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David B. Ramsay

Summary

David is a PhD student at the MIT Media Lab, a Fulbright Scholar, a Musician, and a Systems Engineer. He has 3 years consumer electronics industry experience, a Masters from MIT, and undergraduate degrees in Electrical Engineering and Music. David has experience in circuit design and manufacturability (Altium and Spice), programming (embedded C, full-stack Javascript, and Python), audio signal processing (neural networks/deep learning as well as standard approaches), and system design (particularly acoustic/psychoacoustic designs).

His goals for his PhD are to apply these skills to novel, tactile HCI systems. He is particularly interested in combining low-power distributed microphone systems, speech processing, and deep learning-based NLP/linguistics to model user affect, intent, and behavior. Ideal application areas include music and speech systems that attempt to measure and maximize user focus, wellbeing, and interpersonal human connection.

Projects
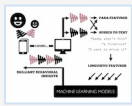
Emotion and Behavior Classification for Parent-Child Interaction (Python)
-used CHILDES database and paralinguistic/linguistic features to classify utterances for affect and behavior type (praise/command/ etc.) using SVMs.

LearnAir: Intelligent, Personal Air Quality Monitoring (Python/Altium)
-used machine learning to estimate accuracy of cheap sensors under a variety of conditions, and built a backend database solution to automatically apply/update ML model for sensor data.

Shenzhen Product Design for Manufacturability (Altium/Solidworks)
-spent six weeks in Shenzhen, designed circuit for audio device with touchscreen and enclosure, had the circuit board and injection molding done in Shenzhen factories.

Mindsprout: Tracking Child Development with Audio (Python/Javascript)
-prototyped several iOS apps (using React-Native) for tracking child development by sending and analyzing audio to our sever. Tested w/test-flight (15 parents), in-home observation with five.

Speaker/Microphone Array Design, System Prototyping, & Speech Intelligibility (Matlab)
-audio signal processing, measurement, and system prototyping at Bose Corporation. One product prototype made it to manufacturing and is now available, one patent issued.


Fulbright Music Interfaces for People with Disabilities (Matlab/C)
-developed a real-time DSP algorithm to make guitar more accessible to people with disabilities, and implemented it on an Analog Devices SHARC development kit. Published ISSC 2011.


Avatars for Exercise Motivation (Javascript)
-designed a mobile web app that allowed users to design an avatar and connect/track their fitbit, and ran a 20 person, two week user study to see what type of experience is most motivating.
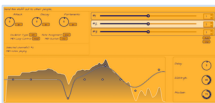
GroupLoop: a Network-Enabled Audio Feedback Instrument (Javascript/WebRTC)
-website using WebRTC, webaudio, and webmidi to create a distributed feedback loop instrument. Published NIME 2015.
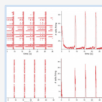
Computational Model of Neural Network for Respiration (Berkeley Madonna)
-Biologically inspired computational modeling of mammalian brainstem neural populations that control respiration, undertaken at NIH. Recently wrote basic NN library in C.

Audio Measurement Toolbox (Python)
-publicly available toolset to automate impulse response measurements and speaker system characterization, written in Python.

Barnacle and Spider Silk Material Properties Research (Labview)
-imaging and study of material properties of biologic materials at the Naval Research Lab. Atomic force microscopy, designed stress/strain tests and data acquisition, etc. Published 2008.
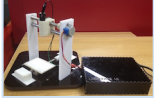
Analog Distortion Pedal Senior Design Project (Spice)
  -Senior thesis implementing EQ and control circuits in analog to drive high-voltage Class A tube distortion.

MetaPiano (Welding/Machine Shop)
  -deconstructed and reconstructed 'pinball machine' from a piano, group art project. This is now on display in the MIT Museum.

Mini-Laser Cutter (3D printing/Laser Cutting/Arduino)
  -built over a few weeks in Shenzhen, parts were sourced from the local market. This could burn a predefined pattern into a business card.

In Progress:

Smart Book – listens to conversation in the room and retrieve relevant Wikipedia article, displayed in a book form factor on the shelf (e-ink display embedded in the book).

Live Music Assistant – learns a band's repertoire and syncs to their songs live, in order to control light cues and recording effects. Distributed light hardware. Measures audience engagement with face tracking.

Microphone Array Filter Design Toolbox – toolbox to design filters for optimal far-field polar response of microphone arrays of variable geometry.

Continued LearnAir Thesis Work – two papers in progress, additional machine learning techniques.

Blockchain Music Payments – decentralized/robust artist payment system using blockchain.

Professional

Google Inc.   *2017*
Software Engineering Intern

Implemented Poincare Embeddings and Generative Adversarial Networks in tensorflow, as well as other standard machine learning algorithms, as part of the Fuschia Intelligence team.

Bose Corporation   *2010 - 2014*
Electrical/Systems Engineer II

2 years in Audio Applied Research as a Systems Engineer:

Designed, constructed, and tuned complex audio prototypes for Home Entertainment applications. Advanced limiting schemes, equalization, speaker spatialization array topologies, and critical listening/evaluation skills.

Designed, implemented, and tested a microphone array using self-implemented speech intelligibility standards; gained familiarity with audio measurement techniques and real-time processing.

Selected for Highly Competitive PACE rotation program:

6 months in Noise Reduction Technology's Advanced Development Group. Designed and tested perceptually based noise management algorithms in Matlab, objective-C.

6 months in Automotive Systems' Electrical Engineering Group. Tested board layouts and worked on embedded/analog circuit design.

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Dublin Institute of Technology   2010 -2011
Fulbright Researcher

Developed and prototyped a DSP (SHARC) based system to allow handicapped musicians to play guitar using real-time feature extraction and pitch shifting; Matlab and C programming, Microchip/ADI hardware.

GE Energy   2009
Electrical Engineering Co-op

Led business support project teams, and worked with Power Engineers to automate the substation design process, in the Transmission and Distribution Projects Division. Presented work to upper-level management.

National Institutes of Health   2008
Biomedical Engineering Intern

Constructed a computational model of interacting neural populations in the brainstem under Dr. Jeffery Smith, as part of the Biomedical Engineering Summer Internship Program (16 students selected nationwide).

Naval Research Laboratory   2004 - 2007
Materials Property Research Intern

Constructed data acquisition systems and test rigs to measure barnacle baseplate mechanics. Modulus mapping/atomic force microscopy of spider silk. Three consecutive internships in the Tribology department.

Education

MIT Media Lab   2014 - present
PhD Student in Responsive Environments Group
MS, MIT Media Lab 2016

-*Affective Computing, Behavior Change, etc. Listener in Computer Networks, OS Engineering, Machine Learning.*
-*Master's Thesis on machine learning techniques for distributed sensor hardware. Summer in Shenzhen.*
-*Teaching Assistant for IoT Workshop, Sensors for Interactive Environments, and Future of Music.*

Bose Corporation (internal)   2013

Dr. Bose's complete MIT Acoustics course, as well as internal classes on Audio Measurements and DSP.

Berklee Online School   2012
Professional Certificate in Music Production

Five classes including Art of Mixing, Mastering Techniques, Recording, and Production Analysis.

Case Western Reserve University   2005 - 2010
BS, Electrical Engineering (*conc. signal processing*)
BA, Music
Minor in Biomedical Engineering

Dual Degree. Digital Communications, Signals and Systems, Signal Processing, Mobile Robotics, Logic Design, etc.

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Patents

Collaboratively Processing Audio between Headset and Source to Mask Distracting Noise.
D. Gauger Jr., C. Ickler, D.B. Ramsay. US 20150281829 A1. Filed March 26, 2014. Pub. Oct 1, 2015.

Publications and Conference Presentations

Automated Characterization of Consumer Grade Sensor Accuracy from Supporting Data in Heterogeneous Air Quality Monitoring Networks. (Conference presentation). Ramsay, DB and Paradiso, J. NEMC, 2016.
LearnAir: towards Intelligent, Personal Air Quality Monitoring. (Master's Thesis). Ramsay, DB. MIT Media Lab, 2016.
GroupLoop: A Collaborative, Network-Enabled Audio Feedback Instrument. Ramsay, DB and Paradiso, J. NIME, 2015.
A Novel Fourier Approach to Guitar String Separation. Ramsay, DB, et al. ISSC, 2011.
Base plate mechanics of the barnacle *Balanus Amphitrite*. Ramsay, DB, et al. Biofouling, 2008.

Leadership and Entrepreneurship

Leader in Bose Young Professional Culture
-Creator of Bose Young Professionals ~4 years ago. The group still has regular events and >100 active members.
-Creator of 'Bose Knows' onboarding process for college recruits; still a primary onboarding initiative for new hires.
-Representative of young professionals in executive level meetings across the organization. College recruiter.

CTO of 'Mindsprout'
Led product development efforts and in-person user testing. Accepted to Competitive Harvard Innovation Lab Incubator for three semesters. Four entrepreneurship classes with team: Nuts and Bolts of Entrepreneurship, New Enterprises, Money for Startups, and Advanced Entrepreneurial Tools and Techniques.

MIT Global Startup Workshop Organizational Team
-Panel organization lead for the 2016 India Workshop (panel topic: Manufacturing in India).
-Web development lead for the 2015 Guatemala Workshop.

Awards

Fulbright Scholarship
Harvard Innovation and Ventures in Education Pitch Competition Third Place Winner
Case Trustee's Scholarship
Case Alumni Association Scholarship
National Merit Finalist Scholarship
Who's Who Among Students at American Universities and Colleges
AP Scholar Award
Golden Key Honor Society, Eta Kappa Nu EECS Honor Society
Naval Research Lab Honor Mention for Outstanding Research Presentation
Naval Research Lab Science and Engineering Apprenticeship Program Achievement Award
Congressional Award Bronze Medal
CWRU Dean's High Honors or Honors every semester

Other

Music - Lead guitarist/singer/songwriter for folk-pop band 'Courage and the Bear'. Gear-nut. Undergrad classical/jazz guitar ensembles and radio station DJ/audio engineer for weekly live band. Laments the end of dynamic range and the rise of laptop speakers.

Travel - Enjoys solo traveling, hiking/backpacking, and caving. 28 countries and counting!