Heitor R. Guimarães

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Research Interests

Machine Learning: Self-supervised learning, robustness against adversarial and OOD data, model compression, generative models // *Speech Processing*: Speech representation learning, keyword spotting, speech recognition, speech enhancement, speaker verification

Education

Institut National de la Recherche Scientifique (INRS) — Montreal, CA
Ph.D. Telecommunications — *2022 – 2026*
Supervisor: Dr. Tiago Falk

University of São Paulo (USP) — São Paulo, BR
M.Sc. Electrical Engineering — *2021 – 2022*
Thesis: On Self-Supervised Representations for 3D Speech Enhancement

Aeronautics Institute of Technology (ITA) — São Paulo, BR
Data Science Specialization — *2018 – 2018*
Thesis: *Monaural Speech Enhancement through Deep Wave-U-Net*

Federal University of Rio de Janeiro (UFRJ) — Rio de Janeiro, BR
Computer and Information Engineering — *2013 – 2018*
Senior Project: *Music Information Retrieval: A deep learning approach.*

Work Experience

Meta — Redmond, WA
Research Scientist Intern — *Sep 2024 – Jan 2025*
Research and development of speech enhancement systems designed for ultra-low-resource devices.

Adobe Research — San Francisco, CA
Research Scientist Intern — *Jun 2024 – Sep 2024*
Conducted fundamental and applied research on Diffusion Models for Speech Enhancement.

Itaú-Unibanco — São Paulo, SP
Senior Data Scientist — *Jun 2018 – May 2022*
Itaú-Unibanco is the largest private bank in Latin America. I worked in a department called Business Incubator, responsible for pushing forward the analytical environment of the company.

- Developed a wide range of classical ML models, from conception to deployment, for the credit card business, impacting more than 20MM users and achieving over US$ 60MM in revenue.
- Implemented a tool based on contextual embeddings to understand the client's necessities on chat and commercial Whatsapp with his account managers to direct business actions.
- Guided business analyst to become Data Scientist through in-company talks and lectures.

General Electric — Global Research Center (*GRC*), Rio de Janeiro
Research Data Scientist Intern — *Aug 2015 – Aug 2017*

- Conception and Implementation of algorithms, written in Python, for asset location in indoor environments (factories, buildings, etc.)
- Developed tools for anomaly detection in Python and R to understand the behavior of a Blowout Preventer (BOP) and analyze the pump efficiency on Petroleum extraction using Machine Learning

Selected Publications

(i) **Heitor R. Guimarães**, Arthur Pimentel, Anderson Avila, and Tiago Falk. "VIC-KD: Variance-Invariance-Covariance Knowledge Distillation to Make Keyword Spotting More Robust Against Adversarial Attacks." IEEE International Conference on Acoustics, Speech, & Signal Processing (ICASSP) (2024). [Link]

(ii) **Heitor R. Guimarães***, Mahsa Abdollahi*, Yi Zhu, Ségolène Maucourt, Nico Coallier, Pierre Giovenazzo, and Tiago H. Falk. "Adapting Self-Supervised Features for Background Speech Detection in Beehive Audio Recordings." IEEE International Workshop on Metrology for Agriculture and Forestry (2023). [Link] **Best Paper Presented by a Young Researcher Award**

(iii) **Heitor R. Guimarães**, Yi Zhu, Orson Mengara, Anderson R. Avila, and Tiago H. Falk. "Assessing the Vulnerability of Self-Supervised Speech Representations for Keyword Spotting Under White-Box Adversarial Attacks." IEEE International Conference on Systems, Man, and Cybernetics (SMC) (2023). [Link]

(iv) **Heitor R. Guimarães**, Arthur Pimentel, Anderson Avila, Mehdi Rezagholizadeh, Boxing Chen, and Tiago Falk. "RobustDistiller: Compressing Universal Speech Representations for Enhanced Environment Robustness." IEEE International Conference on Acoustics, Speech, & Signal Processing (ICASSP) (2023). [Link]

(v) **Heitor R. Guimarães**, Arthur Pimentel, Anderson Avila, Mehdi Rezagholizadeh, and Tiago Falk. "Improving the Robustness of DistilHuBERT to Unseen Noisy Conditions via Data Augmentation, Curriculum Learning, and Multi-Task Enhancement". Efficient Natural Language and Speech Processing (ENLSP-II) Workshop - NeurIPS (2022). [Link]

(vi) **Heitor R. Guimarães**, Wesley Beccaro, and Miguel A. Ramírez. "Optimizing Time Domain Fully Convolutional Networks for 3D Speech Enhancement in a Reverberant Environment Using Perceptual Losses." 2021 IEEE 31st International Workshop on Machine Learning for Signal Processing (MLSP). (2021). [Link]

(vii) **Heitor R. Guimarães**, Hitoshi Nagano, and Diego W. Silva. "Monaural speech enhancement through deep Wave-U-Net." Expert Systems with Applications 158 (2020): 113582. [Link]

Honors & Awards

- Best Paper Presented by a Young Researcher Award - IEEE MetroAgriFor 2023
- IEEE Signal Processing Society (SPS) Scholarship 2023
- CIFAR Inclusive AI Scholarship 2023 to attend the CIFAR DLRL Summer School
- Travel Grant from TD Assurance to attend the ICASSP 2023
- Finalist, spotlight oral presentation (top 8 out of 70+ papers) at the ENLSP Workshop at NeurIPS - 2022
- Scholarship for International Students INRS - 2022
- 2nd place in the L3DAS Challenge, Task 1 (Speech Enhancement) - 2021
- Scholarship from the Foundation for Supporting the Development of Scientific Computing - 2013 - 2015

Additional Information

Reviewer Expert Systems with Applications, IEEE TASLP, MLSP 2021-23, SMC 2023, ICASSP 2023-24

Mentorship Experience

- **Professional Master's 2023** - Co-supervised a student on adversarial attacks for speech emotion recognition.
- **MUSAE Summer Internship 2023** - Co-supervising one student on audio-based deep-fake detection.

Relevant Coursework & Summer Schools

- CIFAR Deep Learning + Reinforcement Learning (DLRL) Summer School - 2023
- Speech Communications (TEL250 - INRS / ECSE523 - McGill, A) - 2023
- Representation Learning (IFT6135 - Mila, A) - 2022
- Adversarial Attacks (TEL351 - INRS, A+) - 2022

Language: English (Fluent), French (Beginner), and Portuguese (Native)