

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, COM² 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 Enghardt, 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 Enghardt, 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 Enghardt, 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

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

WORK EXPERIENCE

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

LEADERSHIP

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

RELEVANT COURSEWORK

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/Parallelism 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