Karel Mundnich

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Education

University of Southern California — Los Angeles, CA
Ph.D. Candidate in Electrical Engineering — *2015 – 2021*
Thesis: Learning Subjective Label Embeddings
Advisor: Dr. Shri Narayanan

Universidad de Chile — Santiago, Chile
Electrical Engineering Diploma — *2007 – 2013*
Thesis: Early Online Detection of High Volatility Clusters using Particle Filters
Advisor: Dr. Marcos Orchard
Honors: Gratuated with highest honors

Universidad de Chile — Santiago, Chile
B. Sc. in Electrical Engineering — *2007 – 2013*
Honors: Graduated with honors

Publications

In progress

[I1] **Karel Mundnich** and Shrikanth Narayanan. Learning subjective label embeddings. In preparation for *IEEE Transactions in Affective Computing*.

[I2] Benjamin Girault, Joanna Yau, Tiantian Feng, **Karel Mundnich**, Amrutha Nadarajan, Brandon M. Booth, Eric Hsieh, and Shrikanth Narayanan. TILES-2019, a longitudinal physiologic and behavioral data set of hospital residents in medical intensive care units. In preparation for *Nature Scientific Data*.

[I3] Tiantian Feng, **Karel Mundnich**, and Shrikanth Narayanan. Relationship between Smartphone Usage and Work Shift Schedules in Hospital Nurses. In preparation for *IEEE Journal of Biomedical and Health Informatics*.

Journals

[J1] 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. Accepted in *International Journal of Semantic Computing*.

[J2] 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.

[J3] **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.

[J4] **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.

[J5] 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.

[J6] **Karel Mundnich** and Marcos E. Orchard. Early Online Detection of High Volatility Clusters using Particle Filters. *Expert Systems with Applications*, 54:228–240, 2016.

[J7] **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.

[J8] 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.

Peer-reviewed conferences

[C1] **Karel Mundnich**, Alexandra Fenster, Aparna Khare, and Shiva Sundnaram. Audiovisual highlight detection in videos. In *ICASSP 2021 - 2021 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, 2021.

[C2] 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.

[C3] 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.

[C4] 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.

[C5] 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.

[C6] **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.

[C7] 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**.

[C8] 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.

[C9] **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.

Research Experience

Amazon Lab126 — Los Angeles, CA

Applied Scientist II Intern — *May '20 – Aug '20*

Design and implementation of a multimodal system for video summarization and highlight detection in unconstrained videos [C1].

Signal Analysis and Interpretation Lab, University of Southern California — Los Angeles, CA

Research Assistant — *Aug '15 – present*

- TILES project (performer team within IARPA's MOSAIC program).
  - Design and implementation of a longitudinal data collection of physiological and behavioral data of hospital workers at USC Keck Hospital [J3].
    - Experimental design and sensor testing/selection [J5].
    - Design of algorithms for indoor localization [C6].
    - Data curation and modeling.
  - Design and implementation of a longitudinal data collection of physiological and behavioral data of residents at LA County Hospital.

- Annotation fusion: Design of algorithms to generate unique labels for supervised machine learning from diverse annotations of subjective constructs [J4, C5, C7, C8, C9].
- MUPET: Mice Ultrasonic Profile ExTractor
  - Mentored a Master's student to refactor the code available at `https://github.com/mvansegbroeck/mupet`.
  - Mentored an undergraduate student to improve the dictionary learning of the MUPET software using sparse subspace clustering techniques [C4]. This work was possible due to the refactoring mentioned above.

Ingeniería y Geofísica Ltda. — Santiago, Chile
Research Engineer — *Oct '13 – Jan '14*
Signal processing for a low-cost ultrasonic anemometer.

Electrical Engineering Dept., Universidad de Chile — Santiago, Chile
Research Assistant — *Mar '12 – Sep '13*
Volatility estimation of financial returns using Particle Filters. Detection of low-likelihood/high-risk events in financial time series [J6, J7].

Infosys — Bangalore, India
Engineering Intern — *Jan '12 – Mar '12*
Development of a modular framework for mitosis detection in histopathological images using MATLAB.

Electrical Engineering Dept., Universidad de Chile — Santiago, Chile
Research Assistant — *Aug '11 – Dec '11*
Study of Information Theory tools in statistical learning for the self-modeling of robots.

Research Assistant — *Mar '10 – Oct '11*
Co-design and implementation of an open hardware/software radiosonde for atmospheric sensing [J8].

Teaching Experience

Electrical Engineering Dept., Universidad de Chile — Santiago, Chile
Teaching Assistant & Grader — *'10 – '12*
Courses: Principles of Communications, Analog Electronic Circuits, Seminar in Remote Atmospheric Sensing.

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*).

Relevant Coursework

At USC:

- *Electrical Engineering*: Linear Algebra, Probability, Statistics, Random Processes, Mathematical Pattern Recognition, Machine Learning, Optimization for the Information and Data Sciences, Mathematics of Data
- *Data Sciences and Operations*: Machine Learning and Statistical Inference
- *Mathematics:* Mathematical Foundations of Statistical Learning Theory
- *Industrial Engineering:* Large Scale Optimization and Machine Learning

At Universidad de Chile:

- *Electrical Engineering*: Computational Intelligence, Neural Networks and Information Theory for Learning, Estimation and Detection, Statistical Signal Processing, Optimal Control, Information Theory (audit)
- *Computer Science*: Algorithms and Data Structures, Design and Programming Methodologies, Systems Software Programming

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Awards & Distinctions

AVEC Workshop 2018: Winner of the AVEC GES sub-challenge 2018 [C7].

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.

Reviewer/subreviewer work

- Engineering in Medicine and Biology Conference (EMBC) 2019, 2020
- Association for the Advancement of Artificial Intelligence (AAAI) 2019, 2020
- Nature Communications Biology
- IEEE Transactions in Audio, Speech, and Language (TASL)