 100+ students.	
Design Build Fly – <i>Lead Computer Scientist</i>	Sep. 2023 – Sep. 2024
○ Coordinated optimization algorithms and data analysis for 30 engineers; placing 3rd nationally.	

## RELEVANT COURSEWORK

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**HCI:** Capstone Software Design to Empower Underserved Populations, Software Design and Implementation, Social Networks, Photography, Robotics Colloquium, Computer Science Colloquium

**Systems:** Compilers, Operating Systems, Computer Communication Networks, Distributed Systems, Systems Programming, Hardware/Software Interface, Computer Systems Architecture, Computer Graphics, Concurrency/Parrallelism and Rust, Digital Design, Coursera Nand To Tetris

**ML:** Capstone Natural Language Processing, Computational Biology, Probabilistic Robotics, Probability and Statistics, Reinforcement Learning, Machine Learning by Andrew Ng

**Theory:** Theory of Computation, Algorithms, Modern Algorithms, Data Structures and Parallelism, Numerical Analysis, Combinatorics, Quantum Information/Computation, Cryptography, Modern Algebra and Coding Theory, Databases, Linear Algebra, Differential Equations, Vector Calculus