Iran R. Roman

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Education

2014-21 | **Ph.D. in Computer-based music theory and acoustics**, Stanford University, Stanford, CA

Advisors: Dr. Julius O. Smith, Dr. Chris Chafe, Dr. Edward W. Large

Thesis title: Mathematical Models of Rhythm Synchronization and Anticipation

2009-14 | **B.A. in Biology, minor in Chemistry**, University of North Texas, Denton, TX

2009-14 | **B.M. in Music Theory**, University of North Texas, Denton, TX

2009-14 | **B.A. in German Language**, University of North Texas, Denton, TX

Employment

2021- | **Postdoctoral Scholar in Machine Listening**, New York University, Brooklyn, NY

- Spatially-aware machine listening with deep neural networks and microphone arrays.
- Wrote multi-channel audio signal processing algorithms for microphone arrays.
- Contributed to the open-source `librosa`, `soundata`, and `micarraylib` python packages.

2020-21 | **Signal Processing Internship**, Tesla Inc, Palo Alto, CA

- Designed signal processing algorithms for the embedded audio system of the 2021 Model S.
- Wrote testing pipelines to identify signal distortion in A2DP and PCM streaming.
- Designed signal processing layouts with the AudioWeaver software for dedicated audio hardware.

2020-20 | **Machine Listening Internship**, Oscillo Biosciences, Farmington, CT

- Implemented gradient frequency neural networks in Tensorflow for audio signal processing and optimization.
- Developed novel speech enhancement algorithms using networks of neural oscillators.
- Deployed a cloud testing environment in AWS to assess our model against SOTA baselines.

2018-19 | **Deep Learning for Speech Recognition Internship**, Apple Inc, Cupertino, CA

- Optimized the Transformer neural architecture to carry out automatic speech recognition (ASR).
- Encoded the length of speech utterances in the Transformer inputs to improve ASR precision and recall.
- Collected human data with novel sensors designed for natural voice interaction with Siri.
- Designed deep neural network architectures that integrate speech and the novel sensor signals.

2017-18 | **Audio Signal Engineering Internship**, Poly, Santa Cruz, CA

- Developed neural networks for biometric authentication of users with audio headsets.
- Collected and curated a new dataset to develop these new algorithms.
- Optimized the size of the neural network to be small enough to run in an embedded system.

Publications

Journal Articles

- **Roman IR**, Washburn A, Large EW, Chafe C, Fujioka T. Delayed feedback embedded in perception-action coordination cycles results in anticipation behavior during synchronized rhythmic action: A dynamical systems approach. PLoS computational biology. 2019 Oct 31;15(10):e1007371.

- Washburn A, **Roman IR**, Huberth M, Gang N, Dauer T, Reid W, Nanou C, Wright M, Fujioka T. Musical role asymmetries in piano duet performance influence alpha-band neural oscillation and Behavioral synchronization. Frontiers in neuroscience. 2019 Oct 15;13:1088.
- Huberth M, Dauer T, Nanou C, **Roman IR**, Gang N, Reid W, Wright M, Fujioka T. Performance monitoring of self and other in a turn-taking piano duet: A dual-EEG study. Social neuroscience. 2019 Jul 4;14(4):449-61.
- Jiménez JE, Crego RD, Soto GE, **Roman IR**, Rozzi R, Vergara PM. Potential impact of the alien American mink (Neovison vison) on Magellanic woodpeckers (Campephilus magellanicus) in Navarino Island, Southern Chile. Biological Invasions. 2014 Apr;16(4):961-6.

Article Preprints

- Fuentes M, Salamon J, Zinemanas P, Rocamora M, Paja G, **Roman IR**, Miron M, Serra X, Bello JP. Soundata: A Python library for reproducible use of audio datasets. arXiv preprint arXiv:2109.12690. 2021 Sep 26.
- **Roman IR**, Roman AS, Large EW. Hebbian learning with elasticity explains how the spontaneous motor tempo affects music performance synchronization. bioRxiv. 2021 Jan 1:2020-10.

Refereed Conference Publications

- **Roman IR**, Bello JP. Micarraylib: Software For Reproducible Aggregation, Standardization, And Signal Processing Of Microphone Array Datasets. In *Proceedings of the Workshop on Detection and Classification of Acoustic Scenes and Events (DCASE)*, 2021.
- Roman, AS, **Roman, IR**. Individual Musician's Spontaneous Performance Rates Affect Interpersonal Synchrony in Joint Musical Performance: A Dynamical Systems Model. In *Abstracts of the 2019 biennial meeting of the Society for Music Perception and Cognition*, 2019.
- **Roman, IR**, Washburn, A, Large, E, Chafe, C, Fujioka, T. Delayed feedback embedded in perception-action coordination cycles results in anticipation behavior. In *Abstracts of the International Conference on Music Perception and Cognition*, 2018.
- **Roman, IR**, Fujioka, T. Music syntactic processing is determined by the architecture of a recurrent neural network. In *Abstracts of the Neurosciences and Music Conference*, 2017.
- **Roman, IR**, Huberth, M, Gang, N, Dauer, T, Reid W, Nanou, C, Wright, M, Fujioka, T. A dual piano performance EEG study: the effect of the partner's animacy and melodic content on alpha-band oscillations. In *Abstracts of the Cognitive Neuroscience Society*, 2017.
- Huberth, M, Dauer, T, **Roman, IR**, Nanou, C, Gang, N, Reid W, Wright, M, Fujioka, T. Involvement or irrelevance: Representation of the self vs. other in joint piano performance recorded by dual-EEG. In *Abstracts of the Cognitive Neuroscience Society*, 2017.
- **Roman, IR**, Fujioka, T. Music syntactic processing is influenced by integration of local and global harmonic structures: an ERP study. In *Abstracts of the Cognitive Neuroscience Society*, 2016.
- **Roman, IR**, Imam, J, Stearns, T. Characterization of five human p53 mutants using the budding yeast Saccharomyces cerevisiae as a model. In *Abstracts of the Annual Biomedical Research Conference for Minority Students*, 2013.
- **Roman, IR**, Jiménez, JE, Vergara, P, Rozzi, R. Magellanic Woodpecker (Campephilus magellanicus) behavior when approached by humans in the context of ecotourism. In *Abstracts of the Ecological Society of America*, 2013.

Other Non-Refereed Publications

- O'Brien T, **Roman IR**. A Recurrent Neural Network for Musical Structure Processing and Expectation. cs224d.stanford.edu
- **Roman IR**. Assessing Neuroplasticity with Convolutional and Recurrent Neural Networks. vision.stanford.edu

Open-Source Software Contributions

- `Micarraylib`, Founded the project and wrote the first version in its entirery, github.com/micarraylib
- `Soundata`, Wrote classes to handle spatial audio and microphone array datasets, github.com/soundata

- `Librosa`, Re-wrote functions to handle multi-channel audio, github.com/librosa

Grants, Fellowships, and Scholarships

2021	Defense Advanced Research Projects Agency, Perceptually Enabled Task Guidance (proposal co-authored with PI: Claudio Silva, grant HR001121S0015-PTG-FP-041)	$5,129,870
2019	Stanford University, Human-Centered Artificial Intelligence Research Fellowship	$70,000
2015	Stanford University, Mind, Brain and Computation Graduate Research Traineeship	$4,500
2015	National Institute of Mental Health, Cognitive Neuroscience Summer Institute Scholarship	∼$2,500
2014	Stanford University, Graduate Fellowship	$308,000
2014	Howard Hughes Medical Institute, Exceptional Research Opportunities Capstone	∼$20,000
2013	Howard Hughes Medical Institute, Exceptional Research Opportunities Fellowship	∼$20,000
2012	Howard Hughes Medical Institute, Undergraduate Research Fellowship	∼$20,000

Honors and Awards

2019 | Excellence in Advocacy Award, Stanford University Diversity and Advocacy Committee

2019 | Outstanding Artificial Intelligence Project for Siri Speech, Apple Inc

2016 | Honorable Mention for Best Paper, Stanford University Deep Learning for Genomics and Biomedicine

2013 | Best poster presentation, Annual Biomedical Research Conference for Minority Students

2013 | Honorable mention for oral presentation, Stanford Summer Research Program

2013 | Nationally Competitive Awards Public Recognition, University of North Texas Honors Day

Mentoring

Research

2021-22 | Aidan Singh, Undergrad, New York University

2021-22 | Aliaa Mahgoub, Brooklyn Technical High School

2018-21 | Adrian S. Roman, Undergrad, University of California Davis, (Now Senior Engineer at Tesla Inc)

2016 | Nasim Eshragh, Undergrad, University of California San Diego, (Now Ph.D. Candidate at UCSD)

2016 | Natalia Rodriguez, Undergrad, University of Puerto Rico, (Now Ph.D. Candidate at UT Southwestern)

2016 | River Jordan, Undergrad, Moravian University, (Now M.D. Candidate at Geisinger Medical School)

Academic

2017-18 | Teaching Assistant Trainer, Stanford University Department of Music

- Taught education theory and practice to Ph.D. candidates before they worked as Teaching Assistants.
- Generated a supportive environment for new TAs to practice their teaching and receive feedback.
- Covered techniques to create an inclusive classroom for students from diverse backgrounds.

2016 | Program Assistant, Stanford Summer Research Program

- Mentored a group of undergraduate students carrying out summer research in the Stanford Medical School.
- Guided these students putting together oral and poster presentations for a research symposium.
- Planned and conducted workshops on professional development and graduate school preparation.

2015 | Program Assistant, Stanford Biosciences ADVANCE Summer Institute

- Planned and conducted a journal club with the participation of new Ph.D. students and post-docs.

Courses Taught

Graduate Level

2017 | EE 367A, Signal Processing Models in Musical Acoustics, Stanford University
2017 | MUSIC 320B, Intro to Audio Signal Processing Part II: Digital Filters, Stanford University
2016 | MUSIC 320A, Intro to Audio Signal Processing Part I: Spectrum Analysis, Stanford University
2016 | EE 367D, Signal Processing Techniques for Digital Audio Effects, Stanford University
2016 | MUSIC 320B, Intro to Audio Signal Processing Part II: Digital Filters, Stanford University
2015 | MUSIC 320A, Intro to Audio Signal Processing Part I: Spectrum Analysis, Stanford University

Undergraduate Level

2014 | BIOL 4022, Microbiology Laboratory, University of North Texas
2013 | BIOL 1710, Principles of Biology I (recitation lecturer), University of North Texas
2012 | BIOL 3452, Genetics Laboratory, University of North Texas

Workshops

2021 | Deep Learning for Music Information Retrieval, Stanford University
2021 | Artificial Intelligence, EduExplora
2020 | Artificial Intelligence for Audio using Neural Networks, Mexican Center for Music and Sonic Arts
2020 | Artificial Intelligence, Stanford University Summer Pre-Collegiate Institute
2018 | Deep Learning for Music Information Retrieval, Stanford University
2018 | Deep Learning Algorithms, Higher Technological Institute of Southern Guanajuato
2017 | Deep Learning for Music Information Retrieval, Stanford University
2016 | Math of Spectral Analysis and Digital Filters, Mexican Center for Music and Sonic Arts
2016 | Artificial Intelligence, Stanford University Summer Pre-Collegiate Institute
2016 | Mobile EEG and Computational Tools for Auditory Research, Stanford University

Online courses

- Artificial Intelligence for Audio Using Neural Networks, cmmas.com
- Deep Learning Algorithms, Higher Technological Institute of Southern Guanajuato, iranroman.algoritmica

Invited Lectures and Seminars

2021 | A Transparent, Interpretable, and Multimodal Personal Assistant, Defense Advanced Research Projects Agency Kickoff Meeting, Nov 17th, Washington, DC
2021 | Hebbian Learning with Elasticity Explains Music Performance Synchronization and Speech Envelope Processing, New York University Center for Neural Science, Oct 11th, New York City, NY
2021 | Artificial Intelligence and Self-Driving Cars, EduExplora, July 22nd, Miami, FL
2020 | Deep Learning Applied to Audio, Universidad Politecnica de Madrid, Nov 13th, Madrid, Spain
2020 | Mathematical Models of Music Anticipation and Synchronization, New York University Center for Neural Science, Feb 22nd, New York City, NY
2019 | Delayed Feedback Embedded in the Sensorimotor System Results in Anticipatory Behavior During Synchronized Rhythmic Action: A Dynamical Systems Approach, Stanford University Jay McClelland Lab Meeting, Nov 27th, Stanford, CA
2019 | Delayed feedback embedded in perception-action coordination cycles results in anticipation behavior during synchronized rhythmic action: a dynamical systems approach, Stanford University Center for Mind, Brain, and Computation, May 20th, Stanford, CA
2015 | Music as a Neural Re-Programmer. Annual Central-American Festival of Audio and Acoustics. July 18th, San José, Costa Rica.

Service

Peer Review

2021 | Reviewer for the National Research Project Competition, Chile's National Science Foundation

2021 | Research Article Reviewer, International Society for Music Information Retrieval

Academic

2021-22 | Policy Council Officer, Northside Center for Child Development

2019-20 | ASSU Executive Director of Graduate Student Affordability, Stanford University

2017-19 | Working Group for Diversity and Inclusion, Stanford University Department of Music

2017-19 | Seminar Coordinator, Stanford University Center for Mind, Brain, and Computation

2012-13 | Student Ambassador, University of North Texas World Languages and Literatures

Other

2013 | Bilingual Tour Guide, UNESCO Cape Horn Biosphere Reserve, Puerto Williams, Chile

Languages

- Spanish: Native
- English: Fluent
- German: Advanced

Press

2019 | Delayed neural communication may underlie anticipatory behaviors, EurekAlert!, Oct 31st

2019 | Stanford's Human-Centered AI Institute awards 30 seed grants, The Stanford Daily, May 1st

2016 | High school students wrestle with perennial questions and make connections between art practice and other disciplines, Stanford University News, August 9th

2013 | UNT undergraduate student earns Howard Hughes grant, The North Texan, June 5th

Last updated: December 10, 2021