

# AURORA CRAMER

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## RESEARCH INTERESTS

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Machine listening, music information retrieval, machine learning, digital signal processing

## EDUCATION

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**New York University - New York, NY, USA**

August 2017 - September 2023

PhD Candidate

GPA: 3.964

Department of Electrical and Computer Engineering

Advisor: Juan Pablo Bello

**University of California, Berkeley - Berkeley, CA, USA**

August 2011 - May 2015

Bachelor of Science (Honors)

GPA: 3.798

Department of Electrical Engineering and Computer Sciences

EECS Honors Program - Music/Audio

Advisor: David Wessel, Edmund Campion

## ACADEMIC RESEARCH EXPERIENCE

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**Music Audio Research Laboratory, NYU**

September 2017 - September 2023

Investigating using natural structure in audio data from class hierarchies, multi-task relationships, multi-modal dynamics, and embodied navigation to learn effective audio representations for machine listening tasks without large annotated datasets. Contributed to machine listening efforts of the SONYC and BirdVox projects.

**Center for New Music & Audio Technology, UC Berkeley**

August 2014 - May 2015

Modeled musical sequences for the task of machine improvisation using an extension of author-topic modeling.

**Video and Image Processing Lab, UC Berkeley**

September 2013 - May 2014

Developed visualizations of indoor point cloud models and their associated sensor data for energy auditing applications

## PEER-REVIEWED PUBLICATIONS

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B. M. Van Doren, V. Lostanlen, A. **Cramer**, J. Salamon, A. Dokter, S. Kelling, J. P. Bello, and A. Farnsworth, "Automated acoustic monitoring captures timing and intensity of bird migration," *Journal of Applied Ecology*, 2022.

A. **Cramer**, M. Cartwright, F. Pishdadian, and J. P. Bello, "Weakly supervised source-specific sound level estimation in noisy soundscapes," in *2021 IEEE Workshop on Applications of Signal Processing to Audio and Acoustics (WASPAA)*, 2021.

M. Cartwright, A. **Cramer**, A. E. M. Mendez, Y. Wang, H.-H. Wu, V. Lostanlen, M. Fuentes, G. Dove, C. Mydlarz, J. Salamon, O. Nov, and J. P. Bello, "SONYC-UST-V2: an urban sound tagging dataset with spatiotemporal context," *Detection and Classification of Acoustic Scenes and Events 2020*, 2020.

A. **Cramer**, V. Lostanlen, A. Farnsworth, J. Salamon, and J. P. Bello, "Chirping up the right tree: incorporating biological taxonomies into deep bioacoustic classifiers," in *2020 IEEE International Conference on Acoustics, Speech and Signal Processing*, 2020.

M. Cartwright, A. E. M. Mendez, A. **Cramer**, V. Lostanlen, G. Dove, H.-H. Wu, J. Salamon, O. Nov, and J. P. Bello, "SONYC Urban Sound Tagging (SONYC-UST): a multilabel dataset from an urban acoustic sensor network," *Detection and Classification of Acoustic Scenes and Events 2019*, 2019.

V. Lostanlen, K. Palmer, E. Knight, C. Clark, H. Klinck, A. Farnsworth, T. Wong, A. **Cramer**, and J. P. Bello, "Long-distance detection of bioacoustic events with per-channel energy normalization," *Detection and Classification of Acoustic Scenes and Events 2019*, 2019.

M. Cartwright, A. **Cramer**, J. Salamon, and J. P. Bello, "TriCycle: audio representation learning from sensor network data using self-supervision," in *2019 IEEE Workshop on Applications of Signal Processing to Audio and Acoustics (WASPAA)*, 2019.

- A. **Cramer**, H.-H. Wu, J. Salamon, and J. P. Bello, “Look, listen and learn more: design choices for deep audio embeddings,” in *2019 IEEE International Conference on Acoustics, Speech and Signal Processing*, 2019.
- C. Summers, G. Tronel, A. **Cramer**, A. Vartakavi, and P. Popp, “GNMID14: A collection of 110 million global music identification matches,” in *Proceedings of the 39th International ACM SIGIR Conference*, 2016.
- O. Oreifej, A. **Cramer**, and A. Zakhori, “Automatic generation of 3D thermal maps of building interiors,” in *ASHRAE*, 2014.

## PATENTS

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- M. Cremer, A. **Cramer**, P. Popp, and C. Summers, “Responding to remote media classification queries using classifier models and context parameters,” July 6 2017. US Patent App. 15/185,616.
- A. **Cramer**, M. Cremer, P. Popp, and C. Summers, “Model-based media classification service using sensed media noise characteristics,” July 6 2017. US Patent App. 15/185,654.
- A. Vartakavi, C. Y. R. Gil, A. Gopakumar, and A. **Cramer**, “Methods and apparatus to generate recommendations based on attribute vectors,” May 27 2021. US Patent App. 16/695,169.

## PROFESSIONAL EXPERIENCE

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- Zoox - Foster City, CA** August 2023 - Present  
Advanced Hardware Engineering - Machine Learning & Signal Processing Engineer  
Investigating and developing machine listening models for self-driving vehicles.
- Mitsubishi Electric Research Laboratory - Cambridge, MA** August 2020 - January 2021  
Speech & Audio Team - Audio Analysis and Source Separation Research Intern  
Investigated source separation models trained with hierarchical targets to improve separation performance.
- NVIDIA - Santa Clara, CA** May 2018 - August 2018  
Applied Deep Learning Research - Research Intern  
Investigated audio inpainting methods using text-to-speech inspired deep sequence-to-sequence models.
- Gracenote - Emeryville, CA** June 2015 - July 2017  
Applied Research - Audio Research Engineer  
Researched and developed audio classifiers to describe attributes of musical audio (e.g. genre classification, vocal detection, fingerprinting reliability); developed AWS applications for ingesting and processing audio content.
- Blue Jeans Network - Mountain View, CA** May 2014 - August 2014  
Media Team - Media Software Engineering Intern  
Refactored the WebRTC and Speex noise suppression modules used in teleconferencing software, and reconfigured modules to improve the system’s perceptual speech quality.
- Guidewire - Foster City, CA** June 2013 - August 2013  
Development Operations - Software Engineering Intern  
Developing an optimization framework for managing virtual machines to balance cost and testing performance.
- WhereLab - Berkeley, CA** February 2013 - May 2013  
Software Engineering Consultant  
Creating an interactive, wide-area augmented reality applications for iOS.
- Siemens Healthcare Diagnostics - Glasgow, DE** June 2012 - August 2012  
Informatics Research and Development - Student Intern  
Creating a log parsing and statistical analysis application.

## HONORS AND AWARDS

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| ECE MS Student Award - New York University, Tandon School of Engineering       | 2018 |
| Samuel Morse MS Fellowship - New York University, Tandon School of Engineering | 2017 |
| Music/Auto Challenge - Gracenote 5.0 Hackathon                                 | 2016 |
| Auto Podcast Challenge - Gracenote 4.0 Hackathon                               | 2015 |
| 3 <sup>rd</sup> Place - CSUA Hackathon, UC Berkeley                            | 2013 |

3 <sup>rd</sup> Place - Code 4 Cal Hackathon, UC Berkeley	2013
Edward Frank Kraft Award - UC Berkeley	2011
Completed all A/B/C-Sides and Chapter 9 - Celeste (Nintendo Switch)	2022

## SELECTED COURSE PROJECTS

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<b>Latent factor models for imputation of urban sound data</b>	Fall 2019
Using Kalman filters and deep learning variants to model the temporal dynamics of audio embeddings computed from a large dataset of urban audio in order to impute embeddings for missing/corrupted audio.	
<b>Ambisonic speech separation using recurrent neural networks using LSTMs</b>	Spring 2019
Implementing an ambisonic speech separation method and trained and evaluated on synthesized ambisonic audio.	
<b>Identifying and reducing gender bias in word-level language models</b>	Spring 2018
Reducing bias in embeddings learned by a language model by applying regularization that penalizes projection onto an embedding subspace capturing variations in gender.	
<b>Audio style transfer with cycle-consistent GANs</b>	Spring 2018
Using a combination of WaveGAN and CycleGAN models for audio style transfer from raw audio.	
<b>Online instrument source separation with source-filter models</b>	Fall 2014
Developing an online framework for performing source separation of instruments in audio using source-filter models.	
<b>Online instrument source separation with PLCA</b>	Fall 2014
Developing an online framework for performing source separation of instruments in audio using PLCA.	

## TEACHING EXPERIENCE

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Teaching Assistant, ECE-GY 6143 Introduction to Machine Learning New York University	Fall 2018
Teaching Assistant, EE 126 Probability and Stochastic Processes University of California, Berkeley	Spring 2015
Teaching Assistant, EE 20N Structure and Interpretation of Signals and Systems University of California, Berkeley	Fall 2014

## ACADEMIC SERVICE

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<b>Challenge Organization</b>	
Task Organizer, IEEE AASP Challenge on Detection and Classification of Acoustic Scenes and Events	2020
<b>Workshop Organization</b>	
Student Volunteer, Workshop on Detection and Classification of Acoustic Scenes and Events	2019
<b>Challenge Organization</b>	
Task Organizer, IEEE AASP Challenge on Detection and Classification of Acoustic Scenes and Events	2019
<b>Journal Reviewer</b>	
IEEE Transactions on Audio, Speech and Language Processing	2019
<b>Conference Reviewer</b>	
Workshop on Detection and Classification of Acoustic Scenes and Events	2019
IEEE International Conference on Acoustics, Speech, and Signal Processing	2019

## ORGANIZATIONS

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IEEE Student Member	2019 - 2021
MIR @ Berkeley Cofounder University of California, Berkeley	2015
Computer Science Undergraduate Association Member University of California, Berkeley	2012 - 2015
Eta Kappa Nu Honor Society Member University of California, Berkeley	2012 - 2015

## SELECTED OPEN SOURCE PROJECTS

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### **BirdVoxClassify**

Open-source Python library for performing classification of bird flight calls at different taxonomic ranks.

### **SONYC Urban Sound Tagging Dataset (SONYC-UST)**

Urban sound classification dataset, released as part of *DCASE 2019 Challenge Task 5: Urban Sound Tagging* and *DCASE 2020 Challenge Task 5: Urban Sound Tagging with Spatiotemporal Context*.

### **openl3**

Open-source Python library for extracting audio and image embeddings, using pre-trained models trained with self-supervised audio-visual correspondence.

## SELECTED COURSEWORK TOPICS

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Machine Learning & AI	Statistical Signal Processing	Music Perception and Cognition
Machine Listening & MIR	Linear Dynamical Systems	Computer Music
3D Audio	Time Series Analysis	Compilers and Languages
Digital Signal Processing	Statistical Learning Theory	Parallel Programming
Probability & Stochastic Processes	Data Structures & Algorithms	Scientific Writing

## PROGRAMMING AND DEVELOPMENT SKILLS

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Python	Web (HTML, CSS, JavaScript, Flask)
MATLAB	Data visualization (matplotlib, d3)
C/C++	UNIX scripting
Java	AWS (ElasticBeanstalk, S3, DynamoDB, CloudWatch)