# Juan Pablo Zuluaga-Gomez

**Speech & Audio Processing Research Group**
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## EDUCATION

*PhD Candidate*, Electrical Engineering & Computer Science
École polytechnique fédérale de Lausanne, Vaud, Switzerland                               January 2024
THESIS - Speech and text-based technologies applied to air traffic control communications
Supervisor: Petr Motlicek, PhD.

*Master of Science*, Mechatronic Engineering
Universidad de Oviedo, Spain & ENSMM, France                               September 2019
THESIS - Breast cancer diagnosis based on computer vision
Score 89/100
Supervisor: Noureddine Zerhouni, PhD.

*Bachelor of Science*, Mechatronic Engineering
Universidad Autonoma del Caribe, Barranquilla, Colombia                               December 2015
THESIS - Precordial signal detection system by Seismocardiography
Score 91/100
Supervisor: Pablo Bonaveri, PhD.

## PROFESSIONAL EXPERIENCE

*Idiap Research Institute, Valais, Switzerland*                               January 2020 -
Doctor of Philosophy (Ph.D.) - Candidate
- Automatic speech recognition (ASR) for air traffic control (ATC): ATCO2 EU-H2020
- Implemented innovative semi-supervised techniques for ASR in air-traffic control (low resource task)
- Led the integration of natural language processing (NLP) techniques. 50% improvement in named-entity recognition from ASR transcripts (breakthrough)
- Developed first system to perform speaker role and speaker change detection based on ASR transcripts
- Participated at several venues: INTERSPEECH, ICASSP, OpenSky Network Symposium (7 conf.)
- Implemented a streaming ASR system for ATC communications: collaboration with industrial partners

*Research Institute Femto-ST, Besancon, France*                               February 2019 - October 2019
Master of Science Thesis
- Participated: SBRA-"Smart BRA" project, financed by INTERREG (France-Suisse)
- Developed a system for breast cancer diagnosis based on thermal images
- Early research in multi-modal techniques (vision & signal) for breast cancer diagnosis
- Published two journal papers
- Master Thesis: Breast Cancer Diagnosis Using Machine Learning

*Universidad Autonoma del Caribe, Barranquilla, Colombia*
Mechatronic Research Group Member UAC                               September 2014 -
- Participation in national and international events (7), co-authorship in publications (4), 2 patents

- Active member of the GIIM research group of mechatronic, as a senior research student for three consecutive years and then an active member

Bachelor Student                                                    January 2011 – December 2015
- Main topics covered: automatic control, electronics, mechanical systems, robotics, nanotechnology, machine learning and computer science
- Research on Titanium dioxide ($TiO_2$) for wastewater decontaminaton: work as student on the GIIM research group in Mechatronics
- Thesis: developed a system to capture and analyze precordial signals by Seismocardiography

## AWARD, NOTABLE ACHIEVEMENT

1. Ranked 2nd and 3rd place at OLR-2021 challenge task 3 & 4, 2021
2. Scholarship: Erasmus Mundus - European Union, EACEA, 2017
3. Scholarship: to attend XVI World Summit of Nobel Peace Laureates in Colombia, 2017
4. Scholarship: to attend XV World Summit of Nobel Peace Laureates in Spain, 2015
5. Distinction: rank obtained during bachelor studies: ranked 1st out of 7, 2015
6. Distinction: six distinctions and scholarships (GPA during bachelor studies), 2012-2015
7. Scholarship: by DAAD (Germany), visiting student September-October, 2014

## PROGRAMMING SKILLS

- Experienced in Bash scripting and Git (Github/Gitlab)
- Experienced in Python, PyTorch, numpy, Google Colab and Jupyter Notebooks
- Speech Recognition toolkit: Kaldi, HuggingFace, SpeechBrain & ESPNet
- Natural Language Processing toolkit: PyTorch, HuggingFace
- Parallel experimentation with SunGrid Engine and Weight & Biases

## LANGUAGE SKILLS

- Spanish: Native
- English: Bilingual Proficiency
- French: Limited Working Proficiency

## TEACHING

Teaching Assistant:
- Deep Learning Course, EE-559, EPFL (Prof. François Fleuret), Spring 2022

## TALKS

- Keynote: An introduction to speech-based technologies for Natural Language Processing applications. *Mexican NLP Summer School 2021*, Ciudad de Mexico, Mexico, 2021
- Paper presentation. Unsupersived speech recognition (abs, pdf). At *ECCS Seminar: Advanced Topics in Machine Learning*, 2022.

## MEMBERSHIPS

- Member of the International Speech Communication Association (ISCA), since 2020
- Graduate Student Member of the Institute of Electrical and Electronics Engineers (IEEE), since 2022

## PATENTS

*Device for Cardiac Signals Detection,* **Granted**      September 2019
- Seismocardiography system for Cardiac Signals Detection
- Registration number: NC16-175508
- Phase: Granted 2020
- Financing partners: Commerce Chamber of Barranquilla - CIENTECH

*Robot for Martial Arts Training - RobPam,* **Granted**      October 2020
- Robotic humanoid to practice martial arts
- Registration number: NC201-0007622
- Phase: Granted 2020
- Financing partners: Commerce Chamber of Barranquilla - CIENTECH

## PUBLICATIONS (BOOK/BOOK CHAPTER)

1. **Zuluaga-Gomez, J** et al. (2017). Tratamiento de aguas residuales mediante el proceso de fotocatalisis con dioxido de titanio (tio2). In U. A. del Caribe (Ed.). Uniautonoma, ISBN: 9789585431010

## PUBLICATIONS (REVIEW PAPER)

1. **Zuluaga Gómez, J**, Bonaveri, P., Zuluaga, D., Álvarez Pena, C., Ramirez Ortiz, N., et al. (2020). Techniques for water disinfection, decontamination and desalinization: A review. *Desalination And Water Treatment*

2. **Zuluaga-Gomez, J** et al. (2019). A survey of breast cancer screening techniques: Thermography and electrical impedance tomography. *Journal of medical engineering & technology*, *43*(5)

## PUBLICATIONS (JOURNAL, PEER REVIEWED)

1. Zhan, Q., Xie, X., Hu, C., **Zuluaga-Gomez, Juan**, et al. (2021). Domain-adversarial based model with phonological knowledge for cross-lingual speech recognition. *Electronics*, *10*(24), 3172

2. **Zuluaga-Gomez, Juan** et al. (2021a). A cnn-based methodology for breast cancer diagnosis using thermal images. *Computer Methods in Biomechanics and Biomedical Engineering: Imaging & Visualization*, *9*(2)

## PUBLICATIONS (CONFERENCE, PEER REVIEWED)

1. Nigmatulina, I., **Zuluaga-Gomez, Juan** et al. (2022). A two-step approach to leverage contextual data: Speech recognition in air-traffic communications. *Proc. ICASSP 2022*

2. **Zuluaga-Gomez, Juan** et al. (2021b). Contextual Semi-Supervised Learning: An Approach to Leverage Air-Surveillance and Untranscribed ATC Data in ASR Systems. *Proc. Interspeech 2021*

3. Kocour, M., Veselý, K., Szöke, I., Kesiraju, S., **Zuluaga-Gomez, Juan**, Blatt, A., Prasad, A., Nigmatulina, I., Motlíček, P., Klakow, D., et al. (2021). Automatic processing pipeline for collecting and annotating air-traffic voice communication data. *Engineering Proceedings*, *13*(1), 8

4. Kocour, M., Veselý, K., Blatt, A., **Juan Zuluaga-Gomez**, et al. (2021). Boosting of Contextual Information in ASR for Air-Traffic Call-Sign Recognition. *Proc. Interspeech 2021*

5. **Zuluaga-Gomez, Juan**, Veselý, K., Blatt, A., Motlicek, P., Klakow, D., Tart, A., Szöke, I., Prasad, A., Sarfjoo, S., Kolčárek, P., et al. (2020). Automatic call sign detection: Matching air surveillance data with air traffic spoken communications. *Multidisciplinary Digital Publishing Institute Proceedings*, *59*(1), 14

6. **Juan Zuluaga-Gomez**, Motlicek, P., Zhan, Q., Vesely, K., & Braun, R. (2020). Automatic Speech Recognition Benchmark for Air-Traffic Communications. *Interspeech*, 2297–2301. https://doi.org/10.21437/Interspeech.2020-2173

7. Ma, J., Shang, P., Lu, C., Meraghni, S., Benaggoune, K., **Zuluaga-Gomez, Juan**, Zerhouni, N., Devalland, C., & Al Masry, Z. (2019). A portable breast cancer detection system based on smartphone with infrared camera. *Vibroengineering Procedia*, *26*, 57–63

8. Bonaveri, P., Barrios, M., & **Zuluaga-Gomez, Juan**. (2017). Diseño y construcción de un sistema basado en acelerometría para la captación y análisis en matlab de señales precordiales usando sismo-cardiografía 3d. *2*(1), 153–156

9. **Zuluaga-Gómez, Juan** et al. (2018). Aprendizaje orientado a proyectos integradores y perfeccionamiento del trabajo en equipo: Caso máster erasmus mundus en ingenieria mecatronica

10. **Zuluaga-Gomez, Juan**, & Bonaveri, P. (2016). Sistema para la detección de señales precordiales mediante sismocardiografia. *Prospectiva*, *14*(1), 89–95

11. Corredor, S., Valbuena, M., **Zuluaga, Juan**, & Barrios, M. (2014). Design and construction a measurer of total body water, fat mass and fat free mass using labview. *2014 III International Congress of Engineering Mechatronics and Automation (CIIMA)*, 1–4

# PUBLICATIONS (PRE-PRINT)

1. **Zuluaga-Gomez, Juan**, Prasad, A., Nigmatulina, I., Sarfjoo, S., Motlicek, P., Kleinert, M., Helmke, H., Ohneiser, O., & Zhan, Q. (2022). How does pre-trained wav2vec2. 0 perform on domain shifted asr? an extensive benchmark on air traffic control communications. *arXiv preprint arXiv:2203.16822*

2. **Zuluaga-Gomez, Juan**, Sarfjoo, S. S., Prasad, A., Nigmatulina, I., Motlicek, P., Ondrej, K., Ohneiser, O., & Helmke, H. (2022). Bertraffic: Bert-based joint speaker role and speaker change detection for air traffic control communications. *arXiv preprint arXiv:2110.05781*

3. Nigmatulina, I., Madikeri, S., Sarfjoo, S. S., Villatoro-Tello, E., Motlicek, P., **Zuluaga-Gomez, Juan**, et al. (2022). Implementing contextual biasing in gpu decoder for online asr. *Submitted to Interspeech 2022*

4. **Prasad, Amrutha**, **Zuluaga-Gomez, Juan**, Nigmatulina, I., Sarfjoo, S. S., & Motlicek, P. (2022). Integrating speaker role information in asr for air traffic communications. *Submitted to Interspeech 2022*

5. Zhan, Q., Hu, C., Su, X., **Zuluaga-Gomez, Juan**, & Xie, X. (2022). Dual lid and multilingual asr for oriental language recognition. *Submitted to Interspeech 2022*

6. Nigmatulina, I., Braun, R., **Zuluaga-Gomez, Juan**, & Motlicek, P. (2021). Improving callsign recognition with air-surveillance data in air-traffic communication. *arXiv preprint arXiv:2108.12156*

7. Prasad, A., **Zuluaga-Gomez, Juan**, Motlicek, P., Ohneiser, O., Helmke, H., Sarfjoo, S., & Nigmatulina, I. (2021). Grammar based identification of speaker role for improving atco and pilot asr. *arXiv preprint arXiv:2108.12175*

8. Madikeri, S., Tong, S., **Zuluaga-Gomez, Juan**, Vyas, A., Motlicek, P., & Bourlard, H. (2020). Pkwrap: A pytorch package for lf-mmi training of acoustic models. *arXiv preprint arXiv:2010.03466*

## RESEARCH PROJECTS

- ATCO2 EU-funded Horizon 2020 project. Website.
- HAAWAII EU-funded Horizon 2020 project. Website.

## SUPERVISION ACTIVITIES

*Universidad Autonoma del Caribe, Barranquilla, Colombia*

Mechatronic Engineering Undergraduate Program                                  October 2016
- Development of a biomedical instrument and mobile APP for cardiac signals (SCG) and pulse oximetry monitoring in older people. **Students**: Cristhian Escalona, Dario Garcia.
- Development of a biomedical system to capture, process and visualize impedance cardiographm and electrocardiogram signals in a web page. **Student**: Juan Villalobos, Daniel Castaneda.

## PARTICIPATION IN CONFERENCES

- IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), 2022
- OpenSky Network (OSN) Symposium, 2021
- Annual Conference of the International Speech Communication Association (Interspeech), 2021
- OpenSky Network (OSN) Symposium, 2020
- Annual Conference of the International Speech Communication Association (Interspeech), 2020
- XXVI CUIEET National Congress, Spain, 2018
- XVIII National and XII International Research Meeting - Colciencias, Colombia, 2015
- XII Departmental meeting of Research, Colombia, 2015
- Biomedical Engineering National Congress, Mexico, 2015
- IV International Mechatronics and Automation Congress, Colombia, 2015
- III International Mechatronics and Automation Congress, Colombia, 2014
- II International Mechatronics and Automation Congress, Colombia, 2013

## INTERESTS

Cooking, Hiking and Traveling, Reading (recommended books), Coffee Brewing.