# Darius Pétermann

Researcher in the field of applied machine learning and signal processing for audio

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Scholar | Website | Email | LinkedIn | GitHub

## 1 Education

**Ph.D. Student in Intelligent Systems Engineering** — Expected Dec 2024
*Luddy School of Informatics, Computing, and Engineering, Indiana University (GPA: 4.0 / 4.0)* — *Bloomington, IN*

- **Selected Coursework:** *Machine Learning for Signal Processing, Deep Learning, Computer Vision, Applied Machine Learning*
- Research Group: Signals and AI Group in Engineering (SAIGE)
- Advisor: Prof. Minje Kim

**M.Sc. in Information and Communication Engineering** — Sep 2020
*Dept. of Information and Communication Technologies, Universitat Pompeu-Fabra (GPA: 9.5 / 10.0)* — *Barcelona, Spain*

- **Selected Coursework:** *Music Information Retrieval, System Design, Audio Signal Processing, ML for Audio, Research Methods, Reinforcement Learning*
- Thesis: ***"SATB Voice Segregation for Monaural Recordings"***
- Advisor: Dr. Pritish Chandna

**B.M. in Electronic Production & Design** — May 2016
*Electronic Production & Design Dept, Berklee College of Music (GPA: 3.8 / 4.0)* — *Boston, MA*

- **Selected Coursework:** *Music Information Retrieval, System Design, Audio Signal Processing, ML for Audio, Research Methods, Reinforcement Learning*
- Thesis: ***"A Deep Look at Spectral Synthesis Techniques Through csConvolve"***
- Advisor: Dr. Richard Boulanger

## 2 Positions Held

**Google Research** — May 2023 – Oct 2023
*Student Researcher* — *Cambridge, MA*

- Supervised by Dr. Hakan Erdogan , Dr. John Herhsey , and Dr. Scott Wisdom
- Working on next-level unsupervised audio source separation problems

**Mitsubishi Electric Research Labs (MERL)** — Summers in 2021 - 2022
*Research Intern* — *Cambridge, MA*

- Received $15'000 of gift-money from MERL to work on the *"Cocktail Fork Problem"*
- Hosted by Dr. Gordon Wichern and Dr. Jonathan Le Roux
- Derived and implemented new models and optimization methods for audio analysis with applications to source separation in challenging multi-source environments and using advanced machine learning techniques

**Signals and AI Group in Engineering (SAIGE), Indiana University** — Jan 2021 - Present
*Research Assistant* — *Bloomington, IN*

- Supervised by Prof. Minje Kim

- Conducting research pertaining to neural audio coding and audio source separation problems

**Senseable Intelligence Group, Massachusetts Institute of Technology (MIT)** Jan 2021 - Present

*Technical Lab Assistant* *Cambridge, MA*

- Contractor for Senseable Intelligence Group, McGovern Institute for Brain Research, led by Dr. Satrajit Gosh

**Apple Inc.** Jun 2016 - Jul 2019

*Content Engineer* *Cupertino, CA*

- Software engineer for Apple's pro Audio & Music Apps (LogicPro, GarageBand)
- Designed real-time MIDI processing systems in C++ for Apple's virtual musical instruments

**Electronic Production & Design Dept, Berklee College of Music** Sep 2015 - May 2016

*Programming Tutor* *Boston, MA*

- Tutored and mentored EPD students for technical classes: *"Audio Programming in C", "Digital Signal Processing", "Csound", "Max/MSP"*

## 3 Publications

### International Conference Papers (Peer reviewed)

[C07] **D. Petermann** and M. Kim, "Hyperbolic distance-based speech separation," in *Proc. of the IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, 2024, (to appear).

[C06] **D. Petermann**, I. Jang, and M. Kim, "Native multi-band audio coding within hyper-autoencoded reconstruction propagation networks," in *Proc. of the IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, 2023, pp. 1–5.

[C05] **D. Petermann**, G. Wichern, A. Subramanian, and J. L. Roux, "Hyperbolic audio source separation," in *Proc. of the IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, 2023, pp. 1–5. `[Best Student Paper Award & Top 3% Papers]`

[C04] **D. Petermann** and M. Kim, "SpaIn-Net: Spatially-informed stereophonic music source separation," in *Proc. of the IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, 2022, pp. 106–110.

[C03] **D. Petermann**, G. Wichern, Z.-Q. Wang, and J. L. Roux, "The cocktail fork problem: Three-stem audio separation for real-world soundtracks," in *Proc. of the IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, 2022, pp. 526–530.

[C02] **D. Petermann**, S. Beack, and M. Kim, "Harp-net: Hyper-autoencoded reconstruction propagation for scalable neural audio coding," in *Proc. of the IEEE Workshop on Applications of Signal Processing to Audio and Acoustics (WASPAA)*, 2021, pp. 316–320.

[C01] **D. Petermann**, P. Chandna, H. Cuesta, J. Bonada, and E. Gomez, "Deep learning based source separation applied to choir ensembles," in *Proc. of the International Society for Music Information Retrieval Conference (ISMIR)*, 2020, pp. 733–739.

### Journal Articles

[J02] **D. Petermann**, G. Wichern, A. S. Subramanian, Z.-Q. Wang, and J. L. Roux, "Tackling the cocktail fork problem for separation and transcription of real-world soundtracks," *IEEE/ACM Transactions on Audio, Speech, and Language Processing*, vol. 31, pp. 2592–2605, 2023.

[J01] P. Chandna, H. Cuesta, **D. Petermann**, and E. Gómez, "A deep-learning based framework for source separation, analysis, and synthesis of choral ensembles," *Frontiers in Signal Processing*, vol. 2, 2022.

### Patents

[P02] S. K. Beack, W. Lim, I. Jang, *et al.*, *Audio signal encoding/decoding methods and apparatus for performing the same*, US Patent App. 63/420 405, 2023.

[P01] **D. Petermann**, G. Wichern, A. Subramanian, and J. L. Roux, *Audio source separation using hyperbolic embeddings*, US Patent App. 18/191 417, 2023.

## 4 Honors and Awards

**Best Student Paper Award & Top 3% Papers Recognition** Jun 2023
*ICASSP 2023*

- For the paper entitled "Hyperbolic Audio Source Separation"

**Outstanding Reviewer Award Recognition** Jun 2023
*ICASSP 2023*

- Awarded to the top 5% of the reviewers (220/4445)

**"Excellent" Grade with Honor, Music Cognition & Perception** Sep 2020
*Universitat Pompeu-Fabra*

**Magna Cum Laude Honor** May 2016
*Berklee College of Music*

**Dean's List** May 2016 - May 2016
*Berklee College of Music*

- Appeared on Berklee Dean's List for 7 semesters out of 8

**BT Production Award & Scholarship** April 2015
*Berklee College of Music*

- Award and scholarship from the Electronic Production & Design Dept

## 5 Tutorials, Other Talks & Posters

**Invited talk for the class "Machine Learning for Musicians"** Nov 2021
*Dept. of Electronic Production & Design (EPD), Berklee College of Music* *Boston, MA*

**Poster Presentations (Non-Archival) on "Hyperbolic Audio Source Separation"** Mar 2023
*Luddy AI Center Open House, Indiana University* *Bloomington, IN*

## 6 Certifications

**Machine Learning** Oct 2019
*Stanford - Coursera*

**Audio Signal Processing for Music Applications** Jul 2018
*Universitat Pompeu-Fabra - Coursera*

## 7 Technical Skills

**Programming Languages**: Python, C++, Objective-C, C, Lua, Javascript, LaTeX

**Deep Learning (over 6 years of experience)**: PyTorch, PyTorch Lightning, TensorFlow, JAX

**Audio Signal Processing (over 10 years of experience)**: JUCE, MATLAB, Csound, MAX/MSP, PureData

# 8 Referees

**Dr. Minje Kim**
Former Principal Investigator of the Signals and AI Group in Engineering (SAIGE) at Indiana University.
Associate professor of Computer Science at University of Illinois Urbana-Champaign (UIUC)

**Dr. Xavier Serra**
Director of the Music Technology Group at Universitat Pompeu-Fabra, Professor in the Dept. of Information and Communication Technologies

**Dr. Richard Boulanger**
Professor in the Electronic Production & Design Dept. at Berklee College of Music