Ishwarya Ananthabhotla

CONTACT INFORMATION

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RESEARCH INTERESTS

I am interested in statistical methods for modeling auditory cognition and perception for applications in audio interface design. I work at the intersection of machine learning, audio signal processing, cognitive science, and human-computer interaction.

EDUCATION

Massachusetts Institute of Technology, Cambridge, MA

Candidate for PhD in Media Arts and Sciences. Aug. 2021 (expected). GPA to Date: 5.0/5.0
Advisor: Prof. Joseph A. Paradiso, Responsive Environments Group, MIT Media Lab

M.Eng. in Electrical Engineering and Computer Science, June 2016. GPA: 5.0/5.0

S.B. in Electrical Engineering and Computer Science, June 2015. GPA: 4.6/5.0

SELECTED REFEREED PUBLICATIONS

Ishwarya Ananthabhotla, David B. Ramsay, Clement Duhart, Joseph A. Paradiso. "Cognitive Audio Interfaces: Mediating Sonic Information with an Understanding of How We Hear." IEEE Pervasive Computing, 2021.

Ishwarya Ananthabhotla, Vamsi Krishna Ithapu, W. Owen Brimijoin. "A Framework for Designing Head-related Transfer Function (HRTF) Distance Metrics that Capture Localization Perception." Journal of the Acoustical Society of America Express Letters, 2021.

Ishwarya Ananthabhotla, Sebastian Ewert, Joseph A. Paradiso. "Using a Neural Network Codec Approximation Loss to Improve Source Separation Performance in Limited Capacity Networks". IJCNN Special Session on Deep Neural Audio Processing, July 2020.

Ishwarya Ananthabhotla, Sebastian Ewert, Joseph A. Paradiso. "Towards a Perceptual Loss: Using a Neural Network Codec Approximation as a Loss for Generative Audio Models". Proceedings of ACM Multimedia, 2019.

David B. Ramsay*, **Ishwarya Ananthabhotla***, Joseph A. Paradiso. "The Intrinsic Memorability of Everyday Sounds", David Ramsay*. Proceedings of AES International Conference on Immersive and Interactive Audio, 2019.

Ishwarya Ananthabhotla*, David B. Ramsay*, Joseph A. Paradiso. "HCU400: An Annotated Dataset for Exploring Aural Phenomenology through Causal Uncertainty." Proceedings of the International Conference on Acoustics, Speech, and Signal Processing, 2019.

Ishwarya Ananthabhotla and Joseph A. Paradiso. "SoundSignaling: Realtime, Stylistic Modification of a Personal Music Corpus for Information Delivery". Proceedings of ACM IMWUT, 2018.

Ishwarya Ananthabhotla, Joseph A. Paradiso. "VisualSoundtrack: An Approach to Style Transfer in the Context of Soundtrack Composition", International Computer Music Conference, 2017.

RECENT AWARDS AND HIGHLIGHTS

Apple Fellowship in Artificial Intelligence and Machine Learning, 2020-2022

National Science Foundation Graduate Research Fellowship, 2016-2019

AIGrant Recipient *(jointly with David B. Ramsay)*, 2019

NPR Spotlight, "Towards New Musics: What the Future Holds for Sound Creativity", 2019

Recent Talks

Invited Speaker, Northwestern University CS Colloquium Series, Spring 2021 –
"Cognitive Audio": Enabling Auditory Interfaces with an Understanding of How we Hear

Invited Speaker, "AES Symposium: Applications of Machine Learning in Audio", Fall 2020 –
"Cognitive Audio": Enabling Machine Learning Systems with an Understanding of How we Hear

Workshop Speaker/ Facilitator, MIT Media Lab Industry Sponsor Meeting, Fall 2020 –
Cognition-driven Responsive Environments

Plenary Panelist, "Bridging the Gap: Exploiting User Interaction for New Immersive Audio Technologies", AES Interactive and Immersive Audio, Fall 2019

Guest Lecturer, "Introduction to Music Technology - 21M.080", Fall 2018

Selected Research Projects

Cognitive Audio
Responsive Environments, MIT Media Lab

Graduate Research **Fall 2018 - Present**

- A long-term research theme with the goal of modeling pre-conscious auditory cognition (gestalt understanding and memory) and applying them to new auditory interfaces
- Constructed a custom audio dataset with accompanying acoustic and gestalt feature annotations, employing novel techniques to quantify the latter from crowd-sourced data
- Proposed strategies for using sparsely annotated data to estimate gestalt properties from real-world audio data
- Developed an approach to ambient audio summarization employing these models, mapping sample selection strategies to aesthetic/ emotional outcomes

Towards Perceptual Error Metrics for HRTFs
Audio Team, Facebook Reality Labs

Internship Research **Spring 2020 - Fall 2020**

- Developed a machine learning framework for constructing a perceptual error metric that is aligned with performance in human sound localization
- Presented strategies for constructing models with limited perceptual examples and feedback

Towards Perceptual Error Metrics for Source Separation
Responsive Environments, MIT Media Lab/ Spotify, Inc.

Graduate Research **Fall 2018 - Summer 2020**

- Developed early methods to introduce principles of spectral masking to error metrics for generative audio neural networks, as an improvement upon traditional sample-level metrics
- Demonstrated a performance improvement on commonplace source separation tasks for limited capacity neural networks

SoundSignaling
Responsive Environments, MIT Media Lab

Graduate Research **Summer 2017 - Summer 2018**

– Designed and implemented a real-time system capable of modifying a personal corpus of audio in a stylistically relevant manner to convey information
– Incorporated cognitive science and HCI theories on auditory attention, music understanding, and task switch-cost

VisualSoundtrack
Responsive Environments, MIT Media Lab

Graduate Research **Fall 2016 - Summer 2017**
– Designed algorithms and system architecture for a novel approach to musical style transfer in the context of soundtrack composition

Voice Hiding
Responsive Environments/ Center for Bits and Atoms, MIT Media Lab

Graduate Research **Spring 2017 - Fall 2017**
– Presented algorithms for robust data embedding in compressed audio with relaxed imperceptibility constraints

Selected Internship Experience

Facebook Reality Labs, Redmond, WA

Audio and Machine Learning PhD Research Intern **Spring 2020**
– Developed modeling frameworks for constructing perceptually-motivated error metrics for HRTF generation/ selection systems

Spotify, New York, NY

Machine Learning PhD Research Intern **Summer 2018**
– Developed deep learning architectures for end-to-end audio compression and reconstruction, capitalizing on semantic relations and perception

Mentorship

Tal Boger

Visiting Undergraduate Researcher from Yale University **Spring 2021**
Project: Manipulating Causal Uncertainty in Sound Object Perception

Sree Harsha Nelaturu

Visiting Undergraduate Researcher from SRM University **Spring - Summer 2019**
Project: Stylistic Audio Manipulation for Information Delivery

Teaching

6.811 Principles and Practices of Assistive Technology, MIT EECS

Teaching Assistant **Fall 2014, Fall 2015**

6.115 Microcomputer Project Laboratory, MIT EECS

Laboratory Assistant **Spring 2015, Spring 2016**

Outreach

MIT WMBR Radio Host, Cambridge, MA

Engineer and Producer **2017 - 2019**
– Host bi-weekly shows entailing (1) interviews of student guests to showcase diversity in student journeys and experiences; (2) South-Asian classical music and literature; and (3) live radio theatre enactments of classics and original productions

MIT ATHack (Assistive Technologies Hackathon), Cambridge, MA

Director and Co-founder **2014 - 2020**

- Developed the idea for and organized a hackathon to bring together undergraduate computer scientists/ engineers to innovate solutions for co-designers with disabilities; Completed 7 successful years of hackathons with substantial media coverage

Skills and Interests

Technical: Python/ Data Compute Stack, Deep Learning Frameworks, Audio Signal Processing, Audio Production/ Engineering, Bluespec/ FPGA, PCB Layout, Embedded Programming
Music: Carnatic Vocal, Keys, Percussion, A Capella, Music Composition
Writing: Fiction, One-Acts, Poetry, Spoken Word
Languages: English, Telugu, French (Basic)