

**Shrikanth S. Narayanan***Andrew J Viterbi Professor of Engineering***University of Southern California**

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Email: [shri@sipi.usc.edu](mailto:shri@sipi.usc.edu)URL: <http://sail.usc.edu>**Professional Interests: HUMAN-CENTERED SENSING, COMPUTING AND INFORMATION PROCESSING**

Speech and Language Processing, Automatic Speech/Speaker Recognition, Speech Translation

- Human Behavioral Signal Processing, Emotions, Behavioral Informatics
- Human-Machine and Mediated Interactions; Spoken dialog and Multimodal Systems; Virtual Humans
- Speech production modeling, Articulatory-Acoustics, Speech/Audio Synthesis; Audio/Music
- Biomedical Signal Processing and Modeling: Imaging & Instrumentation

**Education:**

- June 1995 **Ph.D.** in *Electrical Engineering*, University of California, Los Angeles (UCLA).  
**Fields of Specialty:** Signal Processing, Controls and Communication, Operations Research.  
**Thesis:** “*Fricative consonants: An articulatory, acoustic, and systems study*”  
**Committee:** A. Alwan (Chair), A. V. Balakrishnan, P. Ladefoged, M. M. Sondhi, A. Wilson
- June 1992 **Engineer degree** in *Electrical Engineering*, UCLA.
- December 1990 **Master of Science** in *Electrical Engineering*, UCLA.  
**Thesis:** “*Nonlinear filtering and smoothing for noisy alternating renewal process signals*”  
**Committee:** A. V. Balakrishnan, Richard Mortensen, Paul Wang
- June 1988 **Bachelor of Engineering** in *Electrical Engineering*  
 College of Engineering–Guindy, Anna University, Madras, India.

**Professional Experience:**

- 10-present Director, Ming Hsieh Institute, Electrical Engineering, USC
- 07-present **University of Southern California**, Andrew J. Viterbi Professor of Engineering,
- 05-present Professor, Department of Electrical Engineering, Department of Computer Science (*Joint*),  
 Department of Linguistics & Program in Computational Linguistics (*Joint*)  
 Department of Psychology (*Joint*); Member, Signal and Image Processing Institute  
 Director, Signal Analysis and Interpretation Laboratory (SAIL)
- 02-08 Research Area Director & Investigator, Integrated Media Systems Center (NSF-ERC)
- 03-05 Associate Professor, Department of Electrical Engineering (Computer Science, Linguistics: *Joint*)
- 00-03 Assistant Professor, Department of Electrical Engineering-Systems
- 95-00 **AT&T Labs-Research, Florham Park, NJ (formerly, AT&T Bell Labs, Murray Hill)**
- 99-00 Principal Technical Staff Member
- 95-99 Senior Technical Staff Member  
*Speech and Image processing Research Laboratory.*  
 Speech processing, Automatic speech recognition, Spoken dialog systems  
 Multimodal interfaces, Communication and information service applications  
 Experiments and modeling in speech acoustics.
- 9/92 - 5/95 **Research Assistant, Department of Electrical Engineering, UCLA.**  
*Speech Processing and Auditory Perception Laboratory.*  
 Speech analysis, modeling, synthesis; Biomedical imaging and instrumentation.
- 6/93-10/93 **Member of Technical Staff, AT&T Bell Laboratories, Murray Hill, NJ. (intern)**  
 Speech analysis and articulatory synthesis research.
- 6/92-10/92 **Member of Technical Staff, AT&T Bell Laboratories, Murray Hill, NJ.(intern)**  
 Video coding; Motion compensation techniques.
- 9/89 - 10/91 **Research Assistant, Department of Electrical Engineering, UCLA.**  
 Filtering and control algorithms for energy systems modeling.

**Awards and Honors:**

2015	Distinguished Engineering Educator Award, Engineers Council
2014	Ten-year technical impact award, ACM International Conf Multimodal Interfaces, 2014
2014	Interspeech Computational Paralinguistics Challenge Award, Cognitive Load Estimation from Speech
2014	Co-author on two Northern Digital Excellence Award Papers, International Seminar on Speech Production'14 (with V. Ramnarayanan and with J. Kim)
2013	Interspeech'13 Paralinguistics Challenge Award, Social Signals (with R. Gupta, K. Audhkhasi, S. Lee)
2013	Co-author, Best student paper (C. Vaz, V. Ramnarayanan), ISCA Interspeech'13.
2012	Interspeech'12 Speaker Trait Challenge Award, Pathology (with J. Kim, N. Kumar, A. Tsiartas, M. Li)
2011	UCLA School of Engineering, Alumni Professional Achievement Award
2011	Interspeech'11 Speaker State Challenge Award (with D. Bone, M. Black, M. Li, A. Metallinou, S. Lee)
2011	Co-author, Best Student Paper, Northern Digital Inc. Excellence Award (A. Lammert), International Seminar on Speech Production (ISSP)
2010	Best Paper at InterSpeech 2010, International Speech Communication Association (for Black et al, "Automatic Classification of Married Couples' Behavior using Audio Features")
2010	IBM Faculty Award
2010	Distinguished Faculty Service Award, USC
2010	IEEE Signal Processing Society Best Paper Award (for Lee & Narayanan, "Toward detecting emotions in spoken dialogs" published in IEEE Trans. Speech and Audio Processing)
2010	Fellow of AAAS for "outstanding contributions to human communication science and technologies and their applications to engineering systems development."
2010	Distinguished Lecturer of the IEEE Signal Processing Society (2010-2011)
2009	Fellow of IEEE for "contributions to human-centered multimodal signal processing and applications"
2009	InterSpeech'09 Emotion Challenge Award (with C-C. Lee, E. Mower, C. Busso, S. Lee)
2009	Best Paper Award, IEEE International Conference on Distributed Computing in Sensor Systems
2009	Body Computing Conference, BodySlam Award
2008	IBM Faculty Award
2008	Okawa Foundation Research Award
2007	Co-author, Best student paper (J. Shin), IEEE Multimedia Signal Processing Workshop 2007.
2006	President, Phi Kappa Phi Academic Honor Society, USC Chapter
2006	IEEE Signal Processing Society Best Paper Award (for Narayanan & Potamianos, "Creating Conversational Interfaces for Children" published in IEEE Trans. Speech and Audio Processing)
2006	Co-author, best student paper (S. Sundaram), IEEE Multimedia Signal Processing Workshop 2006.
2006	Mellon Award for Excellence in Mentoring, USC
2005	Fellow of Acoustical Society of America (for "contributions to speech production and imaging")
2005	Acoustical Society of America, "Hot topics" invited speaker (speech production)
2005	The Northrop Grumman High Visibility Research Award, USC Electrical Engineering
2005	Co-author, best student paper (S. Ananthakrishnan), IEEE ICASSP 2005.
2003	Faculty fellow, Phi Kappa Phi
2003	USC Engineering Junior Faculty Research Award
2003	Faculty Fellow, USC Provost Center for Interdisciplinary Research
2003	NSF CAREER award
2002	ISCA Best Student Paper, Second Place ICSLP 2002 (graduate student J. Shin & undergraduate student, A. Kazemzadeh).
2002	Senior Member, IEEE
2000,1997	AT&T Performance Award
1999,1996	AT&T True Achievement Award
1994,1993	Vinnell Foundation Fellowship, Anthony Fellowship
1990-1991	DEED Scholarship, American Public Power Association

**Professional Memberships:**

- Fellow, Acoustical Society of America (ASA)
- Fellow, Institute of Electrical and Electronic Engineers (IEEE) – Signal Processing Society
- Fellow, American Association for the Advancement of Science (AAAS)
- Member, International Speech Communication Association (ISCA)
- Member, Association for Computing Machinery (ACM)

- Member, American Association for Engineering Education
- Member, Linguistic Society of America; Association for Psychological Science
- Member, Association for Psychological Science
- Member, Tau Beta Pi, National Engineering Honor Society; Member, Eta Kappa Nu, National Electrical Engineering Honor Society; Phi Kappa Phi Academic Honor Society

### Key Editorial Services:

2014-present	Associate Editor, IEEE Transactions on Signal and Information Processing over Networks
2007-present	Editor, Computer, Speech and Language Journal, Elsevier.
2009-present	Associate Editor, The Journal of the Acoustical Society of America, American Institute of Physics
2010-present	Associate Editor, IEEE Transactions on Affective Computing
2011-present	Editorial Board, APSIPA Transactions on Signal and Information Processing, Cambridge Univ. Press
2011	Guest Editor, EURASIP Journal on Advances in Signal Processing
2011	Guest Editor, ACM Transactions on Audio, Speech and Language Processing
2008-2012	Associate Editor, IEEE Transactions on Multimedia
2006-2008	Associate Editor, IEEE Signal Processing Magazine
2006	Area Editor, Speech Synthesis, Handbook on Speech Processing, Springer
2002	Editorial Board, IEEE Trans. on Speech and Audio Processing, Spontaneous Speech Special Issue
2000-2004	Associate Editor, IEEE Transactions on Speech and Audio Processing

### Key Professional Society Services:

2016	Technical Program Chair, Interspeech
2014	Publications Chair, IEEE Spoken Language Technology Conference
2014	Technical Area Chair, ACM International Conference on Multimodal Interaction
2013	Co-Organizer, Dagstuhl Seminar on Computational Audio
2012	General Co-Chair APSIPA Annual Summit and Conference
2012	Technical Special Session Chair, Interspeech 2012
2012	Technical Area Chair, ACM International Conference on Multimodal Interaction
2010	Technical Program Co-Chair APSIPA Annual Summit and Conference
2009	Technical Program Co-Chair HLT-NAACL Conference
2009	Technical Program Co-Chair IEEE ASRU
2009	General Co-Chair, Second International Workshop on Children, Computer and Interaction
2007	General Co-Chair, IEEE Multimedia Signal Processing Workshop
2004-2007	Speech Processing Technical committee – IEEE Signal Processing Society (Policy subcommittee)
2005-2008	Multimedia Signal Processing Technical committee – IEEE Signal Processing Society
2001-present	Technical committee - Speech Communication, Acoustical Society of America
2002-present	ASA Committee on Standards Ex-officio member
2008	Co-chair, Registration, ICASSP 2008
2004	Publicity Chair, NAACL/Human Language Technology Conference (HLT)
2004	Sensory Information Processing Area Co-Chair, Intl Conf. Multimodal Interfaces (ICMI)
2003	Technical Program Chair, IEEE Automatic Speech Recognition and Understanding, Virgin Islands
2003	Workshop Technical Program Committees: SigDIAL; Multimodal User Authentication
2003	Education and Member subcommittee, IEEE Signal Processing Society Speech committee
2002	Technical Program Co-Chair, IEEE Speech Synthesis Workshop
2002	Tutorials Chair, International Conf. Spoken Language Processing
2002	Area Chair, Multilingual Processing, International Conf. Spoken Language Processing
2002	Special Session Chair, “Features and Models for Speech”, Acoustical Soc. of Am. Meeting
2002	Co-Chair, Human-Machine Interface Track, International Conf. on Multimedia

### Review Services:

- National Science Foundation
- National Institutes of Health (NIDCD Study Section member 2008-11, Language Communication);
- Israel Science Foundation; Irish Research Council for Science, Engineering and Technology, Indo-US Foundation, Science Foundations of Finland, France, Belgium, EU
- Several IEEE Transactions: Audio, Speech and Language Processing; Automatic Control; Signal Processing Letters; Multimedia; Medical Imaging; Signal Processing; Education

- Journal of the Acoustical Society of America; Speech Communication Journal
- Journal of the International Phonetic Association ; Journal of Speech and Hearing Research
- Several conferences including ICASSP, ICSLP, IJCAI, ACC, ICME, HLT, Interspeech and ASRU.

**Sponsored Research Projects at USC (09/2000-present):**

SPONSOR	ROLE	TITLE	DATES
NIH/NIDCD R01	Co Investigator; USC PI	Verbal/non-verbal asynchrony in adolescents with high-functioning Autism	2013-2017
Geena Davis Institute/ Google Foundation	PI	Rich and Efficient Media Content Processing	2013-2014
IBM	PI	Social Media Informatics	2012-2014
NIH/NICHHD R21	Co Investigator	Family Violence and Young Adult Dating Aggression: Reactivity and Compassion	2012-2014
NIH/NIDA R34	Co Investigator; USC PI	Development and feasibility of computer based fidelity monitoring for MI	2012-2015
NIH/NIDCD R01	Co Investigator	Speech Prosody and Articulatory Dynamics in Spoken Language	2012-2017
DoJ/MIT Lincoln Laboratory	PI	Data collection and Analysis of vocal tract MRI	2012-2015
IARPA/IBM BABEL Project	Co PI	Lorelei Consortium	2012-2015
ONR/BAE Systems	PI	Expeditionary Maneuver Warfare and Combating Terrorism: Basic and Applied Research	2012-2014
Army Research Office	PI	TATRC: Advancing Speech Recognition Technology to Support Training with Virtual Humans	2011-2014
NSF (NeTS Large)	Co PI	Exploration and Exploitation in Actuated Communication Networks	2012-2017
NSF (Medium)	Co PI	Quantitative Observational Practice in Family Studies: The case of reactivity	2011-2014
NSF (Small)	Co PI	Emotional Speech Production: Analysis, Modeling and Synthesis	2011-2014
DARPA (with BBN) BOLT Project	USC PI	Broad Operational Language Translation	2011-2014
DARPA (with IBM) RATs Project	USC PI	Targeted Robust Audio Processing (TRAP) System	2011-2014
ARL	CoPI (USC PI); collaborative research: Cogent	Improving Accuracy, Speed and Usability of Multi-Modal Biometric Handheld Devices	2009-2012
NSF (Large)	USC PI (collaborative research)	Be A Scientist	2010-2015
NIH/NIDCD R01 (through Haskins Labs)	Co Investigator	Variability and Error in Speech Production	2012-2013
NIH/NIAAA R01	USC PI; collaborative research: UWashingtton, UCI	Automating Behavioral Coding via Text-mining and Speech Signal Processing	2010-2015
NIH/NHLBI, R01	Co Investigator	Model-based Phenotyping of OSAS in Pediatric Obesity using Dynamic MR Imaging	2010-2014
DARPA	PI	Healing Heroes: Behavioral Signal Processing for PTSD	2011-2014
NSF (Expeditions in Computing)	PI (USC); collaborative research: GeorgiaTech, UIUC, MIT, BU, CMU	Computational Behavioral Science: Modeling, Analysis, and Visualization of Social and Communicative Behavior	2010-2015
NIH R01/NIDCD	PI	Dynamics of vocal tract shaping	2010-2015
ONR/BAE Systems	PI	Speaker Segmentation and Emotion Detection from Speech	2010-2011
NSF (Large)	PI	An Integrated Approach to Creating Context Enriched Speech Translation Systems	2009-2013
ONR	Co PI	Intelligent Coordination and Adaptive Classification for Naval Autonomous Systems	2009-2014
DARPA (sub to BAE)	PI	DeepGreen Phase II	2009-2010
Los Angeles Basin Clinical Translational Sciences Institute	Co PI	Translating automated bidirectional translation technologies to clinical settings	2009-2010
Army Research Labs	Co PI	Multimodal Biometrics	2009-2012
NIH/NIMH (ARRA)	Co Investigator	Disseminating Scientific Information about Autism to the Latino Community	2009-2011
Army	Co PI	Virtual Humans Research	2009-2011
DARPA	PI	SpeechLinks: Speech Translation for Tactical Communication	2006-2010
Fund for Innovative Undergraduate Teaching	PI	Engineers as Teachers	2009-2010
Army Research Office	Co PI	Virtual Sick Call	2009-2010
ONR	Co PI	INOTS: Interactive Naval Officer Training System	2009-2010

SPONSOR	ROLE	TITLE	DATES
NSF	USC PI; Partner: Georgia Tech	Collaborative Research: Modeling Creative and Emotive Improvisation In Theater Performance	2008-2011
Army Research Office	Co PI	Joint Fires and Effects Trainer System	2008-2009
Autism Speaks	PI	Speech Processing Technology for the Facilitation of Social Communication Training in Children with Autism	2008-2010
NSF	PI Narayanan	Exploring Emotional Vocal Productions through the use of Real-time Magnetic Resonance Imaging	2008-2010
NIH	Co PI	Mobile Device Biomonitoring to Prevent and Treat Obesity in Underserved Minority Youth	2008-2010
NSF	PIs: Mataric, Narayanan	Personalized Socially-Assistive Human-Robot Interaction: Applications to Autism Spectrum Disorder	2008-2013
Qualcomm	PI	Mobile Metabolic Health Monitoring	2008-2009
NSF (sub to ICT)	Investigator	Responsive Virtual Human Museum Guides	2008-2011
Army Research Office	Co-PI	Gunslinger: Virtual Humans in a Kinetic Environment	2007-2008
DHS	Co-PI, Hovy, PI	Center for Knowledge and Information Discovery	2007-2012
Army	PI	Virtual Humans-Natural Language	2007-2009
Army	PI	Tactical Questioning	2006-2008
NSF CRI	Investigator; PI Mataric	Human-Robot Interaction and Socially Assistive Robotics	2007-2008
NSF MRI	Investigator; PI Schaal	Humanoid Robots	2006-2008
Annenberg Center	PI	Emotions in Speaking and Singing	2006-2007
Provost Undergraduate Fund	Co-PIs: Byrd, Narayanan	Speech Production Modeling	2006
Zumberge Interdisciplinary Award	Co-PI; PI Zimmermann	Tele-rehabilitation	2006-2007
NIH R01/NIDCD	Co-PI; Byrd, PI	Prosody and Articulatory Dynamics in Spoken Language	2006-2011
ONR	Co-PI; PI B. Mel	Bioinspired audiovisual processing	2006-2009
MURI – ONR U Wash, Stanford, USC	USC PI ;co PI, Byrd	Human-like speech processing	2005-2010
NIH R01	PI	Dynamics of vocal tract shaping	2005-2009
AT&T	PI	Multilingual processing	2005-07
Dept. of Interior/DARPA	PI	User interface for speech translation	2005-07
School of Social Work	Co-PI; PI Trickett	Planning grant for infrastructure creation for child social service research	2005-06
NSF ITR Collaborative Research (UCLA-UCB-USC)	USC PI; project director A. Alwan, UCLA	“Automating Early Assessment of Academic Standards for Very Young Native and Non-Native Speakers of American English”	2003-2007
ARDA VACE	Co-Investigator; PI Nevatia	“Multimodal Speaker Identification”	2004-05
Sandia Labs	PI	“Multimodal systems”	2004-2005
LASER ACTD	PI	Training for Speech Translation	2004-2005
Army Science Conference	Investigator	Interactive Virtual Soldier System	2004
Freedom Forum	Investigator; ICTsubcontract	“Newseum: Be a Reporter”	2003-2004
Provost Undergraduate Research Fund	with E. Andersen	“Cross-Cultural Issues in Child-Machine Interactions	2003-2004
Provost Undergraduate Research Fund	with D. Byrd	“Toward Illuminating Fine Details in Human Speech Production: Investigations of Vocal Tract Movements”	2003-2004
Center for Interdisciplinary Research	Fellow	“Multimodal-Multilingual Communication Technologies”	2003-2004
Pratt & Whitney Institute for Collaborative Engineering	PI; co-PIs Helmy, Lee, Ortega, Zimmerman	“Wireless Mobile and Distributed Networking System for Efficient Aircraft Engine Inspection and Maintenance”	2003-2006
ONR/DARPA	co-PI; Lewis Johnson, PI	“Training Superiority: Rapid Development of Mission-Oriented Communication Skills”	2003-2005
NSF CAREER award	PI	“Modeling and Optimizing User-Centric Mixed-Initiative Spoken Dialogue Systems”	2003-2009
Provost Undergraduate Research Fund	co-PIs D. Byrd, E. Andersen	“Monolingual and Bilingual Spoken Language Interactions of Preschoolers”	2002-2003
NIH R01	co-PI; Byrd, PI	“Prosody and Articulatory Dynamics in Spoken Language”	2002-2007

SPONSOR	ROLE	TITLE	DATES
NSF ITR	PI, co-PIs E. Chew, C. Kuo	“Content Based Query and Retrieval of Music Using Signal Processing and Knowledge-Based Methods”	2002-2005
DARPA Babylon/CAST Project	PI	“Multilingual Speech to Speech Translation Systems”	2002-2005
US Army/STRICOM	PI	“Robust Speech Recognition for Immersive Training”	2001-2004
US Army	joint PI with L. Johnson	“Expressive Speech Synthesis for Animated Characters in Training Applications”	2002-2004
Acorn Technologies	PI	“Robust Speech Processing”	2002
ALI Microelectronic Corp	PI	“Processing and Retrieval of Music”	2002
Lockheed Martin	PI	“Multimodal Speech Interfaces”	2001-2002
Lucent Technologies	PI	“Speech Interfaces for Mobile Devices”	2001
Zumberge Interdisciplinary Grant	co-PIs: Andersen, McLaughlin	“Investigations Into Preschool Children Interacting with Machines”	2002-2003
USC Arts Initiative	PI: M. Lazzari; co-PIs: Breisch, McLaughlin, Narayanan	Tactile experiences for Arts	2002-2003
Provost Undergraduate Research Fund	co-PIs: Andersen, Byrd	“Analysis of Child-Machine Spoken Dialogues”	2002
NSF-ERC Integrated Media Systems Center	Co-PI with several USC investigators	Integrated Media Systems Center	2000-2008
Powell Foundation	PI	“Speech Analysis and Interpretation Lab Set-Up”	2000-2002

### Hardware/Software Donations Received (09/2000-present):

- Intel, Sun Microsystems, IBM, AT&T, Speechworks, Nokia

### Invited Talks:

Nov 2014	Distinguished Lecture, Electrical & Computer Engineering Department, Rutgers University
Oct 2014	Distinguished Lecture in Computing, Instituto Tecnológico Autónomo de México (ITAM), Mexico
Sept 2014	Keynote Lecture, Workshop on Speech, Language and Audio in Multimedia (SLAM 2014), Malaysia
Sept 2014	Invited Lecture, Workshop on Formalizing Dialogue Genres for Efficient Virtual Character Creation
June 2014	Distinguished Lecture, Instituto Superior Técnico, Lisbon, Portugal
May 2014	Invited Lecture, Autism Center of Excellence Workshop, Emory University, Atlanta
Dec 2013	Keynote Lecture, Symposium on Pathways to Clinical Forecasting, Long beach, CA
Oct 2013	Keynote Lecture, SSPNet Workshop on Conflict and Communication, Rome, Italy
Aug 2013	Keynote Lecture, ISCA Workshop Speech Production in Automatic Speech Recognition, Lyon, France
May 2013	Plenary Lecture, NSF Workshop on Automatically Annotated Repository of Digital Audio and Video Resources Community, Ann Arbor, MI
Apr 2013	Invited Lecture, SenSIP Center, Arizona State University
Apr 2013	Distinguished Lecture, Intelligent Systems Program, University of Pittsburgh
Feb 2013	Invited Lecture, Behavioral Imaging Seminar, GeorgiaTech
Nov 2012	Distinguished Lecture, The Universidad Nacional Autónoma de México (UNAM), Mexico City
Oct 2012	Invited Lecture, Electrical Engineering Seminar Series, UCLA
Oct 2012	Invited Lecture, NSF Workshop on Sentiment Analysis, University of Pennsylvania
April 2012	Invited Lecture, Columbia University, NY, NY
April 2012	Keynote Lecture, CREST Symposium on Human Harmonized Information Technology, Kyoto University, Japan
Mar 2012	Invited Lecture, Johns Hopkins University, Baltimore, MD
Mar 2012	Invited Lecture, Providence Tarzana Medical Center, Encino, CA
Dec 2011	Keynote, IEEE Automatic Speech Recognition and Understanding Workshop, Hawaii, HI
Nov 2011	Keynote, Social Signal Processing Workshop-ACM Multimedia, ACM'2011, Phoenix, AZ
Sep 2011	Booz Allen Hamilton Distinguished Colloquium, University of Maryland, College Park, MD
Jul 2011	Plenary Talk, International Conference on Multimedia and Expo (ICME), Barcelona, Spain
Jul 2011	Invited Talk, Telefonica Research Multimedia Workshop, Barcelona, Spain
Jun 2011	IEEE Distinguished Lecture, Princeton, NJ
Apr 2011	Distinguished Lecture in Computing, Imperial College, London
Apr 2011	Invited Lecture, Cambridge University, UK



Apr 2011	Invited Lecture, Philips Research, Eindhoven, Netherlands
Oct 2010	Invited Lectures: Chinese University of Hong Kong; Hong Kong University of Science & Technology
Oct 2010	IEEE SPS Distinguished Lecture, Hong Kong
Oct 2010	Invited Lectures: Tsinghua University, Beijing; Microsoft Research, Asia
Oct 2010	Keynote, International Conference on Signal Processing Beijing
July 2010	Invited lecture, 8th International Conference on Signal Processing and Communication, Bangalore
July 2010	IEEE SPS Distinguished Lecture, Hyderabad, India
July 2010	Invited Lectures, IIT Madras
May 2010	Keynote Lecture, Speech Prosody Conference, Chicago
Apr 2010	Keynote Lecture, Undergraduate Linguistics Conference, UCLA, Los Angeles
Apr 2010	IEEE SPS Distinguished Lecture, University of Texas, Dallas
Apr 2010	CML Distinguished Speaker Series, University of California, Irvine
Nov 2009	University of California, Merced
May 2007	Tsinghua-USC Workshop on Emerging Technologies, Beijing
Feb 2007	Microsoft Research Seminar, Redmond, Washington
Dec 2006	Indian Institute of Science/IEEE Signal processing Society, Bangalore, India
Dec 2006	National University of Singapore-School of Computing, Singapore
Mar 2006	Indian National Academy of Sciences Seminar, IIT-Madras, India
Nov 2005	Samsung Electronics, Korea
Aug 2005	AT&T Shannon Labs, University Collaboration Seminar, Florham Park, NJ
July 2005	Cognitive Systems Workshop, Human Cognitive Models in System Design, Santa Fe, New Mexico
May 2005	Hot Topics in Speech Communication, Acoustical Society of America, Vancouver, BC
Mar 2005	Yonsei University EE Department Seminar, Seoul, Korea
Oct 2004	International Conference on Spoken Language Processing
Oct 2004	InHa University, Incheon, Korea
Apr 2004	DARPA Workshop on Speech to Speech Translation, San Diego, CA
Sept 2003	Technical University of Athens, Technical University of Crete, Greece
May 2003	Massachusetts Institute of Technology & Harvard, Cambridge, MA
Dec 2002	Cross EU-NSF ISLE Workshop, University of Edinburgh, Scotland
Mar 2002	UCLA-EE Department Communications-Signal Proc. Seminar, LA, CA
Oct 2001	California Institute of Technology-EE Department, Pasadena, CA
Sept 2001	UC-Santa Barbara, ECE Department, Santa Barbara, CA
Jun 2001	Panasonic Speech Technology Labs, Santa Barbara, CA
Nov 2000	Rockwell Science Center, Thousand Oaks, CA
Oct 2000	HRL Laboratories, Malibu, CA
Mar 2000	University of Southern California, CA
Nov 1999	Boston University, Boston, MA
Nov 1998	University of California, Los Angeles, CA
May 1997	Haskins Labs/Yale University, New Haven, CT
Oct 1996	Intl. Conf. Spoken Language Processing, Philadelphia, PA
Feb 1996	SPIE Conf. Medical Imaging, Newport Beach, CA
Oct 1995	Intl. Conf. on Signals, Systems and Electronics, Monterey, CA
Jun 1995	Haskins Labs, New Haven, CT

### Key University Services/USC:

- University Committee on Academic Promotions and Tenure, 2012-present
- Co-chair, USC Strategic Planning Subcommittee, Graduate Programs, 2010-11
- USC Academy of Polymathic Studies, Steering Committee, 2010-11
- Chair, USC University Research Committee, 2006-2009 (Co-Chaired, 2007-08); Member URC, 2010-11
- Faculty Advisory Council, USC Shoah Foundation Institute, 2008-present
- Member, USC University Research Committee, 2005-06; 2009-2012
- Academic Promotions & Tenure Committee, USC Viterbi School of Engineering, 2004-2006
- Research Area Director (Applications Research), Integrated Media Systems Center (NSF-ERC), 2001-2008
- Research Vision Leader – Communications Systems, Integrated Media Systems Center, 2002-2008
- Research Leader, Pratt & Whitney Institute for Collaborative Engineering, USC, 2003-2008

- Faculty Coordinator, Electrical Engineering Systems Teaching Assistants, 2001-2004
- Graduate Student Recruitment, Fellowship Committees, 2001-2006
- Mentor: Undergraduate Research Program, Dean's Merit Research Program for freshmen engineers
- Freshmen interviews (Presidential Scholars/Trustee Scholars)
- Interdisciplinary program in Computational Linguistics

### Pre-USC Services:

- AT&T Bell Labs Intern Mentor: Several graduate, undergraduate and high school students mentored in speech and language projects (1995-2000)
- AT&T Labs PhD Recruiter (1997-99)
- AT&T United Way volunteer
- UCLA Graduate Students Association: EE Departmental representative
- UCLA Minority Engineering Program Facilitator

### Industry Collaborations and Partnerships (2000-present):

- Lockheed International
- HRL Labs
- Speech works International
- AT&T Research
- Bell Labs-Lucent
- IBM
- Qualcomm
- Raytheon BBN Technologies
- BAE Systems
- 3M Cogent Systems
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### Teaching and Mentoring:

Fall'00-02,04-05,06-07 **EE519: Digital Speech Processing** (*Course Developed*)

Spr 10, Fall 10,11,12 Graduate level course on speech signal processing.

Applications to coding, recognition and synthesis

Spr'01 **EE599: Graduate Seminar on advanced topics in speech processing**

Spr'02,04,05,06,07,09 **EE619: Speech recognition and Spoken Language Engineering** (*Course Developed*)

Emphasis on statistical approaches

9/90 - 6/94 **Teaching Associate/Fellow, UCLA.**

Undergraduate engineering courses in Electrical and Electronic circuits, Signals and Systems, Feedback Control.

### POSTDOCTORAL ASSOCIATES/RESEARCH FACULTY:

- Asterios Toutios, Research Associate, Speech Production Research, (2012-present)
- Maarten Van Segbroeck, Postdoctoral Associate, Robust Speech Processing, (2012-present)
- Yoon-chul Kim, Postdoctoral Associate, Imaging Research, (K. Nayak primary supervisor) (2010-present)
- Emily Mower, Postdoctoral Associate, Emotions Research, 2010
- Michael Proctor, Postdoctoral Associate, Speech Production, (2009-2012)
- Athanasios Katsamanis, Postdoctoral Associate, Multimodal Signal Processing, (2009-2012)
- Carlos Busso, Postdoctoral Associate, Multimodal Processing, (2008-2009)
- Matteo Gerosa, Postdoctoral Associate, Speech Recognition, (2006-2007)
- Panayiotis Georgiou, Research Assistant Professor, *Speech/Audio processing* (2002-2013)
- Sungbok Lee, Research Assistant Professor, *Speech Production* (2001-present)
- Jon Nielsen, Postdoctoral Associate, *Imaging* (K. Nayak primary supervisor) (2005-2007)
- Scott Millward, Postdoctoral Associate, *User interfaces* (2004-05)

**PH.D STUDENTS GRADUATED**

1. Karthik Audhkhasi, "A computational framework for diversity in ensembles of humans and machine systems", IBM T J Watson Research Center
2. Andreas Tsiartas, "Enhancing Speech to Speech translation through exploitation of bilingual resources and paralinguistic information", SRI International
3. Vikram Ramanarayanan, "Toward understanding speech planning by observing its execution-representations, modeling and analysis", Educational Testing Service
4. Adam Lammert, "Structure and Function in Speech Production", Swarthmore College
5. Angeliki Metallinou, Dynamics of multimodal emotional expressions, Pearson Research
6. Abe Kazemzadeh, Natural language expressions of emotions, USC Annenberg Innovation Lab
7. Chi-chun Jeremy Lee, Behavioral Modeling in Interactions, Asst. Professor, National Tsing Hua University
8. Ming Li, "Joint variability modeling", Asst. Professor, Sun Yat-Sen Univ./C.M.U. Joint Institute of Engineering
9. Qun Feng Tan, "Sparse representaions in pattern recognition"
10. Matthew Black, "Automating behavioral assessments", Behavioral Informaticx; Farmers Insurance
11. Prasanta Kumar Ghosh, "Novel Signal Representations for Speech", INSPIRE Faculty, Indian Institute of Science
12. Erik Bresch, "Dynamic models in speech production", Philips Research
13. Selina Chu, "Unstructured Audio Processing" (co-advisor C. C. Jay Kuo), Oregon State University
14. Samuel Kim, "Audio Modeling and Indexing", IDIAP/EPFL
15. Emil Ettelaie, "Speech Translation through Classification", Data Mining Research-Reunify
16. Viktor Rozgic, "Multimodal detection and tracking", Raytheon BBN Technologies
17. Emily Mower, "Affective interactions: analysis and recognition" (co- advisor, M. Mataric), Asst. Prof., U Michigan, Ann Arbor
18. Kyu Jeong Han, "Speaker modeling methods", (Fall 2009), IBM TJ Watson Research
19. Ozlem Kalinli, "Attention-based methods in speech and audio processing", (Fall 2009), Sony
20. Joseph Tepperman, "Pronunciation modeling and assessment", (Spring 2009), Rosetta Stone
21. Jorge Silva, "Information theoretic representations and models for classification", (Fall 2008), Asst. Prof., University of Chile [USC Viterbi Best Thesis Award]
22. Erdem Unal, "Music Information Retrieval under uncertainty: Polyphonic Music" (Spring 2008), Scientific and Technological Research Council of Turkey (TUBITAK)
23. Vivek Kumar Rangarajan Sridhar, "Prosody enriched speech translation", (Spring 2008), AT&T Research
24. Carlos Busso, "Multimodal processing of Emotions" (Spring 2008), University of Texas-Dallas
25. Shiva Sundaram, "Data-driven methods in speech and audio processing" (Spring 2008), Deutsche Telecom
26. Chu Ping Liu, "Cochlear Implant Speech Processing" (jointly with Qian-Jie Fu) (Spring 2008), Logitech
27. Sankaranarayanan Ananthakrishnan, "Prosody models for speech applications" (Spring 2008), BBN
28. Jongho Shin, "User modeling in human-machine conversations" (Fall 2007), LG Electronics/Emory Univ.
29. Murtaza Bulut, "Data-driven approaches to expressive speech synthesis" (Fall 2007), Philips Research
30. Abhinav Sethy, "Unsupervised methods for Speech and language modeling" (Spring 2007), IBM Watson
31. Chartchai Meesookho, "Collaborative Classification and Tracking of multiple targets" (with U. Mitra)
32. Dagen Wang, "Embedded Speech Systems with applications to speech translation" (Spring 2006), IBM
33. Serdar Yildirim, "Multimodal processing for child-machine interactions" (Spring 2006), Assistant Professor, Mustafa Kemal University, Turkey
34. Soonil Kwon, "Unsupervised speaker indexing" (Spring 2005), Sejong University, Seoul, Korea
35. Chul Min Lee, "Automatic Emotion Recognition from Speech and Language Information" (Fall 2004), LG Electronics
36. Naveen Srinivasamurthy, "Joint compression and classification with applications to distributed speech recognition" (jointly with A. Ortega) (2003 Fall), Texas Instruments
37. Hsuan-Huei Maverick Shih, "Statistical Recognition and Theme finder for Query by Humming Systems" (jointly with C.-C. Kuo) (2003 Spring), Vice President, ACER, Taiwan

Served in over sixty PhD qualifying/dissertation committees in addition to the following students in my group:

**CURRENT PH.D STUDENTS (research topic)**

- Daniel Bone, "Multimodal Signal Processing"
- Komath Naveen Kumar, "Robust Pattern Learning"
- Bo Xiao, "Multimodal Signal Processing"
- Jangwon Kim, "Emotional Speech Production"
- James Gibson, "Multimodal Signal Processing"

- Dogan Can, “Spoken Language Processing”
- Rahul Gupta, “Human Interaction Modeling”
- Theodora Chaspari, “Behavioral Signal Processing”
- Zhaojun Yang
- Colin Vaz
- Pavlos Papadopoulos
- Nikos Malandrakis
- Chi-wei Huang
- Yin-Ray Rick Huang
- Ruchir Trivedi
- Michael Falcone
- Jesse Bisogni
- Zisis Iason Skordilis
- Elizabeth Staruk
- Mohamad Nasir
- Anil Ramakrishna

### **M.S. STUDENTS (research topic)**

- Andreas Zavou
- Thomas Murray, “Speech Translation Technologies”
- Dhaval Shah, “Audiovisual Biometrics”, (2009)
- Stephen Tobin, “Speech Production Analysis using realtime MRI” (2007)
- Farhad Farahani, “Multiresolution analysis of pitch for speaker recognition” (2005)
- Donal McErlean, “Graphical Models for Collaborative Processing in Sensor Networks” (2003)
- Alvertos Diamantopolous, “Multimodal speech interfaces” (2002)
- Jeff Haynes, “Optimization in sensor networks using genetic algorithms” (2002)

### **UNDERGRADUATE RESEARCH STUDENTS (research topic)**

The students were funded through the undergraduate research program (NSF funded or funded by the USC Provost Research Fund), or the Dean’s Merit Research Program. Some of their work has contributed to conference publications.

- Simon Berman, “Structure Function Interplay in Speech Production”, 2012 (RoseHills Foundation)
- Alex Onopa, “Multimodality in Speech Production”, 2012 (RoseHills Foundation)
- Li Hsuan Lu, “Analysis and Modeling of Speech Production”
- Leah Gum, “Creative Information Technologies”, 2012-present
- Sumukh Anand, “Human interaction modeling”, 2012-present
- Naa Adei Mante, “Speech Imaging Research”, 2011-present
- Ellen Feldman, “Emotions Research”, 2011-present
- Juanchen Li, “Affective Computing”, 2011-present
- James Li, “Multimodal Biometrics”, 2010-present
- Stephanie Aceves, “Emotion Modeling”, 2010-2011
- Michelle Dee, “Human Interaction Analysis”, 2008-present
- Ilene Raffi, “Motion capture based behavior analysis”, 2008-2010
- Jonathan Chang, “Child Machine Interaction”, 2008-2010
- Johnson Wang, “Emotions research”, 2009-2010
- David Grayson Smith, “Emotions research from multimodal perspective”, 2009-2010
- Karie Lau, “Nonverbal signals of emotion”, 2007-08
- Nathan Dahlin, “Vocal Beatbox Production Models”, 2007-08
- Jesse Hans, “Articulatory signatures of spontaneous speech phenomena”, 2007-08
- Matthew Tan, “Expressive Inging Voices”, 2007 Summer (from U California, Berkeley)
- Jeannette Chang, “Detecting Certainty in Problem Solving: Multimodal Processing”, 2006-2010
- Jeremy Chi-chun Lee, “Gesture information processing from motion capture”, 2006-2007
- Joshua Izumigawa, “Toward modeling multiperson interactions”, 2006-2007
- Celeste De Frietas, “Speech production moeling from real time MRI data”, 2006-2007
- Sharad Rao, “Audio modeling: Creating ontologies”, Summer 2005 (from U Illinois, Urbana-Champaign)
- David Hunt and Nathan Go, “Creating a novel speech production database”, 2005

- Nirali Shah, "Analysis of MRI Speech production data", (2003-04)
- Jason Adams and Daylen Riggs, "Speech production", (2004-05)
- Sonia Khurana, Marni Landes, Lewis Lawyer, "Children's Interactive Multimedia Project", (2003-04).
- Sonia Khurana and Talip Ucar, "Acoustic Analysis of Children's speech", (2002-03).
- Joe Tepperman, "Spoken Name Recognition", (2002-03).
- Marni Landes, "Human factors for child machine interactions", (2002-03).
- Abe Kazemzadeh, "Analysis of user behavior in spoken dialogs", (2000-02). *Honor's Thesis: Towards biological models for Linguistics: Human-computer dialog analysis and protein folding*
- Sudha Arunachalam (Neuroscience) and Dylan Gould (Linguistics), "Politeness and frustration language in child-machine interactions (2000-01)
- Joshua Katz (Annenberg) and Sonia Khurana (EE), "Experimental design and tools for investigating preschoolers talking to machines" (2001-02)
- Dylan Gould (Linguistics) and Ryan Cunningham (EE), "Design and collection of data for expressive speech synthesis" (2001-02)
- Ahmet Certen (EE) and Unal Erdem (EE), "Signal Analysis and User modeling for Query by Humming Systems", (2001-02)

## HIGH SCHOOL STUDENTS

- 2007 Summer: Nicolas Castro, Brentwood School; Sophie Leahy: El Segundo High
- 2007-08: Yeon Grace Lu: Los Alamitos High

## VISITING RESEARCH STUDENTS

- Sergi Hernanz, Technical University of Catalunya, Barcelona, 2004, "Robust Speaker Recognition" (Diploma Thesis)
- Matteo Gerosa, IRST/University of Padova, 2005, "Modeling and recognizing children's speech (Ph.D)
- David Suunderman, Siemens, Germany, 2005, "Signal transformation for synthesis" (Ph.D.)
- Michael Grimm, Karlsruhe University, 2005, "Emotions in speech" (Ph.D.)
- Andreu Fernandez, Technical University of Catalunya, Barcelona, 2006, "Error propagation and models for speech recognition" (Diploma Thesis)
- Arthur Pouzet, "Speech Imaging and Acoustic Modeling", 2006
- Tsuneo Kato, "Articulatory information driven Speech recognition", KDDI/Japan, 2007-08
- Jorge Gilabert, "Spanish English Speech to Speech Translation", University of Catalunya, Barcelona 2007-2008
- Carlos Molina, "Novel methods for speech assessment", University of Chile, 2008 (Ph.D.)
- Chi-Sang Jung, "Speech Biometrics", Yonsei University, 2009-10 (Ph.D.)
- Ozan Cakmak, "Affective computing form text", Mustafa Kemal University, Turkey, 2011

## Peer-reviewed Publications and Patents

**Shrikanth S. Narayanan**

### Journals

1. Theodora Chaspari, Andreas Tsiartas, Leah I. Stein, Sharon A. Cermak, and Shrikanth S. Narayanan. Sparse Representation of Electrodermal Activity with Knowledge-Driven Dictionaries. *IEEE Transactions on Biomedical Engineering*. 2015
2. Adam Lammert, Louis Goldstein Vikram Ramanarayanan, and Shrikanth Narayanan. Gestural control in the English past-tense suffix: an articulatory study using real-time MRI. *Phonetica*. 2015
3. Sungbok Lee, Alexandros Potamianos, and Shrikanth Narayanan. Developmental acoustic study of American English diphthongs. *J. Acoust. Soc. Am.* 136(4):1880-1894, October 2014.
4. Daniel Bone, Matthew S. Goodwin, Matthew P. Black, Chi-Chun Lee, Kartik Audhkhasi, and Shrikanth Narayanan. Applying Machine Learning to Facilitate Autism Diagnostics: Pitfalls and promises. *Journal of Autism and Developmental Disorders*. 2014
5. Perigrine Lord, Dogan Can, Michael Yi, Rebecca Marín, Christopher Dunn, Zac Imel, Panayiotis Georgiou, Shrikanth Narayanan, Mark Steyvers, and David Atkins. Advancing methods for reliably assessing motivational interviewing fidelity using the Motivational Interviewing Skills Code. *Journal of Substance Abuse Treatment*. 2014
6. Vikram Ramanarayanan, Adam Lammert, Louis Goldstein and Shrikanth Narayanan. Are articulatory settings mechanically advantageous for speech motor control? *PLoS ONE*, 9(8): e104168. doi:10.1371/journal.pone.0104168, 2014.
7. Naveen Kumar, Urbashi Mitra, and Shrikanth S. Narayanan. Robust object classification in underwater sidescan sonar images by using reliability aware fusion of shadow features. *IEEE Journal of Oceanic Engineering*. 2014.
8. Shrikanth Narayanan, Asterios Toutios, Vikram Ramanarayanan, Adam Lammert, Jangwon Kim, Sungbok Lee, Krishna Nayak, Yoon-Chul Kim, Yinghua Zhu, Louis Goldstein, Dani Byrd, Erik Bresch, Prasanta Ghosh, Athanasios Katsamanis, and Michael Proctor. Real-time magnetic resonance imaging and electromagnetic articulography database for speech production research (TC). *J. Acoust. Soc. Am.* 136(3): 1307-1311, September 2014.
9. Zhaojun Yang, Angeliki Metallinou and Shrikanth S. Narayanan. Analysis and Predictive Modeling of Body Language Behavior in Dyadic Interactions from Multimodal Interlocutor Cues. *IEEE Transactions on Multimedia*. 16(6): 1766-1778, October 2014.
10. Daniel Bone, Chi-chun Lee and Shrikanth S. Narayanan. Robust Unsupervised Arousal Rating: A rule-based framework with knowledge-inspired vocal features. *IEEE Transactions on Affective Computing*. 5(1): 201-213, April-June, 2014.
11. Ming Li and Shrikanth S. Narayanan. Simplified Supervised i-vector Modeling with application to Robust and Efficient Language Identification and Speaker Verification. *Computer, Speech, and Language*. 2014
12. Jangwon Kim, Naveen Kumar, Andreas Tsiartas, Ming Li and Shrikanth S. Narayanan. Automatic intelligibility classification of sentence-level pathological speech. *Computer, Speech, and Language*. 2014

13. Kartik Audhkhasi, Andreas Zavou, Panayiotis Georgiou And Shrikanth Narayanan. Theoretical Analysis of Diversity in an Ensemble of Automatic Speech Recognition Systems. *IEEE/ACM Transactions on Audio, Speech and Language Processing*. 22(3), March 2014
14. Daniel Bone, Ming Li, Matthew P. Black and Shrikanth S. Narayanan. Intoxicated Speech Detection: A Fusion Framework with Speaker-Normalized Hierarchical Functionals and GMM Supervectors. *Computer, Speech, and Language*. 28(2): 375-391, March 2014
15. Jangwon Kim, Adam Lammert, Prasanta Ghosh, and Shrikanth Narayanan. Co-registration of speech production datasets from electromagnetic articulography and real-time magnetic resonance imaging. *J. Acoust. Soc. Am.* 135(2): EL115-EL121, February 2014.
16. Daniel Bone, Matthew P. Black, Chi-Chun Lee, Marian E. Williams, Pat Levitt, Sungbok Lee and Shrikanth Narayanan. The Psychologist as an Interlocutor in Autism Spectrum Disorder Assessment: Insights from a Study of Spontaneous Prosody. *Journal of Speech, Language, and Hearing Research*. 57:1162–1177, August 2014
17. Chi-Chun Lee, Athanasios Katsamanis, Matthew P Black, Brian R Baucom, Andrew Christensen, Panayiotis G Georgiou and Shrikanth S Narayanan. Computing Vocal Entrainment: A Signal-derived PCA-based Quantification Scheme with Application to Affect Analysis in Married Couple Interactions. *Computer, Speech, and Language*. 28(2): 518-539, March 2014
18. Carlos Busso, Soroosh Mariooryad, Angeliki Metallinou and Shrikanth Narayanan. Iterative Feature Normalization Scheme for Automatic Emotion Detection from Speech. *IEEE Transactions on Affective Computing*. 4(4), October 2013.
19. Nikolaus Malandrakis, Alexandros Potamianos, Elias Iosif, and Shrikanth Narayanan. Distributional Semantic Models for Affective Text Analysis. *IEEE Transactions on Audio, Speech and Language Processing*. 21(11): 2379-2392, November 2013
20. Yihe Zu, Shrikanth Narayanan, Yoon-Chul Kim, Krishna Nayak, Christina Bronson-Lowe, Brenda Villegas, Melody Ouyoung, Uttam Sinha. Evaluation of swallow function post tongue cancer treatment using real-time MRI: A pilot study. *JAMA Otolaryngology - Head & Neck Surgery*. 2013
21. Adam Lammert, Michael Proctor and Shrikanth Narayanan. Interspeaker Variability in Hard Palate Morphology and Vowel Production. *Journal of Speech, Language, and Hearing Research*. 2013
22. Vikram Ramanarayanan, Louis Goldstein, and Shrikanth Narayanan. Spatio-temporal articulatory movement primitives during speech production -- extraction, interpretation and validation. *J. Acoust. Soc. Am.* 134(2): 1378-1394, August 2013.
23. Prasanta Ghosh and Shrikanth Narayanan. On smoothing articulatory trajectories obtained from Gaussian Mixture Model based acoustic-to-articulatory inversion. *J. Acoust. Soc. Am.* 134(2): EL258-EL264, August 2013.
24. Vikram Ramanarayanan, Louis Goldstein, Dani Byrd, and Shrikanth Narayanan. An investigation of articulatory setting using real-time magnetic resonance imaging. *J. Acoust. Soc. Am.* 134(1): 510-519, July 2013.
25. Gaël Richard, Shiva Sundaram and Shrikanth Narayanan. An Overview on Perceptually Motivated Audio Indexing and Classification. *Proceedings of IEEE*. 101(9): 1939 - 1954, September 2013.



26. Abe Kazemzadeh, Sungbok Lee, and Shrikanth Narayanan. Fuzzy Logic Models for the Meaning of Emotion Words. *IEEE Computational Intelligence Magazine*. Special Issue on Computational Intelligence and Affective Computing. 8(2): 34-49, May 2013.
27. Shrikanth Narayanan and Panayiotis Georgiou. Behavioral Signal Processing: Deriving Human Behavioral Informatics from Speech and Language. *Proceedings of IEEE*. 101(5): 1203 - 1233, May 2013.
28. Michael Proctor, Erik Bresch, Dani Byrd, Krishna Nayak, and Shrikanth Narayanan. Paralinguistic Mechanisms of Production in Human 'Beatboxing:' a Real-time Magnetic Resonance Imaging Study. *J. Acoust. Soc. Am.* 133(2): 1043-1054, 2013.
29. Adam Lammert, Louis Goldstein, Shrikanth Narayanan and Khalil Iskarous. Statistical Methods for Estimation of Direct and Differential Kinematics of the Vocal Tract. *Speech Communication*. 55: 147-161, 2013.
30. Matthew P Black, Athanasios Katsamanis, Brian R Baucom, Chi-Chun Lee, Adam C Lammert, Andrew Christensen, Panayiotis G Georgiou, Shrikanth S Narayanan. Toward automating a human behavioral coding system for married couples' interactions using speech acoustic features. *Speech Communication*. 55(1):1-21, 2013.
31. Yinghua Zhu, Yoon-Chul Kim, Michael Proctor, Shrikanth Narayanan, Krishna S. Nayak. Dynamic 3D Visualization of Vocal Tract Shaping during Speech. *IEEE Transactions on Medical Imaging*. 32(5): 838 - 848, May 2013.
32. Angeliki Metallinou, Athanasios Katsamanis and Shrikanth Narayanan. Tracking continuous emotional trends of participants during affective dyadic interactions using body language and speech information. *Journal Image and Vision Computing*. 31(2): 137-152, February 2013
33. Adam Lammert, Michael Proctor and Shrikanth Narayanan. Morphological Variation in the Adult Hard Palate and Posterior Pharyngeal Wall. *Journal of Speech, Language, and Hearing Research*. 56(2): 521-530, April 2013
34. Theodosios Moschopoulos, Elias Iosif, Leeda Demetropoulou, Alexandros Potamianos, and Shrikanth Narayanan. Towards the Automatic Extraction of Policy Networks using Web Links and Documents. *IEEE Transactions on Knowledge and Data Engineering*. 25(10): 2404-2417, October 2013.
35. Kartik Audhkhasi and Shrikanth Narayanan. A Globally-Variant Locally-Constant Model for Fusion of Labels from Multiple Diverse Experts Without Using Reference Labels. *IEEE Transactions on Pattern Analysis and Machine Intelligence*. 35(4): 769-783, April 2013
36. Emil Ettelaie, Panayiotis G. Georgiou, and Shrikanth Narayanan. Unsupervised Data Processing for Classifier-based Speech Translator. *Computer, Speech, and Language*. 27(2): 438-454, February 2013
37. Ming Li, Kyu J. Han, and Shrikanth Narayanan. Automatic Speaker Age and Gender Recognition Using Acoustic and Prosodic Level Information Fusion. *Computer, Speech, and Language*. 27 (1), 151-167, January 2013
38. Samuel Kim, Panayiotis Georgiou and Shrikanth Narayanan. Latent Acoustic Topic Models for Unstructured Audio Classification. *APSIPA Transactions on Signal and Information Processing*, 1, e6, doi:10.1017/ATSIP.2012.7, 2012.
39. Björn Schuller, Stefan Steidl, Anton Batliner, Felix Burkhardt, Laurence Devillers, Christian Müller, and Shrikanth Narayanan. Paralinguistics in Speech and Language--State-of-the-Art and the Challenge. *Computer, Speech, and Language*. 27(1):4-39, January 2013



40. Urbashi Mitra, Adar Emken, Sangwon Lee, Ming Li, Viktor Rozgic, Gautam Thatte, Harsh Vathsangam, Daphney Zois, Murali Annavaram, Shrikanth Narayanan, Donna Spruijt-Metz, and Gaurav Sukhatme. KNOWME: a Case Study in Wireless Body Area Sensor Network Design. *IEEE Communications Magazine*. 50(5): 116-125, 2012.
41. JongHo Shin, Panayiotis G. Georgiou, Shrikanth Narayanan. Enabling Effective Design of Multimodal Interfaces for Speech-to-Speech Translation System: An Empirical Study of Longitudinal User Behaviors over Time and User Strategies for Coping with Errors. *Computer, Speech, and Language*. 27(2): 554-571, February 2013
42. Jorge Silva and Shrikanth Narayanan. On Signal Representations within the Bayes Decision Framework. *Pattern Recognition*. 45(5): 1853-1865, 2012
43. Vivek Kumar Rangarajan Sridhar, Srinivas Bangalore, Shrikanth Narayanan. Enriching machine-mediated speech-to-speech translation using contextual information. *Computer, Speech, and Language*. 27(2): 492-508, February 2013
44. Andreas Tsiartas, Prasanta Ghosh, Panayiotis Georgiou, Shrikanth Narayanan. High-quality bilingual subtitle document alignments with application to spontaneous speech translation. *Computer, Speech, and Language*. 27(2): 572-591, February 2013
45. Angeliki Metallinou, Martin Wollmer, Athanasios Katsamanis, Florian Eyben, Bjorn Schuller, and Shrikanth Narayanan. Context-Sensitive Learning for Enhanced Audiovisual Emotion Classification. *IEEE Transactions on Affective Computing*. 3(2): 184-198, April-June, 2012.
46. Jorge Silva and Shrikanth Narayanan. Nearly Optimal Estimation of Mutual Information based on a Complexity Regularized Tree-Structured Partition. *IEEE Transactions on Information Theory*. 58(3): 1940 - 1952, March 2012.
47. Qun Feng Tan and Shrikanth Narayanan. Novel Variations of Group Sparse Regularization Techniques with Applications to Noise Robust Automatic Speech Recognition. *IEEE Transactions on Audio, Speech and Language Processing*. 20(4): 1337-1346, May 2012.
48. Yoon-Chul Kim, Michael Proctor, Shrikanth S. Narayanan, Krishna S. Nayak. Improved Imaging of Lingual Articulation Using Real-Time Multislice MRI. *Journal of Magnetic Resonance Imaging*. 35(4): 943-948, April 2012
49. Prasanta Kumar Ghosh, Louis Goldstein, Shrikanth Narayanan. Auditory-like filter-bank: An optimal speech processor for efficient human speech communication. *Springer Proceedings of Indian Academy of Sciences (Sadhana)*, Special Issue on Speech Processing. 36(5): 699-712, October 2011.
50. Chi-Chun Lee, Emily Mower, Carlos Busso, Sungbok Lee, Shrikanth Narayanan. Emotion recognition using a hierarchical binary decision tree approach. *Speech Communication*. Sensing Emotion and Affect - Facing Realism in Speech Processing. 53(9-10): 1162-1171, November-December 2011.
51. Prasanta Ghosh and Shrikanth Narayanan. Automatic Speech recognition using articulatory features from subject-independent acoustic-to-articulatory inversion. *J. Acoust. Soc. Am. Express Letters*. 130 (4): EL251-EL257, 2011.
52. Qun Feng Tan, Panayiotis Georgiou and Shrikanth Narayanan. Enhanced Sparse Imputation Techniques for a Robust Speech Recognition Front-End. *IEEE Transactions on Audio, Speech and Language Processing*. 19(8): 2418 - 2429, November 2011.
53. Adar Emken, Ming Li, Gautam Thatte, Sangwon Lee, Murali Annavaram, Urbashi Mitra, Shrikanth Narayanan, and Donna Spruijt-Metz. Recognition of Physical Activities in

- Overweight Hispanic Youth Using KNOWME Networks. *Journal of Physical Activity & Health*. 9(3): 432 – 441, 2012.
54. Yoon-Chul Kim, Cecil E. Hayes, Shrikanth S. Narayanan, Krishna S. Nayak. A Novel 16-Channel Receive Coil Array for Accelerated Upper Airway MRI at 3 Tesla. *Magnetic Resonance in Medicine*. 65(6): 1711-1717, 2011.
  55. Matthew Black, Abe Kazemzadeh, Joseph Tepperman and Shrikanth Narayanan. Automatically Assessing the ABCs: Verification of Children's Spoken Letter-Names and Letter-Sounds. *ACM Transactions on Audio, Speech and Language Processing*. 7: 4(15:1 - 15:17), 2011.
  56. Gautam Thatte, Ming Li, Sangwon Lee, Adar Emken, Shrikanth Narayanan, Urbashi Mitra, Donna Spruijt-Metz and Murali Annavaram. KNOWME: An Energy-Efficient, Multimodal Body Area Network for Physical Activity Monitoring. *ACM Transactions on Embedded Computing Systems*. 2011.
  57. Prasanta Ghosh, Louis Goldstein and Shrikanth Narayanan. Processing speech signal using auditory-like filterbank provides least uncertainty about articulatory gestures. *J. Acoust. Soc. Am.* 129(6): 4014-4022, June 2011.
  58. Gautam Thatte, Ming Li, Sangwon Lee, Adar Emken, Murali Annavaram, Shrikanth Narayanan, Donna Spruijt-Metz, and Urbashi Mitra. Optimal Time-Resource Allocation for Energy-Efficient Physical Activity Detection. *IEEE Transactions on Signal Processing*. 59(4): 1843-1857, 2011.
  59. Emily Mower, Maja Mataric and Shrikanth Narayanan. A Framework for Automatic Human Emotion Classification Using Emotional Profiles. *IEEE Transactions on Audio, Speech and Language Processing*. 19(5): 1057-1070, 2011.
  60. Matthew Black, Joseph Tepperman and Shrikanth Narayanan. Automatic Prediction of Children's Reading Ability for High-level Literacy Assessment. *IEEE Transactions on Audio, Speech and Language Processing*. 19(4): 1015 - 1028, 2011.
  61. Joseph Tepperman, Sungbok Lee, Shrikanth Narayanan and Abeer Alwan. A Generative Student Model for Scoring Word Reading Skills. *IEEE Transactions on Audio, Speech and Language Processing*. 19(2): 348-360, 2011.
  62. Serdar Yildirim, Shrikanth Narayanan and Alexandros Potamianos. Detecting Emotional State of a Child in a Conversational Computer Game. *Computer, Speech, and Language*. Special Issue on Affective Speech. 25(1): 29-44, 2011.
  63. Prasanta Ghosh, and Shrikanth Narayanan. Joint source-filter optimization for robust glottal source estimation in the presence of shimmer and jitter. *Speech Communication*. 53(1): 98-109, 2011.
  64. Prasanta Ghosh, Andreas Tsiartas and Shrikanth Narayanan. Robust voice activity detection using long-term signal variability. *IEEE Transactions on Audio, Speech and Language Processing*. 19(3): 600-613, 2011.
  65. Yoon-Chul Kim, Shrikanth S. Narayanan, Krishna S. Nayak. Flexible retrospective selection of temporal resolution in real-time speech MRI using a golden-ratio spiral view order. *Magnetic Resonance in Medicine*. 65(5): 1365-1371, 2011.
  66. Dongrui Wu, Christopher Courtney, Brent Lance, Shrikanth S. Narayanan, Michael Dawson, Kelvin Oie, and Thomas D. Parsons. Optimal Arousal Identification and Classification for Affective Computing Using Physiological Signals: Virtual Reality Stroop Task. *IEEE Transactions on Affective Computing*, 1(2): 109-118, 2010.
  67. Erik Bresch and Shrikanth Narayanan. Real-time MRI investigation of resonance tuning in soprano singing. *J. Acoust. Soc. Am. Express Letters*, 128(5): EL335-341, 2010.

68. Prasanta Ghosh, and Shrikanth Narayanan. A generalized smoothness criterion for acoustic-to-articulatory inversion. *J. Acoust. Soc. Am.* 128(4):2162-2172, 2010.
69. Ming Li, Viktor Rozgic, Gautam Thatte, Sangwon Lee, Adar Emken, Murali Annavaram, Urbashi Mitra, Donna Spruijt-Metz and Shrikanth Narayanan. Multimodal Physical Activity Recognition by Fusing Temporal and Cepstral Information. *IEEE Transactions on Neural Systems and Rehabilitation Engineering.* 18(4): 369-380, 2010.
70. Jorge Silva and Shrikanth Narayanan. Information Divergence Estimation based on Data-Dependent Partitions. *Journal of Statistical Planning and Inference.* 140(11)-3180-3198, 2010.
71. Dhaval Shah, Kyu J. Han, and Shrikanth S. Narayanan. Robust Multimodal Person Recognition Using Low-Complexity Audio-Visual Feature Fusion Approaches. *International Journal of Semantic Computing.* 4(2): 155-179, 2010
72. Prasanta Ghosh and Shrikanth Narayanan. Bark frequency transform using an arbitrary order allpass filter. *IEEE Signal Processing Letters.* 17(6):543-546, 2010.
73. Jorge Silva and Shrikanth Narayanan. Non-Product Data-Dependent Partitions for Mutual Information Estimation: Strong Consistency and Applications. *IEEE Transactions on Signal Processing.* 58(7): 3497-3511, July 2010.
74. Viktor Rozgic, Kyu Jeong Han, Panayiotis G. Georgiou and Shrikanth Narayanan. Multimodal speaker segmentation and identification in presence of overlapped speech segments. *Journal of Multimedia, Special Issue on Data Semantics and Multimedia Information Management.* 5(4): 322-331, 2010.
75. JongHo Shin, Panayiotis G. Georgiou and Shrikanth Narayanan. Towards Modeling User Behavior in Interactions Mediated through an Automated Bidirectional Speech Translation System. *Computer, Speech, and Language.* 24(2): 232-256, 2010.
76. Vivek Kumar Rangarajan Sridhar, Srinivas Bangalore and Shrikanth Narayanan. Combining lexical, syntactic and prosodic cues for improved online dialog act tagging. *Computer, Speech, and Language.* 23(4): 407-422, October 2009.
77. Prasanta Ghosh and Shrikanth Narayanan. Pitch contour stylization using an optimal piecewise polynomial approximation. *IEEE Signal Processing Letters.* 16(9): 814-817, 2009.
78. Vikram Ramanarayanan, Erik Bresch, Dani Byrd, Louis Goldstein, and Shrikanth Narayanan. Analysis of pausing behavior in spontaneous speech using real-time magnetic resonance imaging of articulation. *J. Acoust. Soc. Am. Express Letters* **126** (5):EL160-EL165, 2009.
79. Prasanta Ghosh and Shrikanth Narayanan. Closure duration analysis of incomplete stop consonants due to stop-stop interaction. *J. Acoust. Soc. Am. Express Letters* **126** (1): EL1-7, July 2009.
80. Ozlem Kalinli and Shrikanth Narayanan. Prominence Detection Using Auditory Attention Cues and Task-Dependent High Level Information. *IEEE Transactions on Audio, Speech and Language Processing.* 17(5): 1009-1024, 2009.
81. Yoon-Chul Kim, Shrikanth S. Narayanan, Krishna S. Nayak. Accelerated 3D Upper Airway MRI using Compressed Sensing. *Magnetic Resonance in Medicine.* 61: 1434-1440, 2009.
82. Emily Mower, Maja Mataric, Shrikanth Narayanan. Human Perception of Audio-Visual Synthetic Character Emotion Expression in the Presence of Ambiguous and Conflicting Information. *IEEE Transactions on Multimedia.* 11(5):843-855, 2009.

83. Patti Price, Joseph Tepperman, Markus Iseli, Thao Duong, Matthew Black, Shizhen Wang, Christy Kim Boscardin, Margaret Heritage, P. David Pearson, Shrikanth Narayanan, and Abeer Alwan. Assessment of Emerging Reading Skills in Young Native Speakers and Language Learners. *Speech Communication* 51(10): 968--984. October, 2009.
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## SAIL research reported in the public media

Some of the research by the speech lab members and their collaborators has drawn local/national/international media attention (print, online and broadcast radio/television).

<http://sail.usc.edu/news.php>

<http://viterbi.usc.edu/news/research/narayanan.htm>

### **Behavior Signal Processing and Behavioral Informatics (2009-present)**

BBC World Service, AOL News, BBC News (Technology), NBC Nightly News, KTLA, NBC Ch4 NYTimes (December 4, 2011), Wall Street Journal (Oct 2012), Politico.com, Chronicle of Higher Education (October 2012)

### **Speech Translation (2005-present)**

The work on speech to speech translation has been reported in *Business Week*, *KCET TV*, and a number of print/online outlets including *USNews.com*, *Ventura County Star*, *Persian Journal*, *Clinical Window Journal*, *Annenberg TV* and the *Daily Trojan*.

### **Emotion Recognition (2004-08)**

The work on automatic emotion detection has been highlighted in television (*MSNBC*, *CBS*, *CNN*, *KCAL-Los Angeles*), radio (*BBC*, *Australian Broadcast Corporation*, *National Public Radio*, *Irish National Radio* and other local stations in the USA such as in Los Angeles KPCC, and Boston/Rhode Island) and print media (*MIT Technology Review*, *Wired*, *Newsweek*, *Financial Times of London*, *Australian Financial Review*, *Inc. Magazine*, *German Focus*, *Italian Panorama*, *Miami Herald*, *New Yorker*).

### **Language Training (2004-05)**

The work on language training using speech recognition and virtual reality technologies has appeared on *ABC*, *NPR*, *NY Times*, *IEEE Intelligent Systems*.

### **Expressive Synthesis (2005)**

National Academy of Engineering Radio (WTOP Baltimore), BBC 4 and BBC World Service, Baltimore Sun

### **Speech Production (2004, 2008, 2013)**

USC College Magazine, Medical Science News, ADVANCE for Speech-Language Pathologists & Audiologists. *Wired* (US, UK), *Live Science*, *BBC*, *DailyMail*, *Foxnews*, *Smithsonian*, *Discovery Channel*.

### **Interdisciplinary Research (2004,2007,2008)**

USC Daily Trojan, USC Trojan Family Magazine, USC Chronicle, USC Engineer, USC College Magazine

**LA Weekly People of the Year Issue, 2013:** Chosen as one of "fascinating Angelenos"