Karel Mundnich

kmundnic@gmail.com

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Education

University of Southern California — Los Angeles, CA
Ph.D. in Electrical Engineering — *Aug '15 – May '21*
Thesis: Learning Multi-Annotator Subjective Label Embeddings
Advisor: Dr. Shri Narayanan

University of Southern California — Los Angeles, CA
M.Sc. in Electrical Engineering — *Aug '15 – May '21*

Universidad de Chile — Santiago, Chile
Electrical Engineering Diploma — *Mar '07 – Oct '13*
Thesis: Early Online Detection of High Volatility Clusters using Particle Filters
Advisor: Dr. Marcos Orchard
Honors: Graduated with highest honors

Universidad de Chile — Santiago, Chile
B.Sc. in Electrical Engineering — *Mar '07 – Jan '13*
Honors: Graduated with honors

Experience

AWS AI Labs – Amazon Bedrock — Seattle, WA
Senior Applied Scientist — *Apr '25 – present*
- LLM fine-tuning
  - Technical lead for agent LLM fine-tuning.

Applied Scientist II — *Dec '24 – Mar '25*
- Vision2seq LLM fine-tuning.
- Embedding Models for Knowledge Bases and RAG
  - Development of document embedding models.
  - Development of techniques for synthetic data generation using LLMs.

AWS AI Labs – Amazon Lex — Seattle, WA
Applied Scientist II — *Jul '21 – Dec '24*
- Automatic speech recognition (ASR) for task-oriented ChatBots
  - End-to-end model development (including model size reduction and encoder biasing) [C4, C5].
  - Development of multimodal LLMs for speech recognition and understanding [C2, C3, P1].
- Mentoring
  - Developed a framework for RAG from speech with an intern [C1].

Amazon Lab126 — Los Angeles, CA (remote)
Applied Scientist II Intern — *May '20 – Aug '20*
- Deep audiovisual models for video summarization and highlight detection [C6].

USC Signal Analysis and Interpretation Lab — Los Angeles, CA
Research Assistant — *Aug '15 – May '21*
- Tracking Individual Performance with Sensors (TILES) (IARPA's MOSAIC program):
  - Design and implementation of two longitudinal data collections of physiological and behavioral data of hospital workers. Tasks included: data curation, analysis, development of models, and publication of data sets [J1, J4, J5, J7, C7, C8, C11].
- Learning from subjective human annotations
  - Design of algorithms to generate unique labels for supervised machine learning from diverse annotations of subjective constructs [J6, C10, C12, C13, C14].
- Mice Ultrasonic Profile ExTractor (MUPET)
  - Mentored a Master's student to refactor code base: `https://github.com/mvansegbroeck/mupet`.
  - Mentored an undergraduate student to improve the dictionary learning of the MUPET software using sparse subspace clustering techniques [C9].

Meteodata — Santiago, Chile
Research Engineer — *Oct '13 – Jan '14*
Development of signal processing algorithms for a low-cost ultrasonic anemometer.

Infosys — Bangalore, India
Engineering Intern — *Jan '12 – Mar '12*
Development of models for detection of mitosis in histopathological images.

Universidad de Chile – Electrical Engineering — Santiago, Chile
Research Assistant — *Mar '10 – Sep '13*
- Volatility estimation of financial returns with Particle Filters [J8, J9].
- Statistical learning for self-modeling robots.
- Design of an open hardware/software radiosonde for atmospheric sensing [J10].

Teaching Assistant & Grader — *Mar '10 – Dec '12*
Courses: Principles of Communications, Analog Electronic Circuits, Remote Atmospheric Sensing Seminar.

Publications

Peer-reviewed conferences

[C1] Do June Min, **Karel Mundnich**, Andy Lapastora, Erfan Soltanmohammadi, Srikanth Ronanki, and Kyu Han. Speech retrieval-augmented generation without automatic speech recognition. In *ICASSP 2025 - 2025 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, 2025.

[C2] **Karel Mundnich**, Xing Niu, Prashant Mathur, Srikanth Ronanki, Brady Houston, Veera Raghavendra Elluru, Nilaksh Das, Zejiang Hou, Goeric Huybrechts, Anshu Bhatia, Daniel Garcia-Romero, Kyu J. Han, and Katrin Kirchhoff. Zero-resource speech translation and recognition with llms. In *ICASSP 2025 - 2025 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, 2025.

[C3] Raghuveer Peri, Sai Muralidhar Jayanthi, Srikanth Ronanki, Anshu Bhatia, **Karel Mundnich**, Saket Dingliwal, Nilaksh Das, Zejiang Hou, Goeric Huybrechts, Srikanth Vishnubhotla, Daniel Garcia-Romero, Sundararajan Srinivasan, Kyu Han, and Katrin Kirchhoff. SpeechGuard: Exploring the adversarial robustness of multi-modal large language models. In *Findings of the Association for Computational Linguistics ACL 2024*, pages 10018–10035, August 2024.

[C4] Tyler Vuong, **Karel Mundnich**, Dhanush Bekal, Veera Raghavendra Elluru, Srikanth Ronanki, and Sravan Bodapati. AdaBERT-CTC: Leveraging BERT-CTC for text-only domain adaptation in ASR. In *Proceedings of the 2023 Conference on Empirical Methods in Natural Language Processing: Industry Track*, pages 364–371, 2023.

[C5] Dhanush Bekal, Karthik Gopalakrishnan, **Karel Mundnich**, Srikanth Ronanki, Sravan Bodapati, and Katrin Kirchhoff. A metric-driven approach to conformer layer pruning for efficient asr inference. In *Proceedings of Interspeech 2023*, 2023.

[C6] **Karel Mundnich**, Alexandra Fenster, Aparna Khare, and Shiva Sundaram. Audiovisual highlight detection in videos. In *ICASSP 2021 - 2021 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, 2021.

[C7] Vinesh Ravuri, Projna Paromita, **Karel Mundnich**, Amrutha Nadarajan, Brandon M Booth, Shrikanth S Narayanan, and Theodora Chaspari. Group-specific models of healthcare workers' well-being using iterative participant clustering. In *2020 Second International Conference on Transdisciplinary AI (TransAI)*, pages 115–118. IEEE, 2020.

[C8] George Hadjiantonis, Projna Paromita, **Karel Mundnich**, Amrutha Nadarajan, Brandon M Booth, Shrikanth Narayanan, and Theodora Chaspari. Dynamical systems modeling of day-to-day signal-based patterns of emotional self-regulation and stress spillover in highly-demanding health professions. In *2020 42nd Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC)*, pages 284–287. IEEE, 2020.

[C9] Jiaxi Wang, **Karel Mundnich**, Allison T. Knoll, Pat Levitt, and Shrikanth Narayanan. Bringing in the outliers: A sparse subspace clustering approach to learn a dictionary of mouse ultrasonic vocalizations. In *ICASSP 2020 - 2020 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, pages 3432–3436, 2020.

[C10] Timothy Greer, **Karel Mundnich**, Matthew Sachs, and Shrikanth Narayanan. The role of annotation fusion methods in the study of human-reported emotion experience during music listening. In *ICASSP 2020 - 2020 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, pages 776–780, 2020.

[C11] **Karel Mundnich**, Benjamin Girault, and Shrikanth Narayanan. Bluetooth based indoor localization using triplet embeddings. In *ICASSP 2019 - 2019 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, pages 7570–7574, 2019.

[C12] Brandon M. Booth, **Karel Mundnich**, and Shrikanth Narayanan. Fusing Annotations with Majority Vote Triplet Embeddings. In *Proceedings of the 2018 on Audio/Visual Emotion Challenge and Workshop*, AVEC'18, pages 83–89. ACM, 2018. **Winner of the AVEC GES 2018 subchallenge**.

[C13] Brandon M Booth, **Karel Mundnich**, and Shrikanth Narayanan. A Novel Method for Human Bias Correction of Continuous-time Annotations. In *2018 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, pages 3091–3095. IEEE, 2018.

[C14] **Karel Mundnich**, Md Nasir, Panayiotis Georgiou, and Shrikanth Narayanan. Exploiting Intra-annotator Rating Consistency through Copeland's Method for Estimation of Ground Truth Labels in Couples' Therapy. In *Proceedings of Interspeech 2017*, pages 3167–3171, 2017.

Journals

[J1] Projna Paromita, **Karel Mundnich**, Amrutha Nadarajan, Brandon M Booth, Shrikanth S Narayanan, and Theodora Chaspari. Modeling inter-individual differences in ambulatory-based multimodal signals via metric learning: a case study of personalized well-being estimation of healthcare workers. *Frontiers in Digital Health*, 5, 2023.

[J2] Joanna Yau, Benjamin Girault, Tiantian Feng, **Karel Mundnich**, Amrutha Nadarajan, Brandon M. Booth, Kristina Lerman, Emilio Ferrara, Eric Hsieh, and Shrikanth Narayanan. TILES-2019, a longitudinal physiologic and behavioral data set of hospital residents in medical care units. *Sci Data*, 9(536), 2022.

[J3] Arindam Jati, Amrutha Nadarajan, Raghuveer Peri, **Karel Mundnich**, Tiantian Feng, Benjamin Girault, and Shrikanth Narayanan. Temporal Dynamics of Workplace Acoustic Scenes: Egocentric Analysis and Prediction. *IEEE/ACM Transactions on Audio, Speech and Language Processing*, 29:756–769, 2021.

[J4] Vinesh Ravuri, Projna Paromita, **Karel Mundnich**, Amrutha Nadarajan, Brandon M Booth, Shrikanth S Narayanan, and Theodora Chaspari. Investigating group-specific models of hospital workers' well-being: Implications for algorithmic bias. *International Journal of Semantic Computing*, 14(4):477–499, 2020.

[J5] **Karel Mundnich**, Brandon M. Booth, Michelle L'Hommedieu, Tiantian Feng, Benjamin Girault, Justin L'Hommedieu, Mackenzie Wildman, Sophia Skaaden, Amrutha Nadarajan, Jennifer L. Villatte, Kristina Lerman, Emilio Ferrara, and Shrikanth Narayanan. TILES-2018, a longitudinal behavioral and pyshiologic dataset of hospital workers. *Sci Data*, 7(354), 2020.

[J6] **Karel Mundnich**, Brandon M. Booth, Benjamin Girault, and Shrikanth Narayanan. Generating Labels for Regression of Subjective Constructs using Triplet Embeddings. *Pattern Recognition Letters*, 128:385–392, 2019.

[J7] Brandon M Booth*, **Karel Mundnich***, Tiantian Feng*, Amrutha Nadarajan, Tiago H. Falk, Jennifer L. Villatte, Emilio Ferrara, and Shrikanth Narayanan. Multimodal Human and Environmental Sensing for Longitudinal Behavioral Studies in Naturalistic Settings: Framework for Sensor Selection, Deployment, and Management. *J Med Internet Res*, 21(8):e12832, Aug 2019.

[J8] **Karel Mundnich** and Marcos E. Orchard. Early Online Detection of High Volatility Clusters using Particle Filters. *Expert Systems with Applications*, 54:228–240, 2016.

[J9] **Karel Mundnich**, Marcos E. Orchard, Jorge F. Silva, and Patricio Parada. Volatility Estimation of Financial Returns using Risk-Sensitive Particle Filters. *Studies in Informatics and Control*, 22(3):297–306, September 2013.

[J10] Federico Flores, Roberto Rondanelli, Marcos Díaz, Richard Querel, **Karel Mundnich**, Luis Alberto Herrera, Daniel Pola, and Tomás Carricajo. The Life Cycle of a Radiosonde. *Bulletin of the American Meteorological Society*, 94(2):187–198, 2013.

Pre-prints

[P1] Nilaksh Das, Saket Dingliwal, Srikanth Ronanki, Rohit Paturi, Zhaocheng Huang, Prashant Mathur, Jie Yuan, Dhanush Bekal, Xing Niu, Sai Muralidhar Jayanthi, Xilai Li, **Karel Mundnich**, Monica Sunkara, Sundararajan Srinivasan, Kyu J. Han, and Katrin Kirchhoff. SpeechVerse: A Large-scale Generalizable Audio Language Model. In *arXiv:2405.08295v2*, 2024.

[P2] Arindam Jati, Amrutha Nadarajan, **Karel Mundnich**, and Shrikanth Narayanan. Characterizing Dynamically Varying Acoustic Scenes from Egocentric Audio Recordings in a Workplace Setting. In *arXiv:1911.03843v1*, 2020.

Skills & Background

Scientific Programming: Python, Julia, MATLAB. Classwork experience with C and Java.

Languages: Spanish (*mother tongue*), English (*IELTS score: 8.0/9.0 Oct '14*).

Awards & Distinctions

AVEC Workshop 2018: Winner of the ACM AVEC GES sub-challenge 2018 [C12].

ACM Multimedia 2018: NSF student travel award.

Outstanding Student Award (2010, 2012): Awarded to the top 6% of students of a given class (from a total of 700 students) with highest academic performance in the School of Engineering at Universidad de Chile.

Review Services

Journals

- IEEE/ACM Transactions in Audio, Speech, and Language (TASL)
- IEEE/ACM Transactions in Affective Computing (TAFFC)
- Nature Communications Biology
- International Journal of Human-Computer Studies

Conferences

- International Conference in Acoustic, Speech, and Language (ICASSP)
- International Joint Conference on Neural Networks (IJCCN)
- Engineering in Medicine and Biology Conference (EMBC)
- Association for the Advancement of Artificial Intelligence (AAAI)
- Affective Computing and Intelligent Interaction (ACII)
- International Conference on Multimodal Interaction (ICMI)