



Alejandro  
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# Alejandro Delgado Castro Ph.D.

## Lecturer and Researcher

**About Me** I'm an electronic engineer and academic with a special interest in audio signal processing and acoustics. My research focuses on audio source separation approaches for harmonic or nearly-harmonic sounds, which also includes many aspects of Music Information Retrieval, such as multipitch estimation, onset detection and automatic audio classification. I'm also a full-time lecturer in electrical engineering at the University of Costa Rica, with experience in management of academic programs.

## Education

**2015 - 2020, University of York (UK)**

PhD in Electronic Engineering

**2005 - 2010, University of Costa Rica**

MSc in Electrical Engineering

## Experience

**January 2011 - present, Full-time Lecturer, University of Costa Rica**

Detailed achievements:

- Program coordinator in electrical engineering at Campus Guanacaste.
- Lecturer of the following undergraduate modules:
  - Linear Circuits.
  - Analogue Electronics.
  - Probability and Random Variables.
  - Computer Architecture.
  - Elementary Mathematics.
  - Programming Principles.
- Member of the committee for the international accreditation of the electrical engineering program.
- Web design manager of Campus Liberia from 2013 to 2015.
- Researcher in signal processing and semiconductor gas sensors.

## Communication Skills

**Spanish, Native or bilingual proficiency**

**British English, Full professional proficiency**

Level B2, International English Testing System (IELTS).

**Italian, Full professional proficiency**

Level C1, Dante Alighieri Society Diplomas (PLIDA).

**German, Basic proficiency**

Level B1, Zertifikat Deutsch (ZD) by Goethe Institute.

## Software Development Skills

### Programming Languages

- Matlab
- C
- Assembly
- HTML
- Python
- Ladder Logic

### Development Tools

- Arduino
- Simulink
- LabView



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## Audio Related Tools

- Reaper
- Audition
- ProTools

## Circuit Simulation Tools

- OrCad
- Tina
- MicroCAP

## Research Interests

- Single-channel audio source separation.
- Multipitch estimation and note tracking.
- Optimisation techniques for spectral analysis.
- Pattern recognition and model fitting.
- Acoustics and audio recording techniques.
- Digital restoration of audio recordings.

## Research Projects

### *Construction and Evaluation of Test Equipment for Electrochemical Cells based on Open-Source Platforms, University of Costa Rica*

Low-cost electronic circuits and open-source software platforms are combined to create test equipment for applications in electrochemistry.

### *Machine Learning Applied to the Detection of Hydrogen in Air, University of Costa Rica*

Low-cost semiconductor sensors are combined with recent machine learning algorithms in order to improve their accuracy in the detection and quantification of Hydrogen in air.

### *Single-Channel Audio Source Separation, University of York*

The main objective was to develop an unsupervised system to estimate and separate harmonic or nearly-harmonic sources from polyphonic audio mixtures using multipitch detection, spectral filtering and optimisation techniques. This project was supervised by Dr John E. Szymanski.

### *Restoration of Old Audio Recordings, University of Costa Rica*

A wavelet-based digital process was implemented to remove clicks and reduce the presence of hiss in old sound recordings. This project was supervised by Dr Jorge A. Romero Chacón.

## Publications

- A. Delgado Castro and J. E. Szymanski. "Multipitch Estimation Based on the Iterative Detection and Separation of Note Events from Single-Channel Polyphonic Recordings," *The Journal of the Acoustical Society of America*, vol. 154, issue. 4, pp. 2625-2641, 2023.
- A. Delgado Castro and J. E. Szymanski. "A Note Event-Based Decomposition of Polyphonic Recordings Applied to Single-channel Audio Source Separation," In *E-Business and Telecommunications. Communications in Computer and Information Science*, vol 1247. Springer, 2020.
- A. Delgado Castro and J. E. Szymanski. "Semi-Supervised Audio Source Separation based on the Iterative Estimation and Extraction of Note Events," In *Proceedings of the 16th International Conference on Signal Processing and Multimedia Applications*. Prague, Czech Republic. Jul, 2019.



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- A. Delgado Castro and J. E. Szymanski. "Semi-Automatic Mono-to-Stereo Upmixing via Separation of Note Events," In Proceedings of the AES International Conference on Immersive and Interactive Audio. York, UK. Mar, 2019.
- A. Delgado Castro, G. Siamantas, and J. E. Szymanski. "Onset Detection via Separation of Harmonic Content from Musical Notes," In Proceedings of the 10th York Doctoral Symposium on Computer Science and Electronic Engineering. York, UK. Nov, 2017.
- A. Delgado Castro and J. E. Szymanski. "Improved Pitch Trajectory Estimation for Polyphonic Single-Channel Audio Mixtures," In Proceedings of the 11th Digital Music Research Network Workshop. London, UK. Dec, 2016.
- A. Delgado Castro and J. E. Szymanski. "Multipitch Estimation Applied to Single-Channel Audio Source Separation: Relevant Techniques and Challenges," In Proceedings of the 9th York Doctoral Symposium on Computer Science and Electronic Engineering. York, UK. Nov, 2016.
- A. Delgado Castro y O. Rojas Bolaños. "Construcción de un Sistema de Bajo Costo para el Uso y Evaluación de Sensores Simiconductores para Gases," (*Construction of a Low-Cost Evaluation System for Semiconductor Gas Sensors*). Educación Química, vol. 26, pp. 299-306, 2015.

## Reviewer in Academic Journals

**2019-present, *IEEE/ACM Transactions on Audio, Speech and Language Processing***

Principal topics: Multipitch detection in polyphonic audio mixtures.

**2017-present, *Journal of the Acoustical Society of America (JASA)***

Principal topics: Pitch detection algorithms in audio signals.

## Awards

**2019, *16th International Conference on Signal Processing and Multimedia Applications (SIGMAP), INSTICC***

Best Paper Award.

**2017, *York Doctoral Symposium, University of York***

Highly Commended Paper prize winner.

**2017, *PhD Poster Competition, University of York***

Fourth prize winner and best poster within the Audio Lab.