Zackary Rackauckas

NLP + Speech Researcher — Conversational Agents for Learning

Corona del Mar, California, USA

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Education

Columbia Engineering *New York, NY*

MS Computer Science, Thesis Track *December 2025*

- Thesis advisor: Prof. Julia Hirschberg.
- GPA: 4.0/4.0
- Research areas: Computer Assisted Language Learning, Speech, Dialogue Systems in Education, Large Language Models.

The University of Tokyo *Tokyo, Japan*

Special Graduate Research Student *May 2025 - July 2025*

- Supervisor: Nobuaki Minematsu.
- Research areas: Computer Assisted Language Learning, Human-computer Interaction, Human-agent Interaction.

Swarthmore College *Swarthmore, PA*

BA Mathematics *May 2023*

- Minors in Computer Science and Japanese.
- GPA: 3.8/4.0.
- Research areas: Natural Language Processing, Sentiment Analysis, Japanese Linguistics.

Research Experience

Harvard Graduate School Of Education *Boston, MA*

Supervisor: Dr. Ying Xu *June 2026 - Present*

- Project: Benchmarking proprietary and open-source audio to phoneme models on public, private, and synthetically generated datasets to determine failures and usages for error-preserving children's speech recognition.
- Project: Studying, experimenting, and training various methods of phoneme-controlled text-to-speech models with CMU-39-normalized inputs and spoken language outputs.

University of California Irvine School of Education *Irvine, CA*

Supervisor: Dr. Mark Warschauer *May 2026 - Present*

- Project: Benchmarking multimodal language models for performance on an in-lab collected dataset of children's speech utterances for accurate captioning of children's speech.
- Project: Applying multimodal language models into a conversational agent pipeline for early science education (Converse to Learn).

Columbia University - Dept. of Computer Science *New York, NY*

Supervisor: Dr. Julia Hirschberg *Aug. 2024 - Dec. 2025*

- Project: Created AdaptLingo, a chatbot for English learning that adapts to users' capabilities through prosody detection and constrained decoding of LLMs.
- Project: Developed a pronunciation detection and correction algorithm using Flow Matching TTS algorithms and speech editing for English learners.

Columbia University - Dept. of Computer Science *New York, NY*

Supervisor: Dr. Julia Hirschberg *Aug. 2024 - Dec. 2025*

- Thesis: "Stylized Conversational Agents for Japanese Language Learning: System Design, User Engagement, and Expressive TTS Evaluation."
- Argued that anime-inspired, voiced conversational agents can make Japanese language practice more engaging and culturally resonant, and that iterative user-centered design plus expressive TTS evaluation can make such systems more trustworthy and effective for language learning.

University of Tokyo - Dept. of Electrical Engineering and Information Systems *Tokyo, Japan*

Supervisor: Dr. Nobuaki Minematsu *May 2025 - July 2025*

- Project: Created and published Re:Member, a QA dialogue system that leverages videos of personal memories for Japanese learning.
- Project: Mentored a Bachelor's student to create LangInLab, a system for augmenting engineering lab Instruction with vision- and voice-enabled agents in preparation for the University of Tokyo's shift to English as a Medium of Instruction.

Chapman University - Dept. of Computer Science *Orange, CA*

Supervisor: Dr. Erik Linstead *Jun. 2022 - Aug. 2022*

- Project: Analyzed sentiment to discover changes in public opinions on Twitter before and after the overturning of Roe v Wade, and wrote a paper targeting submission to the Journal of Big Data.

Swarthmore College - Dept. of Modern Languages and Literature *Swarthmore, PA*

Supervisor: Dr. John Bundschuh *Jun. 2022 - Aug. 2022*

- Project: Digitized old Japanese Buddhist sutras to research change in the Japanese language, especially verb forms, from archaic to modern language.

Chapman University - Dept. of Mathematics *Orange, CA*

Supervisor: Dr. Daniele Struppa *Mar. 2018 - Aug. 2018*

- Project: Transcribed bicomplex number research documents in LaTeX and assisted with collaborative analysis problems.

Professional Experience

Harvard Graduate School of Education *Cambridge, MA*

Software Engineer *Dec. 2023 - Present*

- Developing a child-facing AI interface to teach children sentence, word, and phoneme pronunciation.
- Implementing AI pronunciation detection and ASR models to provide feedback to teachers of the children who use this interface.

RoleGaku *Irvine, CA*

Founder and Creator *Dec. 2023 - Present*

- Founded and led RoleGaku/Jouzu, a research-driven Japanese language learning platform using LLM-powered voiced character agents, expressive Japanese TTS, ASR pronunciation feedback, and interactive vocabulary scaffolding.
- Designed and conducted in-the-wild evaluations of stylized conversational agents, studying how anime-inspired personas, character voices, and culturally grounded aesthetics affect learner engagement, motivation, and language practice.
- Led interdisciplinary teams across engineering, art, writing, and voice acting while building backend NLP infrastructure for scripted lessons, in-text word inspection, speech synthesis, speech recognition, SQL-backed analytics, and cloud deployment.

Infineon Technologies *San Jose, CA*

Research Intern *Aug. 2023 - Apr. 2024*

- Evaluated RAGElo, an automated benchmarking framework using Elo-style ranking to evaluate retrieval-augmented generation systems across heterogeneous query tasks.
- Designed evaluation pipelines measuring answer accuracy, retrieval reliability, and hallucination behavior in technical QA systems.
- Built a RAG chatbot for product documentation that reduced engineering search time from minutes to seconds.
- Collaborated with the generative AI team to experimentally compare LLM system configurations and model outputs across enterprise use cases.

Stanford University School of Medicine *Stanford, CA*

Intern *Jul. 2021 - Dec. 2021*

- Developed an interactive website to publish with the Tool for Evaluation of Media Portrayals of Suicide.
- Let journalists verify whether their article on suicide was helpful or harmful and gave instructions to rewrite their article before publication.

Publications

Journal Articles (Peer-Reviewed)

Zackary Rackauckas. 2025. Learner Interactions with Jouzu, the Mobile Application with Conversational Characters. In *JALTCALL Trends*. URL: `https://doi.org/10.29140/jct.v1n1.2164`

Zackary Rackauckas. 2024. RAG-Fusion: A New Take on Traditional RAG. In *International Journal on Natural Language Computing*, 13(1), 11. URL: https://doi.org/10.5121/ijnlc.2024.13103

Conference and Workshop Papers (Peer-Reviewed)

Wen Liang, Siyan Li, **Zackary Rackauckas**, Julia Hirschberg. 2026. A Survey of Automated Presentation Coaching: Systems, Methods, and Open Challenges. Accepted to *21st Workshop on Innovative Use of NLP for Building Educational Applications* ***(ACL 2026)***.

Zackary Rackauckas, Nobuaki Minematsu, Julia Hirschberg. 2025. Re:Member: Emotional Question Generation from Personal Memories. In *Proceedings of the 4th Workshop on Bridging Human–Computer Interaction and Natural Language Processing (HCI+NLP) at the Conference on Empirical Methods in Natural Language Processing* ***(EMNLP 2025)***. URL: https://aclanthology.org/2025.hcinlp-1.13.pdf

Zackary Rackauckas, Julia Hirschberg. 2025. Comparative Evaluation of Expressive Japanese Character Text-to-Speech with VITS and Style-BERT-VITS2. In *Proceedings of the 2025 IEEE 16th Annual Ubiquitous Computing, Electronics & Mobile Communication Conference* ***(UEMCON 2025)***. URL: https://ieeexplore.ieee.org/document/11267532 **Best Presentation Award**

Zackary Rackauckas, Julia Hirschberg. 2025. VoxRAG: A Step Toward Transcription-Free RAG Systems in Spoken Question Answering. In *Proceedings of the 1st Workshop on Multimodal Augmented Generation via Multimodal Retrieval (MAGMaR 2025) at the Annual Meeting of the Association for Computational Linguistics* ***(ACL 2025)***. URL: https://aclanthology.org/2025.magmar-1.3.pdf

Zackary Rackauckas, Arthur Camara, Jakub Zavrel. 2024. Evaluating RAG-Fusion with RAGElo: An Automated Elo-Based Framework. In *Proceedings of the 1st Workshop on Large Language Models for Evaluation in Information Retrieval (LLM4Eval) at the ACM SIGIR Conference on Research and Development in Information Retrieval* ***(SIGIR 2024)***. URL: https://ceur-ws.org/Vol-3752/paper6.pdf

Extended Abstracts (Peer-Reviewed)

Zackary Rackauckas, Siyan Li, Julia Hirschberg. 2026. AdaptLingo: A Speech-to-Speech English Practice System with Fluency-Adaptive Responses. Accepted to **Interspeech 2026** Show & Tell .

Zackary Rackauckas. 2026. A Speech-First Character Interface for Stylized Japanese Dialogue Practice. Accepted to **Interspeech 2026** Show & Tell.

Masanori Shigi, **Zackary Rackauckas**, Yuka Akiyama, Nobuaki Minematsu. 2025. LangInLab: Augmenting Engineering Lab Instruction with Vision- and Voice-Enabled AI Agents for Language Learning. In *Proceedings of the 13th International Conference on Human-Agent Interaction* ***(HAI 2025)***. URL: https://dl.acm.org/doi/full/10.1145/3765766.3765844

Preprints and Under Review

Zackary Rackauckas, Julia Hirschberg. 2025. Learning Japanese with Jouzu: Interaction Outcomes with Stylized Dialogue Fictional Agents. URL: https://arxiv.org/abs/2507.06483

Selected Talks, Posters, and Demonstrations

Zackary Rackauckas. 2026. "ASR for Children." Research talk: *Digital Learning Lab*, Irvine, USA.

Zackary Rackauckas. 2025. "Demonstrating an AI Chatbot that Adapts to Users' English Proficiency with End-to-End Speech." Workshop presentation: *Japan Association for Language Teaching–Computer-Assisted Language Learning (JALTCALL 2025)*, Tokyo, Japan.

Zackary Rackauckas. 2025. "Information Retrieval and Dialogue Systems for Computer-Assisted Language Learning." Research talk: *GAVO Minematsu & Saito Laboratory*, Tokyo, Japan.

Zackary Rackauckas, Riya Raj, Siyan Li, Julia Hirschberg. 2025. "AdaptLingo: An Adaptive Speech-to-Speech Conversational Agent Tailored to Users' English Proficiency Levels." Poster presentation: *Columbia Data Science Day*, New York, USA.

Zackary Rackauckas. 2024. "Jouzu: Voiced Character Language Chatbots for Japanese Learning." Research talk: *Computer-Enabled Abilities Laboratory*, New York, USA.

Zackary Rackauckas. 2024. "Voiced Character Language Chatbots for Japanese Learning." Oral presentation: *Japan Association for Language Teaching–Computer-Assisted Language Learning (JALTCALL 2024)*, Nagoya, Japan.

Awards & Certifications

2025	**Best Presentation Award**, IEEE UEMCON	
2025	**Friends of Global UTokyo Leadership Award**, The University of Tokyo	*$ 4,000*
2024	**Japanese Language Proficiency Test, N2**, The Japan Foundation	
2024	**Artificial Intelligence (AI) for Business**, Wharton Online	
2021 - 2023	**Centennial Academic Honor Roll**, Centennial Conference	

Professional Affiliations and Review Activities

2026	**Concurrency and Computation: Practice and Experience**, Reviewer
2025	**The Thirteenth International Conference on Human-Agent Interaction**, Reviewer
2025	**Demonstrating an AI Chatbot that Adapts to Users' English Proficiency with End-to-end Speech**, Workshop organizer and presenter
2025	**The Third Workshop on Large Language Models (LLMs) for Evaluation in Information Retrieval**, Program committee, reviewer
2025	**The Second Workshop on Large Language Models (LLMs) for Evaluation in Information Retrieval**, Program committee, reviewer
2025	**JALTCALL Trends**, Reviewer for the journal's inaugural edition
2025 - Now	**ACL Student Member**, Stroudsburg, Pennsylvania
2025 - Now	**IEEE Young Professionals**, Orange County Section
2024 - Now	**IEEE Computer Society Member**, Orange County Section
2024 - Now	**IEEE Member**, Orange County Section

Skills

Research and Applied AI

- Human-Centered AI, Human-AI Interaction, Conversational AI, Education Technology, Computer-Assisted Language Learning, Natural Language Processing, Speech Processing, Machine Learning.

AI/ML and Speech Systems

- Chatbots, LLM-based Applications, Speech-to-Text, Text-to-Speech, Audio Processing, Adaptive Learning Systems, PyTorch, TensorFlow, Scikit-learn, NLTK, Praat.

Programming Languages

- Python, JavaScript, HTML/CSS, C/C++, R, Java, Perl.

Software Prototyping and Tools

- React, React Native, WebRTC, PostgreSQL, Web Application Development, Mobile Application Development, Backend Prototyping, APIs, Flask, Research Software Development, Data Analysis, Experimental Design, Literature Reviews, Academic Writing.

Mentoring

2025	**Shigi Masanori**, BS Student, The University of Tokyo
2024-2025	**Riya Raj**, MS Student, Columbia University