STEPHEN ANDREW ZAHORIAN
zahorian@binghamton.edu
(607) 777-4846

NAME   Stephen A. Zahorian
ACADEMIC RANK   Professor of Electrical and Computer Engineering

DEGREES

Doctor of Philosophy (Electrical Engineering), Syracuse University-
    Syracuse, New York, August, 1978
Master of Science (Electrical Engineering), Syracuse University-
    Syracuse, New York, May, 1973
Bachelor of Science, (Electrical Engineering), University of Rochester-
    Rochester, New York, May, 1969

PROFESSIONAL REGISTRATIONS

Registered Professional Engineer in Virginia, 013737

PROFESSIONAL CHRONOLOGY

Department of Electrical and Computer Engineering, Binghamton University, Binghamton, New York
    Professor and Chairman, 2006-present
Department of Electrical and Computer Engineering, Old Dominion University, Norfolk, Virginia
    Chairman, 1996-2006
    Professor, 1994-1996
    Associate Professor, 1984-1994
    Assistant Professor, 1979-1984
Electrical and Computer Engineering, Syracuse University, Syracuse, New York
    Instructor and Research Engineer, August 1977-May 1979
    Dissertation Research, "Low Redundancy Encoding of Speech Spectra", 1976-1978
    Teaching Assistant, 1973-1975
    Research Assistant, Voice Quality and Tactile Vocoder Projects, 1971-1975
RCA Corporation
    Engineer, 1969-1971

SCIENTIFIC AND PROFESSIONAL SOCIETIES MEMBERSHIP

    Institute of Electrical and Electronic Engineers (Member), 1976 - present
    Acoustical Society of America (Associate Member), 1976 - present
    Tau Beta Pi (Member), 1968 - present

HONORS AND AWARDS

Most outstanding professor award (1990). Selected by outstanding student in Electrical and Computer Engineering.

Outstanding instructor award (1980). Awarded by the electrical engineering students.

COURSES TAUGHT DURING LAST FIVE YEARS

Semester II, 2011-2012
EECE 380A, SSTEM Seminar Course
Semester I, 2011-2012
EECE 402/520, Digital Signal Processing I
EECE 380A, SSTEM Seminar Course
Semester II, 2010-2011
EECE 629, Machine Pattern Recognition
EECE 380A, SSTEM Seminar Course
Semester I, 2010-2011
EECE 402/520, Digital Signal Processing I
EECE 380A, SSTEM Seminar Course
Semester II, 2009-2010
EECE 402/520, Digital Signal Processing I
EECE 422, Principles of Electromechanical Systems
Semester I, 2009-2010
EECE 480/580, Electric Power Systems
Semester II, 2008-2009
EECE 402/520, Digital Signal Processing I
Semester I, 2008-2009
EECE 629, Machine Pattern Recognition
Semester II, 2007-2008
EECE 402/520, Digital Signal Processing I
Semester I, 2007-2008
EECE 680F, Machine Pattern Recognition

MAJOR SERVICE ACTIVITIES

National
Panel Reviewer for NSF CCLI Phase I proposals, July, 2009
Panel Reviewer for NSF Platforms II program, September, 2006
Proposal reviewer for Southeastern region of electrical engineering departments, 2003-2006
Panel reviewer for NSF SBIR sensors program, September, 2005
Panel reviewer for NSF in Bioengineering, January, 2003
Panel reviewer for NSF in Bioengineering, December, 2001
Panel reviewer for NSF in Bioengineering, March, 2000
Co-organizer of NSF Workshop on Spoken Language Understanding, February, 1992

MAJOR SERVICE ACTIVITIES
('National' continued)

Panel member to review NSF SBIR proposals in the area of human/machine communication, September, 1991

Reviewer for NSF unsolicited proposals

Reviewer of manuscripts submitted for publication in <u>Journal of Acoustical Society of America, IEEE Transactions on Acoustics, Speech and Signal Processing</u>

Regional Activities

Chair, Virginia Microelectronics Summer Scholars program, 2001-2004

Chair, Virginia Microelectronic Educational Consortium (VMEC), 2001-2003

Chair, Southeastern Region Electrical Engineering Department Heads Association, 2002

University Committees and Activities

Chair, Department of Electrical and Computer Engineering, BU, 2006-present

Chair, Educational Policies and Priorities Committee, BU, 2008-2010

Chair, Watson Strategic Planning Committee, 2007

Engineering Coordinator for Virginia Combined Campaign, 2004-2005, 2005-2006

Human Subjects Institutional Review Board, 2002-2006

Chair, CSEMS scholarship committee, 2000-2006

Chair, Department of Electrical and Computer Engineering, ODU, 1996-2006

Organizer of ODU Engineering Open House Contests, 2003-2005

Organizer of Engineering Lab Tours and Contests for Gifted and Talented Program students from Chesapeake, 2001, 2002, 2005

Organizer of Computer Engineering Summer Camp, 2003

Member, Search Committee for Graduate Dean, 2003

IEEE Faculty Advisor, 1991-1996

Tau Beta Pi Faculty Advisor 1980-1983

PATENTS, LICENSES, OR COPYRIGHTS

A Passive Fetal Heart Rate Monitoring Apparatus and Method with Enhanced Fetal Heart Beat Discrimination, patent #5,524,631.

GRANTS AND CONTRACTS AWARDED

"Detailed Phonetic Labeling of Multi-Language Database for Spoken Language Processing Applications," US Air Force Research Lab, PI Stephen Zahorian, $614,300, January 1, 2012 through December 31, 2014.

"Engineering 2020 Scholarship Program," NSF, PI Stephen Zahorian, Co-PIs James Pitarresi, Doug Summerville, $600,000, July 1, 2010 through June 30, 2015.

"Understanding Tonal Languages," US Air Force Research Lab, PI Stephen Zahorian, $350,000, November 15, 2010 through November 14, 2012.

GRANTS AND CONTRACTS AWARDED
(continued)

"Open Source Multi-Language Audio Database for Spoken Language Processing Applications," US Air Force Office of Scientific Research, PI Stephen Zahorian, $500,000, April 15, 2010 through April 14, 2012.

"Graduate Assistance in Areas of National Need: Electrical and Computer Engineering," Department of Education, PI, S. A. Zahorian, Co-PI, M. Song, $485,466, Aug 1, 2006 through July 31, 2009. (Funding left at ODU; M. Song became PI when S. A. Zahorian left ODU).

"Implementation Grant: Simulation and Visualization Enhanced Engineering Education," National Science Foundation, EEC-0530365, PI, Sushil Chaturvedi, Co-PI, S. A. Zahorian, $999,741, September 15, 2005 through August 31, 2008.

"Scholarship Program for Computer Science, Engineering and Mathematics Students," National Science Foundation, PI, S. A. Zahorian, Co-PIs Larry Wilson, Richard Norton, Sept. 1, 2002 through August 31, 2006, $400,000.

 "Speech to Text for Digital Library Development," JTASC under VMASC agreement, PI, Kevin McClesky, Co-PI, S. A. Zahorian, $200,000, October 1, 2000 through September 30, 2005.

"Automatic Speech Recognition for Use with Aviation Weather Information (AWIN)," NASA, PI, S. A. Zahorian, Co-PI, (GSRP for Penny Hix), $110,000, July 1, 2000 through June 30, 2005.

"A Planning Grant for Simulation and Visualization Enhanced Engineering Education," National Science Foundation, PI, Sushil Chaturvedi, Co-PI, S. A. Zahorian, $100,000 September 1, 2003 through August 30, 2004.

"Graduate Fellowships in Electrical Engineering," US Department of Education, GAANN program, Project #301381PI, S. Zahorian, Co-PI, Amin Dharamsi, $380,750, March 1, 2000 through August 14, 2004.

"Acquisition of Collaborative High Performance Computing and Visualization Cluster," National Science Foundation under the Major Research Infrastructure program, PI, S. A. Zahorian, Co-PI, Bowen Loftin, $306,000, August 1, 2002 through July 31, 2004.

 "Computer based speech training for the hearing impaired," National Science Foundation, Project # 392811 continuation, PI, S. A. Zahorian, $50,000, September 15, 2003 through February 28, 2004.

GRANTS AND CONTRACTS AWARDED
(continued)

"Computer Science, Engineering, and Mathematics Scholarships Program (CSEMS)," National Science Foundation, Project #300861, PI, S. Zahorian, Co-PIs, David Keyes, Bill Stanley, Irv Levenstein, David Lasseigne, $220,000, March 1, 2000 through February 28, 2004.

"Computer based speech training for the hearing impaired," National Science Foundation, NSF Project #392811, PI, S. A. Zahorian, $261,000, September 15, 1999 through September 14, 2003.

 "Learning by Doing: The Use of the Personal Computer in Instrumentation," National Science Foundation, CCLI division, PI, Glenn Gerdin, Co-PI, S. A. Zahorian, $60,000, August 1, 1999 through July 31, 2000.

"Speech Database Development," Syracuse Language Systems, PI, S. A. Zahorian, $10,000, August 1, 1998 to September 30, 1999.

"Signal Processing and Software Enhancements for the Acoustic Fetal Heart Rate Monitor," NASA, Grant number 191331, PI, S. A. Zahorian, $15,000, December 12, 1998 through September 15, 1999.

"A Common Characterization and Industrial Design of the Fetal Heart Rate Monitor," NASA-Langley Research Center, PI, S. A. Zahorian, $15,000, January 1, 1998 through December 31, 1998.

"A Commercialization and Industrial Design of the Fetal Heart Rate Monitor," NASA, PI, S. A. Zahorian, $39,000, February 15, 1997 through August 31, 1998.

"Visual Speech Articulation Training Aid," National Science Foundation, PI, S. A. Zahorian, $178,006, July 1, 1994 through June 30, 1997.

"Binary-Pair Partitioned Neural Networks for Speaker and Dialect Recognition," National Science Foundation, PI, S. A. Zahorian, $2,880, December 1, 1995 through July 31, 1995.

"Binary-Pair Partitioned Neural Networks for Speaker and Dialect Recognition," National Science Foundation, PI, S. A. Zahorian, $259,504, February 15, 1993 through July 31, 1995.

"Calibration and Field Testing of High-Temperature Fiber Optic Acoustics Sensors," NASA/IRD, PI, S. A. Zahorian, $22,131, June 1, 1994 through December 31, 1994.

GRANTS AND CONTRACTS AWARDED
(continued)

"Binary-Pair Partitioned Neural Networks for Speaker and Dialect Recognition - REU Supplement," National Science Foundation, PI, S. A. Zahorian, $10,000, Aug. 31, 1993 through July 31, 1994.

"Signal Processing for Prenatal Detection of Cerebral Palsy, NASA, PI, S. A. Zahorian, $30,000, September 1, 1993 through December 31, 1993.

"Coupling of Bottom-Up and Top-Down Knowledge Sources for Automatic Speech Recognition," National Science Foundation, PI, S. A. Zahorian, $118,846, September 1, 1991 through August 31, 1993.

"Visual Speech Display as an Articulation Training Aid for the Deaf," National Science Foundation, PI, S. A. Zahorian, $150,000, July 15, 1990 through July 14, 1993.

"NSF Workshop on Spoken Language Understanding," (IRI-9208831), National Science Foundation, PI, R. Cole, $35,762, February 1, 1992 through January 31, 1993.

"Spectral Shape Factors as Acoustic Invariants for Speech Perception," National Science Foundation, NSF grant # ITI-87-02649, PI, S. A. Zahorian, $124,000, July 15, 1987 through Dec 15, 1989.

"Automatic Floor Profiler Instrumentation," Edward Face Co. and CIT-Engineering Clinic, ODURF grant # 564205/56406, PI, S. A. Zahorian, $16,000, July 30, 1987 through June 30,1988.

"Speaker Independent Isolated Word Speech Recognition Using the Discrete Cosine Transform," ODURF grant # 564541/764541, Texas Instruments and Virginia Center for Innovative Technology, PI, S. A. Zahorian, $59,000, January 1, 1986 through June 1, 1987.

"Speaker Independent Isolated Word Speech Recognition Using the Discrete Cosine Transform," ODURF grant #764270, Texas Instruments, PI, S. A. Zahorian, $17,000, September 1, 1985 through December 31, 1985.

"Visual Speech Display for the Deaf," The Whitaker Foundation, ODURF grant #544540 PI, S. A. Zahorian, $49,972, July 1, 1985 through June 30, 1985.

"Visual Speech Display for the Deaf," The Whitaker Foundation, PI, S. A. Zahorian, $61,580, March 1, 1983 through February 28, 1985.

GRANTS AND CONTRACTS AWARDED
(continued)

"Low Redundancy Encoding of Speech Spectra," NSF (Engineering Initiation Proposal), NSF grant # ECS 8106570, PI, S. A. Zahorian, $47,754, June 1, 1981 through November 30, 1983.

"Development of Digital Signal Processing Laboratory," Digital Equipment Corporation, PI, S. A. Zahorian, $30,000 equipment grant, June 1, 1982 through May 30, 1983.

"Speech Parameter Extraction," ODU (Summer Faculty Research Fellowship), PI, S. A. Zahorian, $2,905, June 1, 1980 through December 15, 1980.

"Low Redundancy Voice Encoding," Syracuse University Senate Research Committee, PI, S. A. Zahorian, $7,500, July 1, 1976 through June 30, 1977.
"Speech Intelligibility Testing," General Electric Company, PI, S. A. Zahorian, $2,933.84.

SCHOLARLY ACTIVITIES COMPLETED
Refereed Journal Articles

S. A. Zahorian, D. Summerville, S. Craver, M. Elmore, "ACTS—An ABET Compliance Tracking System for Assessing Student Outcomes," Computers in Education Journal, Vol 3, No 2, pages 49-58, April-June 2012.

S. A. Zahorian, A. J. Zuckerwar, and M. Karnjanadecha, "Dual Transmission Model of the Fetal Heart Sounds," Elsevier Computer Methods and Programs in Biomedicine, COMM3323, 10.1016/j.cmpb.2011.12.006, January 28, 2012.

S. A. Zahorian and Hongbing Hu, "A Spectral/Temporal Method for Robust Fundamental Frequency Tracking," *Journal of the Acoustical Society of America* 123(6), pp. 4559-4571, June 2008.

M. Karnjanadecha and S. A. Zahorian, "Signal Modeling for High-Performance Isolated Word Recognition," *IEEE Transactions on Speech and Audio Processing*, Vol. 9, No. 6, pp. 647-654, September 2001.

S. A. Zahorian, W. Swart, V. Lakdawala, J. Leathrum, O. González, "A Modular Approach to using Computer Technology for Education and Training," *International Journal of Computer Aided Manufacturing*, Vol. 13, pp. 286-297, May-June 2000.

S. A. Zahorian and Z. B. Nossair, "A Partitioned Neural Network Approach for Vowel Classification Using Smoothed Time/Frequency Features," *IEEE Transactions on Speech and Audio Processing*, Vol. 7, No. 4, pp. 414-425, July 1999.

R. Cole, L. Hirschman, L. Atlas, M. Beckman, A. Biermann, M. Bush, M. Clements, J. Cohen, O. Garcia, B. Hanson, H. Hermansky, S. Levinson, K. McKeown, N. Morgan, D. G. Novick, M. Ostendorf, S. Oviatt, P. Trice, H. Silverman, J. Spitz, A. Waibel, C.

SCHOLARLY ACTIVITIES COMPLETED
('Refereed Journal Articles' continued)

Weinstein, S. Zahorian, and V. Zue, "The Challenge of Spoken Language Systems: Research Directions for the Nineties," *IEEE Trans. on Speech and Audio Processing*, Vol. 3, pp. 1-21, January 1995.

S. A. Zahorian and A. J. Jagharghi, "Spectral-Shape Features Versus Formants as Acoustic Correlates for Vowels," *J. Acoust. Soc. Am*, Vol. 94-4, pp. 1966-1982, October 1993.

S. A. Zahorian and A. J. Jaghurghi, "Minimum Mean-Square Error Transformations of Categorical Data to Target Positions," *IEEE Trans. on Signal Processing*, 40-1, pp. 13-23, 1992.

S. A. Zahorian and A. J. Jagharghi, "Speaker Normalization of Static and Dynamic Vowel Spectral Features," *J. Acoust. Soc. Amer.*, 90-1, 67-75, 1991.

Z. B. Nossair and S. A. Zahorian, "Dynamic Spectral Shape Features as Acoustic Correlates for Initial Stop Consonants," *J. Acoust. Soc. Amer.*, 89-6, 2978-2991, 1991.

S. A. Zahorian and M. Rothenberg, "Principal-Components Analysis for Low-Redundancy Encoding of Speech Spectra," *J. Acoust. Soc. Amer.*, 69, 832-845, 1981.

M. Rothenberg, R. Verillo, S. A. Zahorian, M. Brachman and S. Bolanow-ski, Jr., "Vibrotactile Frequency for Encoding a Speech Parameter," *J. Acoust. Soc. Amer.*, 62, 1003-1012, 1977.

Book Chapters

S. A. Zahorian and H. Hu, "Nonlinear Dimensionality Reduction Methods for Use with Automatic Speech Recognition," In Speech Technologies,edited by Ivo Ipsic, June, 2011, pages 55-78.

Refereed National/International Proceedings

M. Karnjanadecha, S. A. Zahorian, "Toward an Optimum Feature Set and HMM Model Parameters for Automatic Alignment of Spontaneous Speech," accepted for September 2012 Interspeech conference.

S. A. Zahorian, J. Wu, M. Karnjanadecha, C. Sekhar Vootkuri, B. Wong, A. Hwang, E. Tokhtamyshev, "Open Source Multi-Language Audio Database for Spoken Language Processing Applications," *Interspeech* 2011, August, 2011.

SCHOLARLY ACTIVITIES COMPLETED
('Refereed National/International Proceedings' continued)

S. A. Zahorian, D. Summerville, S. Craver, and M. Elmore, "ABET Compliance Tracking System (ACTS)," Paper M423, 118th ASEE Annual Conference & Exposition, Vancouver, B.C. Canada, June 26-29, 2011.

H. Hu and S. A. Zahorian, "Dimensionality Reduction Methods for HMM Phonetic Recognition," *ICASSP 2010*, Sp-P9.3, 2010.

H. Hu and S. A. Zahorian, Neural Network Based Nonlinear Discriminant Analysis for Speech Recognition, ANNIE, 2009.

S. A. Zahorian, H. Hu, Z. Chen, and J. Wu, (2009) "Spectral and Temporal Modulation Features for Phonetic Recognition," *Proc. Interspeech 2009*.

S. A. Zahorian, R. Belohlavek, S. Craver, R. McGrann, L. Yu, "Bringing SOCRATES into Computer-Assisted Instruction," *2008 Frontiers in Education Conference*, October, 2008.

H.Hu and S. A. Zahorian*, "*A Neural Network Based Nonlinear Feature Transformation for Speech Recognition," *Interspeech 2008,* September 2008, Brisbane, Australia.

S. A. Zahorian, T. Singh, H. Hu, "Dimensionality Reduction of Speech Features using Nonlinear Principal Components Analysis," *Interspeech 2007*, pp 1134-1137, August, 2007.

S. A. Zahorian, P. Dikshit, H. Hu, "A Spectral-Temporal Method for Pitch Tracking," *Interspeech 2006-ICSLP*, Pittsburgh, PA, September 2006.

S. Prasad, S. A. Zahorian, "Nonlinear and Linear Transformations of Speech Features to Compensate for Channel and Noise Effects," pp.969-972, *Proceedings of the 9th European Conference on Speech Communication and Technology*, Lisbon, Portugal, September 4-8, 2005.

P. Dikshit, S. A. Zahorian and S. Nagulapati, "An Algorithm for Locating Fundamental Frequency Markers in Speech Signals," *International Conference on Acoustics, Speech, and Signal Processing,* Philadelphia, Pennsylvania, pp. I.233-I.236, March 2005.

Stephen A. Zahorian, Mame Sall, Fansheng Meng, and Wei Wang, "Generalization of Support Vector Machines versus Neural Networks for Pattern Classification," *Intelligent Engineering Systems through Artificial Neural Networks*,   Volume 14, pp 639-644, Nov 7-10, 2004, St. Louis.

SCHOLARLY ACTIVITIES COMPLETED
('Refereed National/International Proceedings' continued)

Wei Wang and Stephen A. Zahorian, "Vocal Tract Normalization based on Spectral Template Matching," *International Conference on Spoken Language Processing*, Oct 4-8, 2004, Paper FrB1801p.8_p1185, Korea.

Mukund Devarajan, Fansheng Meng, Penny Hix, and Stephen A. Zahorian, "HMM-Neural Network Monophone Models for Computer-Based Articulation Training for the Hearing Impaired," *2003 International Conference on Multimedia and Expo*, v III, pp. 197-200, July 2003.

Mukund Devarajan, Fansheng Meng, Penny Hix, and Stephen A. Zahorian, "HMM-Neural Network Monophone Models for Computer-Based Articulation Training for the Hearing Impaired," *International Conference on Acoustics, Speech, and Signal Processing*, v II, pp369-372, (Conference cancelled due to SARS, but proceedings published) 2003.

Stephen A. Zahorian, A. Mathew Zimmer, Fansheng Meng, "Vowel Classification for Computer-Based Visual Feedback for Speech Training for the Hearing Impaired," *International Conference on Spoken Language Processing*, 973-976, Denver, CO, September 16-20, 2002.

Kavita Kasi and Stephen A. Zahorian, "Yet Another Algorithm for Pitch Tracking," Paper #2294, l-361-364, *International Conference on Acoustics, Speech, and Signal Processing*, Orlando, FL, May 13-17, 2002.

Lakdawala, V. K., Zahorian, Stephen A., Gonzalez, Oscar R., Kumar H., Amit, and Leathrum, James F., "An Instrument for Assessing Knowledge Gain in a First Course in Circuit Theory," *Proceedings of the 2002 American Society for Engineering Education Annual Conference & Exposition*, Montreal, Canada, 2002.

Stephen A. Zahorian, Vishnu Lakdawala, Oscar Gonzalez, Scott Starsman, and James F. Leathrum, "Question model for Intelligent Questioning Systems in Engineering Education," *Proceedings of the 2001 Frontiers in Education Conference*, Reno, Nevada, October 10-13, 2001.

Stephen A. Zahorian, Sacharia Albin, William Swart, "Global Engineering Education: A partnership between Rajagiri College (Cochin, India), and Old Dominion University (Norfolk, VA)," *Proceedings of the 2001 ASEE meeting*, Albuquerque, NM, June 24-27, 2001.

Vishnu Lakdawala, Stephen A. Zahorian, "Knowledge Maps for Intelligent Questioning Systems in Engineering Education," James Leathrum, Oscar Gonzalez, *Proceedings of the 2001 ASEE meeting*, Albuquerque, NM, June 24-27, 2001.

SCHOLARLY ACTIVITIES COMPLETED
('Refereed National/International Proceedings' continued)

P. Hix, S. A. Zahorian, F. Meng, "Novel Feature Extraction for Noise Robust ASR using the Aurora II Database," *International Conference on Acoustics, Speech, and Signal Processing,* Toulouse, France, May 2001.

J. Venugopal, S. A. Zahorian, and M. Karnjanadecha, "Minimum Mean Square Error Spectral Peak Envelope Estimation for Automatic Vowel Classification," *Proc. International Conference on Spoken Language Processing*, vol. 4, pp. 700-703, Beijing, China, Oct 16-20, 2000.

M. Karnjanadecha and S. A. Zahorian, "An Investigation of Variable Block Length Methods for Calculation of Spectral/Temporal Features for Automatic Speech Recognition," *Proc. International Conference on Spoken Language Processing*, vol. 4, pp. 1053-1056, Beijing, China, October 16-20, 2000.

S. A. Zahorian and M. A. Zimmer, "Discriminative and Maximum Likelihood Classifiers for Computer-Based Visual Feedback and Speech Training for the Hearing Impaired," *World Multiconference on Systemics, Cybernetics and Informatics (SCI 2000/ISAS 2000)*, Vol. VI, Part II, pp. 475-479, Orlando, Florida, July 2000.

S. A. Zahorian, S. Patilkulkarni, M. Karnjanadecha, and C. Brewton, "Speech-to-Text Translation for Indexing and Searching of Audio/Visual Materials for a Digital Library," *World Multiconference on Systemics, Cybernetics and Informatics (SCI 2000/ISAS 2000)*, Vol. VI, Part II, pp. 415-417, Orlando, Florida, July 2000.

William Swart, Stephen Zahorian, Vishnu Lakdawala, James Leathrum, Oscar González, "A Multi-Use Architecture for Technology-Based Delivery of Curricula," *ASEE/IEEE Frontiers in Education Conference*, Nov 10-13, 1999, San Juan, Puerto Rico, 12c2-12 – 12c2--17.

Montri Karnjanadechi and Stephen A. Zahorian, "Signal Modeling for Isolated Word Recognition," *International Conference on Acoustics, Speech, and Signal Processing*, pp. II-293-296, March 15-19, 1999.

Stephen A. Zahorian, "Reusable Binary-Paired Partitioned Neural Networks for Text-Independent Speaker Identification," *International Conference on Acoustics, Speech, and Signal Processing*, pp. II-849-852, March 15-59, 1999.

S. A. Zahorian, A. Zimmer, and B. Dai, "Personal Computer Software Vowel Training Montri Karnjanadechi and Stephen A. Zahorian, "Robust Feature Extraction for Alphabet Recognition," *5th International Conference on Spoken Language Processing,* pp. II-337-340, November 30 – December 4, 1998.

SCHOLARLY ACTIVITIES COMPLETED
('Refereed National/International Proceedings' continued)

S. A. Zahorian, A. Zimmer, and B. Dai, "Personal Computer Software Vowel Training Aid for the Hearing Impaired," *International Conference on Acoustics, Speech, and Signal Processing*, pp. VI-3625-3628, May 12-15, 1998.

S. A. Zahorian, P. Silsbee and X. Wang, "Phone Classification with Segmental Features and a Binary-Pair Partitioned Neural Network Classifier," *ICASSP 97*, Munich, Germany, April 21-23, 1997.

S. Albin, J. Zheng, A. Lavariag, S. A. Zahorian, "A Non-Invasive Fiber Optic Sensor for the Fetal Heart Rate Monitoring," *International Conference on Fiber Optics and Photonics*, December 9-13, 1996.

X. Wang, S. A. Zahorian, and S. Auberg, "Variable Resolution Spectral/Temporal Features for Speech Segments," *ICSLP-96*, pp. 1221-1224.

B. A. Hawickhorst, S. A. Zahorian, and R. Rajagopal, "A Comparison of Three Neural Network Architectures for Automatic Speech Recognition," *Intelligent Engineering Systems Through Artificial Neural Networks*, Vol. 5, Fuzzy Logic and Evolutionary Programming, pp. 221-226, St. Louis, Missouri, November 1995.

C. A. Norton, III and S. A. Zahorian, "Speaker Verification Based on Speaker Position in a Multidimensional Space," *Intelligent Engineering Systems Through Artificial Neural Networks*, Vol. 5, Fuzzy Logic and Evolutionary Programming, pp. 739-744, St. Louis, Missouri, November 1995.

H. L. Cycon, W. Li and S. A. Zahorian, "Stop Consonant Classification Using Wavelet Packet Transforms and Neural Network," *Intelligent Engineering Systems Through Artificial Neural Networks*, Vol. 5, Fuzzy Logic and Evolutionary Programming, pp. 733-738, St. Louis, Missouri, November 1995.

Z. B. Nossair, P. L. Silsbee, and S. A. Zahorian, "Signal Modeling Enhancements for Automatic Speech Recognition," *ICASSP-95*, Vol. I, pp. 824-827, Detroit, MI, May 1995.

C. A. Norton, III, S. A. Zahorian, and Z. B. Nossair, "The Application of Binary-Pair Partitioned Neural Networks to the Speaker Verification Task," ANNIE '94 Conference, and published in *Intelligent Engineering Systems through Artificial Neural Networks*, Vol. 4, pp. 441-446, St. Louis, MO, November 1994.

SCHOLARLY ACTIVITIES COMPLETED
('Refereed National/International Proceedings' continued)

S. A. Zahorian, A. Zhou, and N. Correal, "Comparison of Minimum Misclassification (MME) Networks with Least Mean Square Error (LMS) Networks," ANNIE '94 Conference, and published in *Intelligent Engineering Systems through Artificial Neural Networks*, Vol. 4, pp. 191-198, St. Louis, MO, November 1994.

S. A. Zahorian and Z. B. Nossair, "A Neural Network Clustering Technique for Text-Independent Speaker Identification," ANNIE '94 Conference, and published in *Intelligent Engineering Systems through Artificial Neural Networks*, Vol. 4, pp. 453-460, St. Louis, MO, November 1994.

P. L. Silsbee, S. A. Zahorian, and Z. B. Nossair, "A Warped Time-Frequency Expansion for Speech Signal Representation," *Proc. IEEE-SP Symposium on Time-Frequency and Time-Scale Analysis*, pp. 636-639, Philadelphia, Pennsylvania, October 1994.

Z. B. Nossair and S. A. Zahorian, "Smoothed Time-Frequency Features for Vowel Classification," *Proc. IEEE-SP International Symposium on Time-Frequency and Time-Scale Analysis*, pp. 592-595, Philadelphia, Pennsylvania, October 1994.

S. A. Zahorian, Z. B. Nossair, and C. A. Norton, "A Partitioned Neural Network Approach for Vowel Classification Using Smoothed Time/Frequency Features," *Eurospeech*, Vol. 2, pp. 1225-1228, Berlin, Germany, September 1993.

S. A. Zahorian and L. Rudasi, (1993). "Speaker Identification with Partitioned Neural Networks," *Proc. IEEE DUAL-USE Technologies and Applications Conference*, pp. 189-195, Utica/Roma, New York, May 24-27, 1993.

S. A. Zahorian and L. Rudasi, (1993). "Neural Network Advances for Speaker Identification," *Secure Tech/Card Tech Conference Proceedings*, April 19, 1993, Washington, D.C., pp. 339-349.

L. Rudasi and S. A. Zahorian (1992). "Text Independent Talker Identification Using Binary-Pair Partitioned Neural Networks," *International Joint Conference on Neural Networks*, Vol. 4, pp. 679-684, Baltimore, MD, June 1992.

S. A. Zahorian, and D. L. Livingston (1992). "Neural Networks for Feature Computations in Automatic Speech Recognition," *International Joint Conference on Neural Networks*, Vol. 4, pp. 667-672, Baltimore, MD, June 1992.

S. A. Zahorian, S. Kelkar and D. L. Livingston (1992). "Formant Estimation from Cepstral Coefficients Using a Feedforward Memoryless Neural Network," *International Joint Conference on Neural Networks*, Vol. 4, pp. 673-678, Baltimore, MD, June 1992.

SCHOLARLY ACTIVITIES COMPLETED
('Refereed National/International Proceedings' continued)

A. E. Beck and S. A. Zahorian (1992). "Transformations of Speech Spectra to a Two-Dimensional Continuous-Valued Phonetic Feature Space for Vowel Training," *ICASSP-92*, pp. 241-244, San Francisco, CA, March 1992.

L. Rudasi and S. A. Zahorian (1991). "Text-Independent Talker Identification with Neural Networks," *ICASSP-91*, 389-392.

S. A. Zahorian, D. Qian, and A. J. Jagharghi (1991). "Acoustic-Phonetic Transformations for Improved Speaker-Independent Isolated Word Recognition," *ICASSP-91*, 561-564.

S. A. Zahorian and S. Venkat (1990). "Vowel Articulation Training Aid for the Deaf," *ICASSP-90*, 1121-1124.

S. A. Zahorian and Z. B. Nossair (1990). "Dynamic Spectral Features for Speaker-Independent Automatic Recognition of Stop Consonants," *ICASSP-90*, 793-796.

S. A. Zahorian, "Color Display of Vowels as a Speech Articulation Training Aid," *IEEE Engineering in Medicine & Biology Society 10th Annual International Conference*, pp 1539-1540, 1988.

S. A. Zahorian and P. Gordy, "Finite Impulse Response (FIR) Filters for Speech Analysis and Synthesis," *ICASSP-83*, 808-811, 1983.

Refereed Regional/Local Proceedings

L. Rudasi and S. A. Zahorian, "Pattern-Recognition Using Neural Networks with a Binary Partitioning Approach, *SOUTHEASTCON-91,* 1991.

P. J. Berlinsky and S. A. Zahorian, "A Program for Plotting Experimental Data on a Personal Computer," *SOUTHEASTCON '86*, 251-254, 1986.

S. A. Zahorian, J. S. Stoughton and M. A. Do, "A Laboratory for Designing Digital Systems," *SOUTHEASTCON '86* , 246-250, 1986.

Technical Reports

"Commercialization and Industrial Development for the Fetal Heart Rate Monitor," Final Report submitted to NASA, January 30, 2000, ODURF #191331

"Visual Speech Articulation Training Aid," Final report submitted to the National Science Foundation, December 3, 1998.

"Commercialization and Industrial Development for the Fetal Heart Rate Monitor," Final Report submitted to NASA, November 3, 1998.

SCHOLARLY ACTIVITIES COMPLETED
('Technical Reports' continued)

S. A. Zahorian, "Passive Acoustically Based Fetal Heart Rate Monitor," NASA TASK ASSIGNMENT #79, June 1996.

S. A. Zahorian, "Calibration and Field Testing of High Temperature Fiber Optic Acoustic Sensors," NASA TASK ASSIGNMENT #31, February 1996.

S. A. Zahorian, "Signal Processing for Prenatal Detection of Cerebral Palsy," NASA TASK ASSIGNMENT #32, December 1995.

S. A. Zahorian, "Coupling of Bottom-Up and Top-Down Knowledge Sources for Automatic Speech Recognition," NSF Final Report, Sept. 1993.

S. A. Zahorian, "Visual Speech Display as an Articulation Training Aid for the Deaf," NSF Final Report, July 1993.

S. A. Zahorian, "Coupling of Bottom-Up and Top-Down Knowledge Sources for Automatic Speech Recognition," progress report submitted to the National Science Foundation, May 1991.

S. A. Zahorian, "Visual Speech Display as an Articulation Training Aid for the Deaf," progress report NSF Grant #BCS-9010334, May 1991.

S. A. Zahorian and M. Bountress. "Visual Speech Display as an Articulation Training Aid for the Deaf," Rehabilitation R&D Progress Reports, Veterans Health Administration, pp. 334-335, 1991.

S. A. Zahorian, "Spectral Shape Factors as Acoustic Invariants for Speech Perception," final report Grant #IRI-8702649, July 1990.

S. A. Zahorian, "Speaker Independent Isolated Word Speech Recognition Using the Discrete Cosine Transform," progress report to Texas Instruments, Inc., December 1986.

S. A. Zahorian, "Visual Speech Display for the Deaf," final report for the Whitaker Foundation, September 1986.

S. A. Zahorian, "Research Initiation: Low Redundancy Encoding of Speech Spectra," final report submitted to NSF, February 1984.

S. A. Zahorian, "Visual Speech Display for the Deaf," progress report submitted to the Whitaker Foundation, February 1984.

SCHOLARLY ACTIVITIES COMPLETED
('Technical Reports' continued)

> S. A. Zahorian, "Research Initiation: Low Redundancy Encoding of Speech Spectra," progress report submitted to NSF, September 1982.

> S. A. Zahorian, "Principal-Components Analysis for Low Redundancy Encoding of Speech Spectra," Syracuse University Technical Report TR-78-10, October 1978.

Presentations not Published in Proceedings [International]

> J. Wu, S. A. Zahorian, and H. Hu, "Tone Recognition in Continuous Mandarin Chinese," submitted for the fall 2012 meeting of the Acoustical Society of America.

> S. A. Zahorian, "Parametric Forms of Spectral Amplitude Nonlinearities for Use in Automatic Speech Recognition," submitted for the fall 2012 meeting of the Acoustical Society of America.

> H. Hu and S. A. Zahorian, "An Experimental Comparison of Fundamental Frequency Tracking Algorithms," submitted for the fall 2012 meeting of the Acoustical Society of America.

> M. Karnjanadecha and S. A. Zahorian, "An Automatic Method for Determining Phonetic Boundaries for Continuous Speech Utterances in an Open Source Multi-Language Audio/Video Database," *J. Acoust. Soc. America*, Vol 130.4.2, p2524, 2011, paper presented at the 162nd Meeting of the Acoustical Society of America, San Diego.

> S. A. Zahorian and B. Wong, "Spectral Amplitude Nonlinearities for Improved Noise Robustness of Spectral Features for use in Automatic Speech Recognition," *J. Acoust. Soc. America*, Vol 130.4.2, p2524, 2011, paper presented at the 162nd Meeting of the Acoustical Society of America, San Diego.

> S. A. Zahorian , J. Wu, and M. Karnjanadecha, "Non-Symmetric Time Resolution for Spectral Feature Trajectories," *J. Acoust. Soc. America*, Vol 130.4.2, p2444, 2011, paper presented at the 162nd Meeting of the Acoustical Society of America, San Diego.

> S. A. Zahorian, H. Hu, and J. Wu, "Time/Frequency Resolution of Acoustic Features for Automatic Speech Recognition," *J. Acoust. Soc. America*, Vol 128.4.2, p2324, 2010, invited talk.

> S. A. Zahorian and J. Wu, "Variable Resolution Spectral/Temporal Features for Automatic Speech Recognition," *Acoustical Society of America Meeting*, November, 2008, Miami, Florida.

SCHOLARLY ACTIVITIES COMPLETED
(Presentations not Published in Proceedings [International] continued)

F. Meng, E, Rodel, and S. A. Zahorian, "A Consonant-Vowel-Consonant Display as a Computer-Based Articulation Training Aid for the Hearing Impaired,**"** paper presented at the 149th Meeting of the Acoustical Society of America, Vancouver, Canada, May 16-20, 2005, abstract appeared in *The Journal of the Acoustical Society of America*, Vol. 117, No. 4, Pt. 2, p. 2621, May 2005.

L. Gu and S. A. Zahorian, "A New Robust Algorithm for Isolated Word Endpoint Detection," IV-4161 <u>International Conference on Acoustics, Speech, and Signal Processing</u>, Orlando, FL, May 13-17, 2002.

K. Kasi, L. Gu, and S. A. Zahorian, "Toolbox for fundamental frequency estimation," ICASSP 2001, Salt Lake City, UT, May 2001. (Student presentation)

A. M. Zimmer and S. A. Zahorian, "The integration of discriminative and maximum likelihood distance measures for a vowel articulation training aid," paper presented at the 136th Meeting of the Acoustical Society of America, Norfolk, VA, October 15, 1998, abstract appeared in *The Journal of the Acoustical Society of America*, Vol. 104, No. 3, Pt. 2, p. 1854, September 1998.

B. Dai and S. A. Zahorian, "Fundamental frequency synchronous spectral analysis for vowel classification," paper presented at the 136th Meeting of the Acoustical Society of America, Norfolk, VA, October 14, 1998, abstract appeared in *The Journal of the Acoustical Society of America*, Vol. 104, No. 3, Pt. 2, p. 1805, September 1998.

S. A. Zahorian and N. S. Correal, "Vowel Training Experiments with a Computer-Based Vowel Training System," *J. Acoust. Soc. Am.*, Vol. 95, No. 5, Pt. 2, p. 3014, May 1994.

Z. B. Nossair, Z. J. Zhang, and S. A. Zahorian, "Spectral Envelope Features for Vowel Classification in Clean and Noisy Speech," <u>J</u>. *Acoust. Soc. Am.*, Vol. 95, No. 5, Pt. 2, p. 2817, May 1994.

S. A. Zahorian and Z. B. Nossair, "Acoustic Segment Models for Automatic Speech Recognition," *Proc. 1993 IEEE Workshop on Automatic Speech Recognition*, pp. 22-23, Snowbird, Utah, December 1993.

S. A. Zahorian, Z. J. Zhang, and Z. B. Nossair, "Spectral Shape Cues for Vowels Which Predict the Perception of Multiple-Tone Steady-State Stimuli," *J. Acoust. Soc. Amer.*, Vol. 93, 2298, 17-21 May 1993, Ottawa, Canada.

S. A. Zahorian, Z. Zhang, and Z. Nossair "Perception of Vowels Synthesized from Sinusoids that Preserve Either Formant Frequencies or Spectral Shape," *J. Acoust. Soc. Amer.*, Vol. 92, p. 2414, Nov. 3, 1992, New Orleans, LA.

SCHOLARLY ACTIVITIES COMPLETED
(Presentations not Published in Proceedings [International] continued)

A. J. Jagharghi and S. A. Zahorian, "Vowel Perception: Spectral Shape Versus Formants," *J. Acoust. Soc. Amer.* 87, Supp 1, S159, 1990.

L. Rudasi and S. A. Zahorian, "Text-Independent Talker Identification Using Recurrent Neural Networks," *J. Acoust. Soc. Amer*. 87, Supp. 1, S104, 1990.

S. A. Zahorian and A. J. Jagharghi, "Linear Transformations for Vowel Normalization," *J. Acoust. Soc. Amer. Suppl 1* 85, S51., 1989.

Z. B. Nossair and S. A. Zahorian, "Spectral Shape Factors for Speaker-Independent Automatic Recognition of Stop Consonants," *J. Acoust. Soc. Amer.* 85, S136, 1989.

A. J. Jagharghi and S. A. Zahorian, "Vowel Identification: Are Formants Really Necessary?" *J. Acoust. Soc. Amer.* 81, S18, 1987.

S. A. Zahorian and A. J. Jagharghi, "Speaker-Independent Vowel Recognition Based on Overall Spectral Shape Versus Formants," *J. Acoust. Soc. Amer.* 82, S37, 1987.

S. A. Zahorian, Z. B. Nossair, and R. F. Coleman, "Evidence Against Acoustic Invariance in Initial Voiced Stop Consonants," *J. Acoust. Soc. Amer.* 81, S136, 1987.

E. A. Effer and S. A. Zahorian, "An Investigation of Mixed-Source Excitation Models for Linear Predictive Vocoders," *J. Acoust. Soc. Amer. Suppl 1* 79, S26, 1986.

S. A. Zahorian and A. J. Jagharghi, "Matching of 'Physical' and 'Perceptual' Spaces for Vowels," *J. Acoust. Soc. Amer. Suppl 1* 79, S8, 1986.

S. A. Zahorian and A. J. Jagharghi, "Color Display of Vowel Spectra as a Speech Training Aid for the Deaf," *J. Acoust. Soc. Amer. Suppl 1* 77, S97, 1985.

J. Holland and S. A. Zahorian, "Block Encoding of Speech Spectral Principal Components," *J. Acoust. Soc. Amer. Suppl 1* 75, S59, 1984.

S. A. Zahorian and J. Holland, "Visual Speech Display for the Deaf," *J. Acoust. Soc. Amer. Suppl 1* 75, S32, 1984.

S. A. Zahorian, "Optimal Vector Quantization of Speech Spectral Principal Components," *J. Acoust. Soc. Amer.* 71, Supp 1, S6., 1982.

S. A. Zahorian, "Orthogonal Coding of Linear Prediction Log Area Ratios," *J. Acous. Soc. Amer.*, 67, Supp 1, S12, 1980.

Presentations not Published in Proceedings (Regional/Local)

A. J. Jagharghi and S. A. Zahorian, "Visual Speech Display for the Deaf," presented at the Virginia Academy of Sciences, 1988.

S. A. Zahorian and M. Rothenberg, "Principal Components Analysis of Speech Spectra," *J. Acoust. Soc. Amer.* 61, Supp 1, S69, 1977.

GRADUATE DEGREES SUPERVISED

Andrew Hwang, "Linear Transformations of Features for Automatic Speech Recognition," M.S. Thesis, August, 2011.

Brian Wong, "Compressive Nonlinearity for Representing Speech Spectral Magnitude to Improve Noise Robustness of Automatic Speech Recognition," M.S. Thesis, August 2011.

Hongbing Hu, "Nonlinear Discriminant Analysis Based Feature Dimensionality Reduction for Automatic Speech Recognition," PhD, December 2010.

Penny Hix, "Automatic Speech Recognition using LP-DCTC/DCS Analysis followed by Morphological Filtering," PhD, December 2006.

Fansheng Meng, "Whole Word Phonetic Displays for Speech Articulation Training," PhD, May 2006.

Tara Singh, "Dimensionality Reduction using Non-linear Principal Components Analysis," M.S. Thesis, August 2006.

Usha Chalkapaly, "Gaussian Mixture Models and Neural Networks for Automatic Speaker Identification," M.S. Thesis, August 2006.

Mame Sall, "Generalization Issues in Pattern Classification Applied to Speaker Identification," M. S. Thesis, February, 2005.

Saurabh Prasad, "Nonlinear Transformations of Speech Features for Robust Recognition and Speaker Identification," M. S. Thesis, June 2005.

Princy Dikshit, "An Algorithm for Locating Fundamental Frequency (F0) Markers in Speech," M. S. Thesis, December, 2004.

Wei Wang, "Speaker Normalization for Improved Automatic Speech Recognition for Digital Libraries," M. S. Thesis, May 2004.

GRADUATE DEGREES SUPERVISED
(continued)

Ashutosh Mishra, "Automatic Speaker Identification Using Reusable and Retrainable Binary-Pair Partitioned Neural Networks," MS Thesis, May 2003.

Mukund Devarakan, "A Computer-Based Articulation Training Aid for Short Words (CATA)," M. S. Thesis, December 2003.

Kavita Kasi, "YAPT: Yet another Pitch Tracking Algorithm," M. S. Thesis, December 2002.

Lingyun Gu, "A New Robust Algorithm for Isolated Word Endpoint Detection," M. S. Thesis, February, 2002.

Matt Zimmer, "VATA: An Improved Personal Computer-Based Vowel Articulation Training Aid," M. S. Thesis, February, 2002.

Montri Karnjanadecha, "Signal Modeling with Non-Uniform Time Sampling of Features for Automatic Speech Recognition," Ph.D. Dissertation, August 2000.

Bingjun Dai, "Variability Analysis of Discrete Cosine Transform coefficient (DCTC) Features for Speech Processing," MS thesis, December 1998.

Xihong Wang, "Acoustic Segmentation Model for Isolated Word Recognition," MS Thesis, April 1998.

Charles Brewton, "An Enhanced Signal Processing Strategy for Fetal Heart Rate Detection," M. S. Thesis, May 1996.

Stefan Auberg, "Speech Feature Computation for Visual Speech Articulation Training," M. S. Thesis, May 1996.

C. A. Norton, III, "Text Independent Speaker Verification Using Binary-Pair Partitioned Neural Networks," December 1995.

Roger Zhou, "Fetal Heart Rate Detection with a Passive Acoustic Sensor System," M.S. Thesis, spring 1995.

Neiyer Correal, "Real-Time Visual Speech Articulation Training Aid," M.S. Thesis, Fall 1994.

Zhongjiang Zhang, "Acoustic Correlates of Vowel Perception as Determined From Synthesis Experiments with Multi-Tone Stimuli," M. S. Thesis, Dec. 1993.

GRADUATE DEGREES SUPERVISED
(continued)

Andrew Beck, "Neural Network Based Vowel Training Aid for the Deaf," M.S. Thesis, May 1992.

Laszlo Rudasi, "Text Independent Automatic Speaker Identification Using Partitioned Neural Networks," Ph.D. Dissertation, August 1992.

Shubanghi Kelkar, "Formant Estimation from DCTS's Using a Feedforward Neural Network," M.S. Thesis, May 1992.

Amir Jagharghi, "A Comparative Study of Spectral Peaks Versus Global Spectral Shape as Invariant Acoustic Cues for Vowels," Ph.D. Dissertation, August 1990.

D. Qian, "Encoding Phonetic Knowledge for Use in Hidden Markov Models of Speech Recognition," Master's Thesis, June 1990.

Subhashri Venkat, "Visual Speech Training Aid for the Deaf," M.S. Thesis, August 1990.

Zaki Nossair, "Dynamic Spectral Shape Features as Acoustic Correlates for Stop Consonants," Ph.D. Dissertation, December 1989.

C. Shen, "Discrete Cosine Transform Analysis for Speaker-Independent Automatic Acoustic-Phonetic Transcription," Ph.D. Dissertation, August 1988.

A. Jagharghi, "Color Display of Vowel Spectra as a Speech Training Aid for the Deaf," M.S. Thesis, August 1985.

Elizabeth Effer, "An Investigation to Improve Linear Predictive Vocoder Pulse/Noise Models," M.E. Thesis, December 1985.

James Holland, "Block Encoding of Speech Spectral Principal Components," Master's Thesis, August 1984.

Paul E. Gordy, "Speech Spectral Modeling and Speech Synthesis Using Finite Impulse Response Digital Filters," M.E. Thesis, December 1982.

Last updated: June 12, 2012