

Heitor R. Guimarães

Last Update October 18, 2023

heitor.guimaraes@inrs.ca • +1 514 553 8381
www.hguimaraes.me • www.linkedin.com/in/hrguimaraes
800 Rue de la Gauchetière O • H5A 1K6 • Montreal • Quebec

Research Interests

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

Education

- Institut National de la Recherche Scientifique (INRS)** MONTREAL, CA
Ph.D. Telecommunications 2022 – 2026
Advisor: Dr. Tiago H. Falk
Research Interests: Self-Supervised Learning; Model Compression; Domain Adaptation
- University of São Paulo (USP)** SÃO PAULO, BR
M.Sc. Electrical Engineering 2021 – 2022
Advisor: Dr. Miguel Arjona Ramírez, Dr. Wesley Beccaro
Thesis: On Self-Supervised Representations for 3D Speech Enhancement
- Aeronautics Institute of Technology (ITA)** SÃO PAULO, BR
Data Science Specialization 2018 – 2018
Advisor: Dr. Hitoshi Nagano
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
Advisor: Dr. Ricardo Guerra Marroquim
Senior Project: *Music Information Retrieval: A deep learning approach.*

Work Experience

- 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
- CBPF (Brazilian Center for Research in Physics)** URCA, RIO DE JANEIRO
Research Assistant (Undergraduate) Jun 2013 – Aug 2015
- Implemented the Kozeny–Carman method to estimate permeability through computer vision. Compared to commercial software, our tool improved the time performance by 36 times, costing an acceptable 9% relative error.
 - Recipient of a Scholarship from the Foundation for Supporting the Development of Scientific Computing

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." **Under review**. Submitted to IEEE International Conference on Acoustics, Speech, & Signal Processing (ICASSP) (2024). [\[Link\]](#)
- (ii) **Heitor R. Guimarães**, Arthur Pimentel, Anderson Avila, Mehdi Rezagholizadeh, Boxing Chen, and Tiago Falk. "An Efficient End-to-End Approach to Noise Invariant Speech Features via Multi-Task Learning." **Under review**. Submitted to IEEE Transactions on Audio, Speech, and Language Processing (2023).
- (iii) Wesley Beccaro, Miguel Arjona Ramírez, William Liaw, and **Heitor R. Guimarães**. "Analysis of Oral Exams with Speaker Diarization and Speech Emotion Recognition: A Case Study." IEEE Transactions on Education (2023).
- (iv) **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).
- (v) Yi Zhu, Mahsa Abdollahi, Ségolène Maucourt, Nico Coallier, **Heitor R. Guimarães**, Pierre Giovenazzo, and Tiago H. Falk. "Early prediction of honeybee hive winter survivability using multi-modal sensor data." IEEE International Workshop on Metrology for Agriculture and Forestry (2023).
- (vi) **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).
- (vii) **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). [\[Link\]](#)
- (viii) **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). [\[Link\]](#)
- (ix) **Heitor R. Guimarães**, Arthur Pimentel, Anderson Avila, Mehdi Rezagholizadeh, and Tiago Falk. "An Exploration into the Performance of Unsupervised Cross-Task Speech Representations for *In the Wild* Edge Applications". Abstract. Edge Intelligence Workshop (2022). [\[Link\]](#)
- (x) Arthur Pimentel, **Heitor R. Guimarães**, Anderson Avila, Mehdi Rezagholizadeh, and Tiago Falk. "How Robust is *Robust wav2vec 2.0* for Edge Applications? An Exploration into the Effects of Quantization and Model Pruning on *In the Wild* Speech Recognition". Abstract. Edge Intelligence Workshop (2022). [\[Link\]](#)
- (xi) **Heitor R. Guimarães**, Wesley Beccaro, and Miguel A. Ramirez. "A PERCEPTUAL LOSS BASED COMPLEX NEURAL BEAMFORMING FOR AMBIX 3D SPEECH ENHANCEMENT." Proc. L3DAS22: Machine Learning for 3D Audio Signal Processing: 16-20 (2022). [\[Link\]](#)
- (xii) **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). [\[Link\]](#)
- (xiii) **Heitor R. Guimarães**, Hitoshi Nagano, and Diego W. Silva. "Monaural speech enhancement through deep Wave-U-Net." Expert Systems with Applications 158 (2020): 113582. [\[Link\]](#)
- (xiv) Luciana Dias, Clecio Bom, **Heitor R. Guimarães**, Elisângela Faria, Marcio Albuquerque, Marcelo Albuquerque, Maury Correia, and Rodrigo Surmas. "Segmentation of Microtomography images of rocks using texture filter." Notas Técnicas. 6. 19-27 (2016). DOI 10.7437/NT2236-7640/2016.01.003. [\[Link\]](#)

Workshops, Presentations, and Talks

- (i) "RobustDistiller: Compressing Universal Speech Representations for Enhanced Environment Robustness". Poster Presentation. IEEE ICASSP (2023).
- (ii) "Improving the Robustness of DistilHuBERT to Unseen Noisy Conditions via Data Augmentation, Curriculum Learning, and Multi-Task Enhancement". Oral Presentation (**Spotlight**). Efficient Natural Language and Speech Processing (ENLSP-II) workshop - NeurIPS (2022). [\[Link\]](#)
- (iii) "An Exploration into the Performance of Unsupervised Cross-Task Speech Representations for *In the Wild* Edge Applications". Poster Presentation. Edge Intelligence Workshop (2022).
- (iv) "Optimizing Time Domain Fully Convolutional Networks for 3D Speech Enhancement in a Reverberant Environment Using Perceptual Losses." Oral Presentation. IEEE 31st International Workshop on Machine Learning for Signal Processing (MLSP). (2021).
- (v) Porosity and Absolute Permeability estimation through Image Processing. Oral Presentation. "XXII undergraduate research fair of the Brazilian Center for Research in Physics (2015)".

Honors & Awards

- IEEE Signal Processing Society (SPS) Scholarship 2023
- CIFAR Inclusive AI Scholarship 2023
- 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

Journal Reviewer Expert Systems with Applications, IEEE TASLP

Conference Reviewer IEEE MLSP 2023, IEEE SMC 2023, IEEE ICASSP 2023, IEEE MLSP 2021

Invited Talk

- Self-Supervised Learning for Speech Applications. *Minds Digital*. (2023).
- On the usage of Neural Networks for Speech Enhancement. *Itaú Data Science Meetup*. (2022).

Teaching Experience

- **Lecturer at Ada Bootcamp** - Deep Learning. 2020 - 2022.
- **Teaching Assistant at UFRJ** - Undergraduate course EEL890 - Big data. 2016.

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

Diversity and Inclusion Member of the Black in AI (BAI) affinity group

Extracurricular activity Member of the Formula SAE - Responsible for the implementation of a telemetry system and data analysis of a small formula-style car. Our team achieved 5th place in the 2015 competition.

Language: English (C1), French (A1), and Portuguese (Native)