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

BS/MS Computer Science and BS Mathematics, Graduate Compilers Teaching Assistant, UWSO First Violin Section, Accelerated Honors Math, Guest Lecturer [T7, T8, T9], NeurIPS reviewer, COM^2 Mentor.

Awards

[H3] CRA Outstanding Undergraduate Researcher Award: Honorable Mention 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: 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.

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 designed the multi-modal pipeline.
- **Industry adoption** of our work by Google and Amazon as well as a publicly accessible Chrome Extension.

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 SIGCHI 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 affordable for 10K farmers.

UBC NLP Group – *Advisor: 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 becomming more universal in context of dialects.

- **First-authoring** the ACM FAccT submission, mentoring an undergrad and high school student.

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.

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.

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 SIGCHI* 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 ACM SIGCHI* 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

[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, Everwhere* 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
- **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 – *Software Engineer* 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. – *Software Development Intern* Jun. 2023 – Aug. 2023
- **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
- **Mentoring** research projects for High Schoolers, and collaborating on internationaly recognized projects.
- **Developed** software for 500+ youth musicians and antenna software for 10K+ aspiring scientists.

Cascade Enrichment – *Technical Lead* Sep. 2022 – Sep. 2024
- **Managing** certification and curriculum for 30+ tutors; developed online platform for 100+ students.

Design Build Fly – *Lead Computer Scientist* Sep. 2023 – Sep. 2024
- **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/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