KALVIN CHANG

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EDUCATION

Carnegie Mellon University (CMU) *Pittsburgh, PA*
Master of Science in Language Technologies, School of Computer Science *May 2023*
GPA: 4.28/4.33 (Rank: 1/18), Advisor: David Mortensen
Selected courses: Speech Processing, Multilingual NLP, Computational Ethics of NLP, ML for Structured Data (probabilistic graphical models), Phonetics & Phonemics, Phonology

Bachelor of Science in Computer Science *Dec 2021*
GPA: 3.67/4.0 (University Honors), Concentration in Human-Computer Interaction
Selected courses: Design & Analysis of Algorithms, Designing Human-Centered Software, Language Variation & Change, Language Diversity & Cultural Identity, Ethics & Policy of Computing

RESEARCH EXPERIENCE

CMU WAVLab & ChangeLingLab Pittsburgh, PA
Visiting Scholar, Advisors: Prof. Shinji Watanabe, Prof. David Mortensen *Aug 2024 - Present*

- Investigating speech in-context learning for low-resource ASR using insights from historical linguistics
- Training open source, Whisper-like speech foundation model for universal phone recognition, POWSM
- Prepared a National Science Foundation grant proposal ($1,000,000) using the two techniques above
- Integrated a dataset of African American English into ESPnet for benchmarking pronunciation variation
- Probing how self-supervised speech models encode allophonic clusters and vowel compositionality
- Created 3 linguistic datasets for an instruction tuning benchmark for speech LMs (DynamicSUPERB)

CMU Language Technologies Institute Pittsburgh, PA
Graduate Research Assistant, Advisor: Prof. David Mortensen *Jan 2022 - May 2023*

- Discovered bias in self-supervised speech models against African American English (Interspeech 2024)
- Collected Taiwanese corpus for end-to-end ASR with self-supervised speech features (ASRU 2023)
- Set state-of-the-art on protoform reconstruction with a Transformer encoder-decoder model (ACL 2023)
- Built a pipeline matching 87.6% of language quartets from a linguist's language family tree, using a neural network trained on linguists' intuitions to score the probability of sound changes (LChange 2023)
- Expanded open-source G2P package's coverage of 7 low-resource Chinese varieties, enabling the collection of 67,000+ pronunciations to address gap in comparative Chinese datasets (Coling 2022)
- Proposed metric learning & masked LM for learning phonetic word embeddings (LREC-Coling 2024)
- Supervised an LSTM-based phonotactic language model for Dutch and Min Chinese dialects with syllable structure, incorporating domain knowledge from phonology (LREC-Coling 2024)
- Created Python interface to encode morphotactic rules with FSTs for endangered lang. documentation

Amazon Web Services, Responsible AI Team Seattle, WA
Machine Learning Engineer Intern, Supervisor: Dr. Alicia Sagae *May 2022 - Aug 2022*

- Designed a phonetic feature space to cluster high error ASR utterances for debiasing, capturing phonetic (pronunciation) variation across regional dialects of English
- Extracted phonetic embeddings from phoneme recognition and acoustic embeddings from wav2vec 2.0's self-supervised speech representations
- Employed CLS-token pooling and visualized embeddings with PCA, t-SNE, and UMAP

PUBLICATIONS

[1] **Kalvin Chang***, Yi-Hui Chou*, Jiatong Shi, Hsuan-Ming Chen, Nicole Holliday, Odette Scharenborg, and David R. Mortensen. 2024. Self-supervised Speech Representations Still Struggle with African American Vernacular English. In *Proceedings of **INTERSPEECH***. **Honorable Mention, Special Session on Responsible Speech Foundation Models.**

[2] Yi-Hui Chou*, **Kalvin Chang***, *et al.* 2023. Evaluating Self-Supervised Speech Models on a Taiwanese Hokkien Corpus. In *Proceedings of IEEE **ASRU***.

[3] Vilém Zouhar*, **Kalvin Chang***, Chenxuan Cui, Nate B. Carlson, Nathaniel Romney Robinson, Mrinmaya Sachan, and David R. Mortensen. 2024. PWESuite: Phonetic Word Embeddings and Tasks They Facilitate. In *Proceedings of **LREC-Coling***.

[4] Ryan Soh-Eun Shim*, **Kalvin Chang***, and David R. Mortensen. 2024. Phonotactic Complexity across Dialects. In *Proceedings of **LREC-Coling***.

[5] Young Min Kim*, **Kalvin Chang***, Chenxuan Cui, and David R. Mortensen. 2023. Transformed Protoform Reconstruction. In *Proceedings of **ACL***. **Oral Presentation.**

[6] **Kalvin Chang***, Nathaniel Robinson*, Anna Cai*, Ting Chen, Annie Zhang, and David R. Mortensen. 2023. Automating Sound Change Prediction for Phylogenetic Inference: A Tukanoan Case Study. In *Proceedings of **LCHANGE***. **Oral Presentation.**

[7] **Kalvin Chang**, Chenxuan Cui, Youngmin Kim, and David R. Mortensen. 2022. WikiHan: A New Comparative Dataset for Chinese Languages. In *Proceedings of **COLING***.

* denotes equal contribution.

Under Review:

[1] Kwanghee Choi, Eunjung Yeo, **Kalvin Chang**, Shinji Watanabe, and David R. Mortensen. Leveraging Allophony in Self-Supervised Speech Models for Atypical Pronunciation Assessment.

[2] Chien-yu Huang *et al.*. Dynamic-SUPERB Phase-2: A Collaboratively Expanding Benchmark for Measuring the Capabilities of Spoken Language Models with 180 Tasks.

[3] Atharva Naik *et al.* Can Large Language Models Code Like a Linguist?: A Case Study in Low Resource Sound Law Induction.

WORK EXPERIENCE

Amazon Web Services Seattle, WA
Software Development Engineer, Test Generation Team *Aug 2023 - Aug 2024*

· Experimented with prompt engineering (prompt chaining, few shot) for LLM-based test generation
· Created feedback loop to fix runtime errors with chain-of-thought, doubling number of executable tests
· Designed automatic evaluation suite for LLM-generated tests for 384 AWS services in an ECS container

Software Development Engineer Intern, EC2 Quality Team *Jun 2021 - Aug 2021*

· Implemented pagination & presigned URL for website diagnosing EC2 Instances during on-call
· Caught elusive bug in the AWS Java SDK with two SDK teams, leading to a bug fix

Cardinal Blue Software, Inc. Taipei, Taiwan
Server Developer Intern *Feb 2020 - Jul 2020*

· Transitioned PostgreSQL database to transactional pooling, increasing scalability 18-fold

AWARDS

Nominee, Cambridge Theoretical & Applied Linguistics, Gates Cambridge Scholarship *Nov 2024*
Honorable Mention, Responsible Speech Foundation Models, Interspeech *Sep 2024*
University Honors, Carnegie Mellon University *May 2022*
Dean's List with High Honors, CMU School of Computer Science *Fall 2020, Spring 2021, Fall 2021*
Leadership and Service Award, Glen A. Wilson High School *May 2018*

ACADEMIC SERVICE

Reviewer, NAACL, *Speech Communication* *2024*

TEACHING EXPERIENCE

Teaching Assistant, Introduction to Machine Learning *Fall 2022*

· Developed coursework for 400+ students, which covered Hidden Markov Models and gradient descent

Teaching Assistant, Principles of Functional Programming *Fall 2019, Fall 2020*

· Held office hours and labs for 200-student course covering structural induction and higher order functions

ACTIVITIES

Leader, Computational Historical Linguistics Subgroup *Jan 2023 - May 2023*

· Recruited and led team of 6 towards publication on phylogenetic inference (Chang *et al.* 2023)
· Mentored 3 freshmen who were new to machine learning, deep learning, NLP, and research

The Impact Fellowship, Impact Labs *Jan 2019*

· Selective ($< 5\%$) two-week program to train software engineers working in tech for social good
· Connected with speakers and leaders from NGOs, social startups, and think tanks

Mentor, Glen A. Wilson High School CODE Team *2018 - present*

· Taught human-centered design, web dev (HTTP, API design) and data structures (big O, linked lists)
· Awarded one of two Leadership and Service Awards by Principal Dr. Danielle Kenfield
· Hosted Shark Tank to critique Congressional App Challenge ideas, emphasizing human-centered design
· Provided free college apps critiques, helping 2 high school students secure Amazon internships
· Encouraged students to find their interdisciplinary niche within CS (e.g. computational linguistics)
· Mentored twenty-five alumni across prestigious universities (e.g. Berkeley and Harvey Mudd)

TALKS

Neural Reconstruction of Middle Chinese, CMU Language Technologies Institute *May 3, 2023*
Computer Science After High School, Wilson Hacks, Glen A. Wilson CODE *Apr 1, 2023*

SKILLS

Software Engineering Python, Java, Ruby, Go, C, AWS, HTML/CSS, JS, Git
Machine Learning Tools PyTorch, ESPnet, fairseq, HuggingFace, SLURM
Languages English (native), Mandarin Chinese (native), Spanish (California Biliteracy Seal), Taiwanese Hokkien