

Mary B. Pietrowicz

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Education

University of Illinois at Urbana-Champaign

Advisors: Mark Hasegawa-Johnson and Karrie Karahalios

Committee Members: Jennifer Cole, Julia Hockenmaier,
Jerome McDonnough, and Gina-Anne Levow

Studied Music Composition with: Philipp Blume, Guy Garnett,
Heinrich Taube, Stephen Taylor, and Reynold Tharp.

Ph.D. Computer Science

Florida Atlantic University

Degree completed while working full time in industry.

Master of Computer Science

Purdue University

B.S. Electrical Engineering

Teaching Experience (University of Illinois)

Interactive Computer Graphics: Teaching Assistant

Taught computer graphics programming sections two hours per week to grad students and advanced undergrads (four semesters). Developed course content. Graded student projects and exams, and advised students on their class projects.

Multimedia Signal Processing: Teaching Assistant

Taught lectures pertaining to programming projects to grad students and advanced undergrads (one semester). Graded student work and advised students.

User Interfaces: Teaching Assistant

Developed course content, graded student projects and exams, and advised students at all levels in office hours (one semester).

MS in Health Technology Program Capstone: Mentor

Mentored students for their capstone projects, which included 1) a data collection and journaling platform designed to gather periodic survey data and voice/video data recordings, and 2) a prototype pipeline for data analysis and machine learning. Primary use case for both projects was detection of emotion, major depressive disorder, and anxiety disorders (one semester).

Professional Experience

Applied Research Institute (ARI) at the University of Illinois (2020-current)

Senior research scientist investigating relationships among embodied, behavioral, and creative signals and health and wellness states (health mirrors). Goals of this research work include developing AI-based tools and machine models that can identify, predict, and estimate disease presence, severity, and disease phenotypes based on how someone speaks, writes, moves, or creates. Neurological and psychiatric disorders, cardiac conditions, and speech disorders are particularly well suited to this approach. AI models which can screen for disease via analysis of accessible signals such as speech, language, and movement are also well suited to telemedicine, and overcome many known barriers to diagnosis and treatment. Currently investigating relationships among speech and language, major depressive disorder, and anxiety disorders through funded “Voice Vitals” research projects that seek to produce machine/deep learning models that can detect presence and severity of these disorders via voice analysis, considering acoustics, linguistics, and semantics. Investigating similar questions for detecting and modeling presence, type, and severity of traumatic brain injury and major depressive disorder in Veterans via a funded project, “Developing a Living Brain Bank.” Current unfunded explorations include detection of epilepsy via language analysis and characterizing voice disorders via analysis of speech, language, movement, and clinical measures. As part of a separate effort, created virtual reality simulation environments for autonomous vehicle navigation, physics simulations, hazard detection, and object identification and avoidance.

IBM Thomas J Watson Research Center (2017-2019)

Postdoctoral research scientist studying human expression and speech in the context of health and wellness. Investigated the relationships among behavioral signals, expressive speech, biological data, clinical measures, and the detection and prediction of mental and physical illness. Some of the conditions explored included schizophrenia, cocaine addiction, Amyotrophic Lateral Sclerosis (ALS), Autism Spectrum Disorder (ASD), Huntington’s disease, and psychological trauma. Explored relationships among prosody, emotion, voice quality, and perceived personal quality in expressive speech, for the purposes of discovering markers of health and wellness. Developed tools and new techniques to discover and distinguish nuanced paralingual expression. Developed a new technique to fingerprint laughter and use the results to understand higher-level expressive gestures in speech, such as sarcasm. This technique is applicable to other kinds of human expression, and generalizable to other kinds of higher-level understanding. Wrote technical content of grant to explore automated assessment and monitoring of child development, considering language, movement, and cognitive milestones.

W.W. Grainger, Inc. (2015-2016)

Intellectual Property researcher and software development engineer, focusing on Internet of Things (IoT) technologies. Wrote patent submissions.

National Center for Supercomputing Applications (NCSA), & Institute for Advanced Computing Applications and Technologies (IACAT) (2006-2011)

Research programmer, developer, and performer for virtual worlds projects, interactive art performances, and cyber-infrastructure development. Composed and performed interactive creative works, explored novel interfaces for interactive creativity platforms, and developed

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machine models for human motion quality based on Laban movement analysis. Explored multimodal creativity in the context of live and machine-generated sound, live motion, virtual worlds, and physical device interactions. Developed electronic dashboards for monitoring watershed environments.

Informatics Research Institute at IUPUI (2006)

Consultant and engineer for continuing Pervasive Technology Labs projects.

Pervasive Technology Labs at Indiana University (2002-2005)

Senior engineer specializing in location tracking, RFID, and tangible user interface applications. Developed location tracking systems for a museum digital docent and a building navigation system. Developed a tangible interface for teaching nutrition to children, which used RFID-instrumented food models and the USDA foods database. The finished system simulated the process of selecting foods from a school cafeteria line and placing them on a tray, with nutrition content provided on an overhead display.

University of Illinois, Department of Computer Science (2001-2002)

Research programmer for explorations in smart environments. Explored applications and infrastructure for a cluster-driven tiled display wall and various distributed sensors and devices. Did the initial research for the location tracking system which was deployed at the Supercomputing 2002 conference.

Personal Genie (2000-2001)

Senior engineer specializing in smart device control.

dChain Commerce (1999-2000)

Chief research and development engineer for electronic trading hub projects. Designed database architecture and Java service architecture for B2B commerce system.

National Center for Supercomputing Applications (NCSA) (1995-1999)

Research programmer specializing in scientific analytic workbenches, synchronous and asynchronous collaboration systems, early web portals, and notification systems. Developed these tools before much of the packaged support for these capabilities was available via Java packages and open source software kits.

Motorola, Inc. (1993-1995)

Computer-aided software engineering (CASE) engineer. Led site-wide initiative for project management process improvement. Evaluated and deployed software design and project management tools. Negotiated contracts with vendors.

Ungermann-Bass (1991-1993)

Software engineer for network management projects. Developed network card health and wellness status software.

Motorola, Inc. (1986-1991)

Software engineer for embedded, 2-way radio software features and radio service software (RF

tuning and software configuration of police radios). Also managed an array of radio service software projects and contracts.

Recent Leadership & Service

Master of Science in Health Technology Program Mentor at the University of Illinois:

Mentor and research supervisor, 2020-21.

International Conference on Acoustics, Speech, and Signal Processing (ICASSP): reviewer 2019, 2020, 2021, 2022.

Interspeech: reviewer 2019, 2020, 2021.

Journal of Artificial Intelligence Research (JAIR): reviewer 2018.

PLOS ONE: reviewer 2018

Undergraduate Mentoring Program at the University of Illinois: research supervisor and mentor 2016-2017.

Journal of the Acoustical Society of America (JASA): reviewer 2015, 2016, 2017, 2019.

iConference: reviewer 2015, 2021, 2022.

Creativity & Cognition: Graduate Student Symposium Committee, 2015.

CHI: WIP Program Committee, 2014.

ASSETS: Mentor, 2014 (resulted in successful publication for 1st-time authors).

Awards

Qualcomm Innovation Fellowship Finalist

University of Illinois Department of Music, Composition Division Award

Project highlights

Voice Analysis for Human Health and Wellness

IBM: Center for Computational Biology, Thomas J Watson Research Center

Developed analytic methods and software for the automated detection and prediction of physical and mental health conditions, focusing on Amyotrophic Lateral Sclerosis (ALS), schizophrenia, addiction, and emotional trauma. Developed software to infer selected emotional intelligence parameters from acoustic and interactive conversational qualities in the voice. Explored markers for ALS and addiction in the voice. Developed a new technique for automated detection of people at risk for developing schizophrenia, which was not possible prior to this work. Developed a new technique to discover and model the dimensions of expressive laughter present in a speech corpus. Explored relationships among paralingual elements in speech, such as emotion, voice quality, prosody, and non-vocal expression. Explored automated analysis of child speech, movement, and interactive behavior for scheduled health assessments, and wrote a grant to explore automated tracking of child development milestones. *See publications list below for project papers.*

Perception-grounded Analytics for Vocal Expression

UIUC: Departments of Computer Science and Electrical and Computer Engineering

Developed transformative research methods for exploring the perception of human vocal expression. These methods enabled 1) the discovery and description of naturally occurring expressive dimensions in human speech, and 2) the discovery of relationships among emotion, voice quality, prosody, and nonverbal quality. Also developed machine listening software to recognize these dimensions, along with lower-level voice qualities, in both scripted and unscripted speech. Demonstrated that whispering, breathiness, modal speech, and resonant speech lie on a continuum, both perceptually and acoustically (they are not unrelated, discrete states). Methods applied here are recommended for all researchers interested in 1) exploring any form of human expressive modality (not just speech), 2) discovering relationships among different expressive modalities, and 3) producing applications which support natural interaction which is correctly aligned with human perception. *See publications list below for project papers.*

CrowdBand

UIUC: Department of Computer Science

Developed software for automated, crowdsourced sound composition. This project demonstrated the potential of using crowdsourced systems for the creation of complex, creative works. *See publications list below for project paper.*

Astral Convertible

National Center for Supercomputing Applications (NCSA)

Developed interactive gesture-tracking software for remade version of original groundbreaking Trisha Brown/John Cage piece, which was performed at the Krannert Center for the Performing Arts. *See the press release: <https://news.illinois.edu/blog/view/6367/205733>.*

Kinetic Flame

UIUC: Departments of Music and Dance

Interactive piece for dancer, percussion, motion sensors, electronics, lighting, and video, performed at the Krannert Art Museum, University of Illinois. I composed the piece, rendered the sound electronically, developed gesture tracking software, and used the dancer's gestures to modulate the sound, visuals, and lighting in real time. Incorporated the stage set for Astral Convertible into the piece. *See a recording at: <https://vimeo.com/23083695>.*

Location-aware Museum Guide: ArtXplore

Pervasive Technology Labs (PTL) at Indiana University

Developed wifi-based, location-tracking software for a handheld museum guide, which was demonstrated at the Indianapolis Museum of Art (IMA) during its 2005 re-opening. This project was influential in the future technology directions at the IMA, and indirectly, at other museums. *See the press release: <http://newsinfo.iu.edu/news-archive/2129.html>.*

Make-a-Meal System for Health Education

Pervasive Technology Labs (PTL) at Indiana University

Developed an engaging, child-appropriate, RFID-instrumented physical object interface for teaching nutrition (part of the required curriculum) to thousands of Indiana school children at the Ruth Lilly Health Education Center in Indianapolis, IN. The interface allowed a class to build meals by placing instrumented food models on a cafeteria tray for nutrient analysis. The system

automatically detected the selected foods, analyzed the nutrient content, and displayed the results. *See the presentation list below for presentation and demonstration.*

NCSA Joule & NCSA Habanero

National Center for Supercomputing Applications (NCSA)

Developed early internet tools for synchronous and asynchronous collaboration. Joule, the asynchronous collaboration system, was an early interactive web portal package created before the term “web portal” had been coined, and before web infrastructure was generally available (created with pre-serialization versions of Java). Also wrote the subscription-based notification system for Joule (also in pre-serialization Java). Developed an object database interface for Habanero (the primarily synchronous platform), and extended its infrastructure to support a blended synchronous-asynchronous collaboration infrastructure for the collaboration platform.

See the Wall Street Journal Article for NCSA Habanero:

<http://www.wsj.com/articles/SB833398067192005000>

Radio Service Software Toolkits

Motorola, Inc.

Developed field service software packages for the electronic tuning/programming of police radios. Also managed a range of software contracts and contractors in this application domain.

Motorola service shop engineers and field technicians worldwide used this software.

Publications

Conference Papers & Posters (Peer-Reviewed)

- [1] **Mary Pietrowicz**, Carla Agurto, Raquel Norel, Elif Eyigoz, Guillermo Cecchi, Zarina R. Bilgrami, and Cheryl Corcoran, “A New Approach for Automating Analysis of Responses on Verbal Fluency Tests from Subjects At-Risk for Schizophrenia,” INTERSPEECH 2019.
- [2] **Mary Pietrowicz**, Carla Agurto, Jonah Casebeer, Mark Hasegawa-Johnson, Karrie Karahalios, and Guillermo Cecchi, “Dimensional Analysis of Laughter in Female Conversational Speech,” IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP) 2019.
- [3] Carla Agurto, Raquel Norel, **Mary Pietrowicz**, Muhammad Parvaz, Sivan Kinreich, Keren Bachi, Guillermo Cecchi, and Rita Z. Goldstein, “Speech Markers for Clinical Assessment of Cocaine Users,” IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP) 2019.
- [4] Carla Paola Agurto Rios, **Mary Pietrowicz**, Elif Eyigoz, Elizabeth Mosmiller, Emily Baxi, Jeffery D. Rothstein, Promit Roy, James Berry, Nicholas Maragakis, Omar Ahmad, Guillermo Cecchi, and Raquel Norel, “Analyzing Progression of Motor and Speech Impairment in ALS,” 41st Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC) 2019.

- [5] Raquel Norel, **Mary Pietrowicz**, Carla Agurto, Shay Rishoni, and Guillermo Cecchi, “Detection of Amyotrophic Lateral Sclerosis (ALS) via Acoustic Analysis,” INTERSPEECH 2018.
- [6] Jonah Casebeer, Hillol Sarker, Murtaza Dhuliawala, Nicholas Fay, **Mary Pietrowicz**, and Amar Das. “Verbal Protest Recognition in Children with Autism,” International Conference on Acoustics, Speech, and Signal Processing (ICASSP) 2018.
- [7] **Mary Pietrowicz**, Mark Hasegawa-Johnson, and Karrie Karahalios. “Discovering Dimensions of Perceived Vocal Expression in Semi-structured, Unscripted Oral History Accounts,” International Conference on Acoustics, Speech, and Signal Processing (ICASSP) 2017.
- [8] **Mary Pietrowicz**, Mark Hasegawa-Johnson, and Karrie Karahalios. “Acoustic Correlates for Perceived Effort Levels in Expressive Speech,” INTERSPEECH 2015.
- [9] **Mary Pietrowicz** and Karrie Karahalios. “Visualizing Vocal Expression,” ACM Conference on Human Factors in Computing Systems Extended Abstract (CHIEA) 2014.
- [10] **Mary Pietrowicz** and Karrie Karahalios, “Sonic Shapes: Visualizing Vocal Expression,” International Community for Auditory Display (ICAD) 2013.
- [11] **Mary Pietrowicz**, Danish Chopra, Amin Sadeghi, Puneet Chandra, Brian Bailey, and Karrie Karahalios. “CrowdBand: An Automated Crowdsourcing Sound Composition System,” Human Computation and Crowdsourcing (HCOMP) 2013.
- [12] **Mary Pietrowicz** and Karrie Karahalios. “Phonetic Shapes: An Interactive, Sonic Guest Book,” ACM Conference on Human Factors in Computing Systems Extended Abstract (CHIEA) 2012.
- [13] Guy Garnett, Robert E. McGrath, and **Mary Pietrowicz**. “mWorlds: novel human interaction with virtual worlds,” Mardi Gras 2009: Virtual Worlds: New Realms for Culture, Creativity, Commerce, Computation, and Communication, 2009.

Journal articles

- [14] **Mary Pietrowicz**, Mark Hasegawa-Johnson, and Karrie Karahalios. “Acoustic correlates for perceived effort levels in male and female acted voices,” Journal of the Acoustical Society of America (JASA), 2017.

Book chapters

- [15] “Special Edition, Using Java,” First Edition, Que Publishing, 1996.

Workshop papers (peer-reviewed)

- [16] **Mary Pietrowicz** and Karrie Karahalios. “Paralingual Analysis, Voice Visualization, and Mobile Devices as Enabling Technologies,” Human Computer Interaction Consortium (HCIC) 2014.
- [17] Jennifer Kim, Melinda Snodgrass, **Mary Pietrowicz**, Karrie Karahalios, and Jim Halle. “Visual Analytics for Behavioral and Physiological Data,” Visual Analytics in Healthcare (VAHC) 2013.
- [18] **Mary Pietrowicz**, Robert E. McGrath, Guy Garnett, and John Toenjes. “Multimedia Gestural Interaction in Performance,” Whole Body Interfaces Workshop, ACM Conference on Human Factors in Computing Systems (CHI) 2010, Whole Body Interfaces Workshop.
- [19] Robert E. McGrath, **Mary Pietrowicz**, Ben Smith, and Guy Garnett, “Transforming Human Interaction with Virtual Worlds,” ACM Conference on Human Factors in Computing Systems (CHI) 2009, Workshop on Computational Creativity Support.

Presentations

- [20] **Mary Pietrowicz**, “Health Mirrors: Exploring relationships between embodied signals and well being,” presented to students in the Masters in Health Technology Program at the University of Illinois, December 2021.
- [21] **Mary Pietrowicz**, Carla Agurto, Jonah Casebeer, Mark Hasegawa-Johnson, Karrie Karahalios, and Guillermo Cecchi, “Modeling Expressive Laughter in Conversational Speech,” presented at the Technology in Psychiatry Summit (TIPS) at Harvard Medical School, 2019.
- [22] Cansu Sarac, Carla Agurto, Raquel Norel, Elif Eyigoz, Guillermo Cecchi, Zarina R. Bilgrami, Cheryl Corcoran, and **Mary Pietrowicz**, “A New Approach for Automating Analysis of Responses on Verbal Fluency Tests from Subjects At-Risk for Schizophrenia,” presented at the Technology in Psychiatry Summit (TIPS) at Harvard Medical School, 2019.
- [23] **Mary Pietrowicz**, Carla Agurto, Kely Norel, and Guillermo Cecchi, “Three Voice Analysis Techniques for Mental and Physical Wellness,” presented to collaborators at Mount Sinai Medical Center, 2018.
- [24] **Mary Pietrowicz**, Carla Agurto, and Guillermo Cecchi, “Analysis of ICU Patient Interviews,” presented to collaborators at Hospital de Clinicas de Porto Alegre, 2018.
- [25] **Mary Pietrowicz**, and Guillermo Cecchi, “Proposed Approach for Automated Assessment of Early Childhood Development,” presented to early childhood researchers at New York University, Department of Psychology, and the Databrary Project, 2018.
- [26] **Mary Pietrowicz**, Mark Hasegawa-Johnson, and Karrie Karahalios, “Discovering

Dimensions of Perceived Vocal Expression in Semi-Structured, Unscripted Oral History Accounts,” Midwest Speech and Language Days (MSLD) 2017.

- [27] **Mary Pietrowicz**, Mark Hasegawa-Johnson, and Karrie Karahalios, “Acoustic Correlates for Perceived Effort Levels in Male Scripted Speech,” Midwest Speech and Language Days & Midwest Computational Linguistics Colloquium (MSLD & MCLC) 2016.
- [28] **Mary Pietrowicz**, Mark Hasegawa-Johnson, and Karrie Karahalios, “Acoustic Correlates for Perceived Effort Levels in Expressive Speech,” Midwest Speech and Language Days (MSLD) 2015.
- [29] **Mary Pietrowicz** and Karrie Karahalios. “Visualizing Vocal Expression,” for NSF Expeditions project: “Collaborative Research: Computational Behavioral Science: Modeling, Analysis, and Visualization of Social and Communicative Behavior,” 2013.
- [30] John Toenjes, Thecla Schiphorst, and **Mary Pietrowicz**, Interactive Workshop on Laban Movement, 2009 (accelerometer-based, interactive motion analysis demonstration and presentation).
- [31] **Mary Pietrowicz** and Polly Baker, “Location Aware Multimedia Delivery in an Art Museum,” I-Light Symposium Presentation, Indianapolis, IN, 2005.
- [32] Robert Comer, Verlyn Wilson, and **Mary Pietrowicz**, “Make-A-Meal Interface for Nutrition Education,” National Association of Health Education Centers, Philadelphia, PA, 2003 (demonstration and presentation).

Patents

- [33] Avner Abrami and **Mary Pietrowicz**, “Speech Characterization Using a Synthesized, Reference Audio Signal,” IBM, Inc. Application: 16/553997, filed on August 28, 2019.
- [34] Geoffrey A. Westphal and **Mary Pietrowicz**, “System and method for using geographical locations to provide access to product information,” W.W. Grainger, Inc., US20170055112A1, Priority date 2015-08-17, Publication date 2017-02-23.
- [35] Brice Klein, Alessia Serafino, Yashaswini Madhavan, Jerry Shim, Norman Lee, Murtaza Heider, Lindsay Hai, **Mary Pietrowicz**, and Xiaoyue Chen, “Methods and apparatus for securing a sensor to a monitored device,” W.W. Grainger, Inc., US20170018165A1, Priority date 2015-07-13, Publication date 2017-01-19.

Interactive Art Performances

- [36] **Air Tropes**
A sonification of soybean growth data, which emphasized differences between CO₂ enhanced and Ozone-enhanced environments for plant growth. Part of the “Sounds of Science” collaboration between artists and scientists at the University of Illinois, at the Krannert Art Museum, University of Illinois, September 2014.

[37] **Kinetic Flame**

Interactive piece for dancer, percussion, motion sensors, electronics, and video, at the Krannert Art Museum, University of Illinois, April 2011.
Available at: <https://vimeo.com/23083695>

[38] **Dark Star**

Interactive piece for dancer, percussion, motion sensors, electronics, and electronic lighting, at the Krannert Art Museum, University of Illinois, April 2011.
Available at: <https://vimeo.com/63711846>

[39] **Remembering**

Composed piece for 4 voices and chamber orchestra, based on WWII oral history texts, at Smith Hall, University of Illinois, October 2010.

[40] **Voltage**

Composed piece for flute, piano, and electronics, at Smith Hall, University of Illinois, July 2010.

[41] **Astral Convertible** (motion tracking software component)

Developed gesture-tracking, interactive software for remade version of original Trisha Brown/John Cage piece, at the Krannert Center for the Performing Arts, February 2009.

[42] **Edream and Be Merry**

Interactive, improvised, distributed performance for violin, flute, percussion, and distributed virtual worlds display. Developed portions of the interactive software, and performed the flute part. At the HASTAC Blue Lights in the Basement event, Krannert Center for the Performing Arts, April 2009.
Available at: <https://vimeo.com/198106703>

Grants and Awards

[43] **SCH: Voice Vision Vitals: An Embodied Approach for Automated Screening of Laryngeal Dystonia, Vocal Tremor, and Muscle Tension Dysphonia.**

Submitted November 2020 to the NSF Smart Health and Biomedical Research in the Era of Artificial Intelligence and Advanced Data Science (SCH) program; it is currently under review at the National Science Foundation. This submission was developed in collaboration with Co-PIs Diana Orbelo (Department of Otolaryngology) at Mayo Clinic and Keiko Ishikawa (Department of Speech and Hearing Science) at the University of Illinois.

[44] **Developing a Living Brain Bank. (PI)**

Awarded through the Center for Social and Behavioral Science (CSBS) at the University of Illinois. October 2021.

[45] **Voice Vitals: Novel Infrastructure for Disease Screening and Treatment Tracking. (PI)**
Faculty fellowship awarded by the National Center for Supercomputing Applications (NCSA) at the University of Illinois. July, 2021.

[46] **Voice Vitals: A New Approach for Anxiety and Depression Screening in the Era of COVID-19. (PI)**
Awarded via the Jump Applied Research through Community Health through Engineering and Simulation (ARCHES) program, a partnership between the Healthcare Jump Simulation and Education Center at OSF and the Health Care Engineering Systems Center at the University of Illinois. May 2021.

[47] **Investigation of Mental Health Needs/Services in Minority Rural Community. (Co-I)**
Awarded through the Center for Social and Behavioral Science (CSBS) at the University of Illinois. December 2020.