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PERSONAL DATA

Current Position: Professor, Electrical and Computer Engineering, Clemson University
Citizen: USA

DEGREES

Ph.D., University of Virginia, 1979, Electrical Engineering
M.E., Rensselaer Polytechnic Institute, 1976, Electric Power Engineering
B.S., University of Virginia, 1975, Electrical Engineering, with Highest Distinction

PROFESSIONAL EXPERIENCE

Clemson University, 1989- : Professor of Electrical and Computer Engineering; 1985-89:
Associate Professor of Electrical and Computer Engineering (Tenured 1987)
Worcester Polytechnic Institute, 1983-85: Associate Professor of Electrical Engineering
(Tenured 1985); 1979-83: Assistant Professor of Electrical Engineering
Exxon Production Research Company, 1976-77: Engineer, Subsea Systems Section.
Houston, TX

AREAS OF SPECIALIZATION

Computer Vision and Image Processing, Pattern Recognition (including neural networks
and fuzzy systems), Artificial Intelligence.

PUBLICATIONS: Books and Monographs

Schalkoff, R.J., *Digital Image Processing and Computer Vision*, John Wiley and Sons, 1989, ISBN 0-471-85718-1.

Schalkoff, R.J., *Artificial Intelligence: An Engineering Approach*, McGraw-Hill, 1990, ISBN 0-07-055084-0.

Schalkoff, R.J., *Pattern Recognition: Statistical, Syntactic and Neural Approaches*, John Wiley and Sons, 1992, ISBN 0-471-52974-5.

Schalkoff, R.J., *Artificial Neural Networks*, McGraw-Hill, 1997, ISBN 0-07-057118-X.

Schalkoff, R.J., *Programming Languages and Methodologies*, Jones and Bartlett, 2007, ISBN 0-763-740594.

Schalkoff, R.J., *Intelligent Systems: Principles, Paradigms and Pragmatics*, to appear.

PUBLICATIONS: Invited Book Chapters

Herwig, C.M., and Schalkoff, R.J., "Morphological Image Processing Using Artificial Neural Networks, *Digital Image Processing: Techniques and Applications*, Control and Dynamic Systems, Advances in Theory and Applications, Vol. 67, (C.T. Leondes, ed), Academic Press, 1994, p. 319-379.

Herwig, C.B., and Schalkoff, R.J., "Implementing Morphological Image Operators Via Trained Artificial Neural Networks", in *Mathematical Morphology and Its Applications to Image and Signal Processing*, (P. Maragos, R.W. Schafer and M.A. Butt, eds.), Kluwer Academic Publishers, 1996, p. 245-252.

Invited contribution 'Pattern Recognition' in *Encyclopedia of Electrical and Electronics Engineering*, (J.G. Webster, ed), Volume 16, John Wiley and Sons, ISBN 0-471-13946-7, 1999, p. 10-26.

Invited contribution 'Expert and Rule-based Systems', in *The Internet Encyclopedia*, (H. Bidgoli, ed), John Wiley and Sons, 2003.

Invited contribution 'Pattern Recognition' in *Wiley Encyclopedia of Computer Science and Engineering*, (B. Wah, ed), John Wiley and Sons, accepted (to appear 2006).

PUBLICATIONS: Refereed Journals

Schalkoff, R.J., and McVey, E.S., "A Model and Tracking Algorithm for a Class of Video Targets", *IEEE Transactions on Pattern Analysis and Machine Intelligence*, Vol. PAMI-4, No. 1, p. 2-10, January 1982.

- Schalkoff, R.J., and Labuz, J., "New Results Using an Integrated Model and Recursive Algorithm for Image Motion Estimation", *Pattern Recognition Letters*, Vol. 2, No. 3, p. 179-183, March 1984.
- Schalkoff, R.J., "A Distributed Parameter Systems Approach to Feature Extraction and Motion Estimation in Image Sequences", *Image and Vision Computing*, Vol. 1, No. 4, p. 227-233, November 1983.
- Schalkoff, R.J., and Labuz, J., "A 3-D Surface Mapping Simulator: Theory, Capabilities and Operation", *Image and Vision Computing*, Vol. 3, No. 1, p. 36-39, February 1985.
- Schalkoff, R.J., "On the Recalibration of Moving Cameras in Stereo Vision Systems," *Image and Vision Computing*, Vol. 3, No. 3, p. 118-121, August 1985.
- Schalkoff, R.J., and Dzialo, K.A., "Control Implications in Tracking Moving Objects Using Time-Varying Perspective-Projective Imagery," *IEEE Transactions on Industrial Electronics*, Vol. IE-33, No. 3, p. 247-253, August 1986.
- Schalkoff, R.J., "A Note on the Effective Use of PC-Based Spread Sheets for Course Grading," *IEEE Transactions on Education*, Vol. E-29, No. 1, p. 42-45, February 1986.
- Schalkoff, R.J., "Automated Reasoning About Image Motion Using a Rule-Based System," *Image and Vision Computing*, Vol. 4, No. 2, p. 97-106, May 1986.
- Schalkoff, R.J., and Topa, L.C., "An Analytical Approach to the Determination of Planar Surface Orientation Using Active-Passive Image Pairs," *Computer Vision, Graphics, and Image Processing*, Vol. 35, No. 3, p. 404-418, September 1986.
- Schalkoff, R.J., "Analysis of the Weak Solution Approach to Image Motion Estimation," *Pattern Recognition*, Vol. 20, No. 2, p. 189-197, 1987.
- Schalkoff, R.J., "Dynamic Imagery Modelling and Motion Estimation Using Weak Formulations," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, Vol. PAMI-9, No. 4, p. 578-583, July 1987.
- Topa, L.C., and Schalkoff, R.J., "Edge Detection and Thinning in Time-Varying Image Sequences Using Spatio-Temporal Templates," *Pattern Recognition*, Vol. 22, No. 2, February 1989.
- Jamison, T.A., and Schalkoff, R.J., "Image Labelling Using a Neural Network and a Comparison with Alternative Approaches," *Image and Vision Computing*, Vol. 6, No. 4, November 1988.

- Schalkoff, R.J., and Nag, H., "A Decomposition and Parallel Architecture for the Geometric Transformation of Digital Images," *Image and Vision Computing*, Vol. 9, No. 5, October 1991, p. 275-283.
- Mousavi, M., and Schalkoff, R.J., "ANN Implementation of Stereo Vision: Feature Extraction and Disparity Determination," *IEEE Transactions on Systems, Man and Cybernetics*, Volume 24, No. 08, August 1994, p. 1220-1238.
- Shaaban, K. M. , and Schalkoff, R.J., "Design of Recursive Neural Pattern Associators By Optimizing Feedforward Sub-Network Generalization Properties," *Intelligent Engineering Systems Through Artificial Neural Networks*, Vol. 5, (Fuzzy Logic and Evolutionary Programming), C.H. Dagli, ed., ASME Press, 1995, p. 141-146.
- Schalkoff, R.J., Poole, K.F., and Singh, R., "Design and Implementation of an Expandable Feedforward Neural Network Chip," *Intelligent Engineering Systems Through Artificial Neural Networks*, Vol. 5, (Fuzzy Logic and Evolutionary Programming), C.H. Dagli, ed., ASME Press, 1995, p. 39-44.
- Busboom, A. and Schalkoff, R.J., "Direct Surface Parameter Estimation Using Structured Light: A Predictor-Corrector Based Approach," *Image and Vision Computing*, Vol. 14, No. 5, June 1996, p. 311-321.
- Busboom, A. and Schalkoff, R.J., "Active Stereo Vision and Direct Surface Parameter Estimation: Curve-to-Curve Image Plane Mappings ," *IEE Proc. on Vision, Image and Signal Processing*, Vol. 143, No. 2, April 1996, p. 109-117.
- Schalkoff, R.J., Invited discussion on "Prediction of Estuarine Instabilities with Artificial Neural Networks, *ASCE Journal of Computing in Civil Engineering*, Volume 9, No. 4, April 1997.
- Sorgel, W., and Schalkoff, R.J., "An Efficient and Accurate Structured Light Algorithm for Direct Measurement of Cylindrical Surface Parameters", *Optical Engineering*, Vol. 36, No. 1, January 1997, p. 73-84.
- Geist, R., Stinson, T., Schalkoff, R.J., and Gurbuz, S., "Autonomous Virtualization of Real Environments for Telepresence Applications", *Presence*, Vol. 6, No. 6, December 1997, p. 645-657.
- Sorgel W., and Schalkoff, R.J., "Direct Surface Parameter Determination Using an Enhanced Line-to-Curve Mapping Approach", *Optical Engineering*, Vol. 36, No. 7, July 1997, p. 2000-2009.
- Shaaban, K.M., and Schalkoff, R.J., "Synthesis of Cascade Recurrent Neural Networks Using Feedforward Generalization Properties", *Information Sciences*, Vol 108, (1998), pp. 207-217.

Carver, A., and Schalkoff, R.J., "Deformation Detection on Composite Reflectance Surfaces Using Two-Image Photometric Stereo", *Optical Engineering*, Vol. 40, No. 2, February 2001, p. 295-302.

PUBLICATIONS: Refereed Conference Proceedings

Schalkoff, R.J., and McVey, E.S., "Algorithm Development for Real-Time Automatic Video Tracking Systems", *3rd International Computer Software and Applications Conference*, p. 504-511, Chicago, IL, November 1979.

Schalkoff, R.J., "Video Tracking from the Control Viewpoint: Designing a New Type of Distributed Parameter System Regulator", *Proc. 1981 Joint Automatic Control Conference*, Charlottesville, VA, June 1981.

Schalkoff, R.J., "Dynamic Imagery Analysis Via Distributed Parameter Systems: Characteristics, Discontinuities, Weak Solutions and Shocks", *Proc. IEEE 1982 Conference on Pattern Recognition and Image Processing*, p. 119-125, Las Vegas, NV, June 1982.

Schalkoff, R.J., "Image Motion Analysis Using the Concept of Weak Solutions to Distributed Parameter Systems", *Proc. 1983 IEEE Computer Vision and Pattern Recognition Conference*, p. 232-239, Washington, DC, June 1983.

Schalkoff, R.J., and Labuz, J., "An Integrated Spatio-Temporal Model and Recursive Algorithm for Image Motion Estimation", *Proc. Seventh International Conference on Pattern Recognition*, p. 530-533, Montreal, Canada, August 1984.

Schalkoff, R.J., and Labuz J., "Designing a Simulator for 3-D Surface Mapping", *Proc. IEEE Southeastcon '85*, March 1985.

Schalkoff, R.J., "A Parallel Decomposition and Architecture for Implementing Geometric Image Transforms", *Proc. IEEE 1985 Workshop on Computer Architecture for Pattern Analysis and Image Database Management*, p. 292-297, Miami Beach, FL, November 1985.

Schalkoff, R.J., "An Integral Transform Technique for Noise Sensitivity Reduction in the TSVIP Video Tracking Algorithm", *Proc. IEEE Southeastcon '80*, p. 89-90, April 1980.

Schalkoff, R.J., "Towards an Efficient, Dedicated Architecture for a Digital Geometric Image Transformer (DGIT)," *Computer Architecture News (ACM-SIGARCH)*, Vol. 11, No. 4, September 1983.

Schalkoff, R.J., "Contextual Image Motion Estimation and Analysis Using Spatio-Temporal Primitives", *Applications of Artificial Intelligence*, Proc. SPIE Vol. 485, p. 180-188, May 1984.

- Schalkoff, R.J., "Tracking Non-Textured Video Targets: A Solvable Problem in Distributed Parameter Systems", *Proc. IEEE Southeastcon '81*, p. 583-587, April 1981.
- Schalkoff, R.J., and Warnekar, C.S., "A Predictor-Corrector Approach to Tracking 3-D Objects Using Perspective-Projected Images", *Proc. IEEE Southeastcon '82*, p. 371-374, Ft. Walton Beach, FL, April 1982.
- Schalkoff, R.J., "Video Tracking Problem Hierarchy and Solution Approaches", *Proc. IEEE Southeastcon '82*, p. 525-528, Ft. Walton Beach, FL, April 1982.
- Schalkoff, R.J., "Video Tracking System Design Via Distributed Parameter Identification and Control", *Proc. IEEE Southeastcon '82*, p. 529-532, Ft. Walton Beach, FL, April 1982.
- Schalkoff, R.J., "Parallel Implementation of Digital Geometric Image Transforms Using a Bit-Plane Approach", *Proc. 1985 SPIE Intelligent Robots and Computer Vision Conference*, Cambridge, MA, September 1985.
- Schalkoff, R.J., and Topa, L.C., "A Production System for Image Motion Analysis," *Proc. 18th Southeastern Symposium on System Theory*, p. 48-52, Knoxville, TN, April 1986.
- Schalkoff, R.J., "Development of High-Resolution Digital Image Mosaic from Low-Resolution Sensors Using Image Processing Techniques," *Proc. 18th Southeastern Symposium System Theory*, p. 42-46, Knoxville, TN, April 1986.
- Bagley, M.J., Girgis, A.A., and Schalkoff, R.J., "Development of an Expert System for Identification of Faulted Sections in a Transmission System" *Proc. 19th Southeastern Symposium on System Theory*, p. 121-125, Clemson, SC, March 1987.
- Wang, X., and Schalkoff, R.J., "An Edge Relational Structure Matching Approach to Multiple Object Motion Estimation," *Proc. 19th Southeastern Symposium on System Theory*, p. 529-533, Clemson, SC, March 1987.
- Topa, L.C., Kegley, K.A., and Schalkoff, R.J., "High-Level Models for Image Representations," *Proc. 19th Southeastern Symposium on System Theory*, p. 144-149, Clemson, SC, March 1987.
- Glidewell, S.R., Baxa, E.G., and Schalkoff, R.J., "Design of a Multiple Electronic Sensor Acquisition and Display Workstation for Advanced Tactical Surveillance Systems Studies," *Proc. 19th Southeastern Symposium on System Theory*, p. 551-555, Clemson, SC, March 1987. (Also in *Proc. National Aerospace and Electronics Conference, NAECON '87*, Dayton, OH, May 1987).
- Schalkoff, R.J., "Integrating Artificial Intelligence Into the Undergraduate Engineering Curriculum," *Proc. 20th Southeastern Symposium on System Theory*, p. 91-94, Charlotte, NC, March 1988.

- Jamison, T.A., and Schalkoff, R.J., "An Alternative Approach to Image Labelling Using Neural Networks," *Proc. 20th Southeastern Symposium on System Theory*, p. 95-99, Charlotte, NC, March 1988.
- Nag, H., and Schalkoff, R.J., "A Generalized Two-Pass Approach to Image Geometric Transform Implementation: Theory and Ramifications," *Proc. 20th Southeastern Symposium on System Theory*, p. 202-206, Charlotte, NC, March 1988.
- Jamison, T.A., and Schalkoff, R.J., "Feature Extraction and Shape Classification of 2-D Polygons Using a Neural Network", *Proc. Southeastcon '89*, p. 953, Columbia, SC, April 1989.
- Wang, X., and Schalkoff, R.J., "A Model-Based Viewpoint Determination Method for Multiple Object 3-D Motion Estimation," *Proc. Southeastcon '89*, p. 1074-1079, Columbia, SC, April 1989.
- Mousavi, M., and Schalkoff, R.J., "A Neural Network Approach for Stereo Vision," *Proc. IEEE Southeastcon '90*, p. 808-812, New Orleans, LA, April 1990.
- Topa, L.C., and Schalkoff, R.J., "A Qualitative Approach to Object Structure and Motion Analysis," *Proc. Workshop on Qualitative Vision AAAI-90*, Boston, MA, August 1990.
- Mousavi, M., and Schalkoff, R.J., "Stereo Vision: A Neural Network Application to Constraint Satisfaction," *SPIE Proc. on Intelligent Robots and Computer Vision IX: Neural, Biological and 3-D Methods*, SPIE, Vol. 1382, Boston, MA, November 1990.
- Mousavi, M., and Schalkoff, R.J., "A Parallel Distributed Algorithm for Feature Extraction and Disparity Analysis of Computer Images," *Proc. Second IEEE Symposium on Parallel and Distributed Processing*, Dallas, TX, December 1990.
- Schalkoff, R.J., and Wang, X., "Model-Based, Multiple Sensor Dynamic Scene Interpretation," *Proc. SPIE*, Vol. 1609, Model-Based Vision Development and Tools, November 1991.
- Liburdy, K.A., and Schalkoff, R.J., "Model-Based Object Classification Using Unification Grammars and Abstract Representation," *Proc. SPIE Model-Based Vision Conference*, Vol. 1827, Boston, MA, November 1992.
- Schalkoff, R.J., Poole, K.F., Singh, R., Owens, R.E., Gowdy, J.N., and Turner, A.E., "Design and Implementation of the ACU: An Expandable ANN Building Block," *Proc. 1992 Government Neural Network Applications Workshop*, (GNN92), Dayton, OH, August 1992.
- Schalkoff, R.J., et al., "Design and Implementation of a Neural Network Building Block," *Proc. Southeastcon '93*, Charlotte, NC, March 1993.

- Schalkoff, R.J., et al, "Design Considerations for a Intelligent Mobile Robot for Mixed Waste Inspection", *Proc. Second International Mixed Waste Symposium*, Baltimore, MD, August 17-20, 1993.
- Busboom, A. and Schalkoff, R.J, "A Novel Approach to Direct Surface Parameter Estimation Using Structured Light," *Proceedings of the SPIE*, Vol. 2488, "Visual Information Processing IV", April 1995, p. 57-69.
- Shaaban, K.M., and Schalkoff, R.J., "Image Processing and Computer Vision Algorithm Selection and Refinement Using An Operator-Assisted Meta-Algorithm," *Proceedings of the SPIE*, Vol. 2488, "Visual Information Processing IV," April 1995, p. 77-87.
- Shaaban, K.M, and Schalkoff, R.J., "Synthesis Of Cascade Recurrent Neural Networks Using Feedforward Generalization Properties," *Proc. Second Annual Joint Conference on Information Sciences*, Wrightsville Beach, NC, Sept, 1995, p. 145-148 (invited paper).
- Sorgel, W., Garrison, A., Whitehouse, J. and Schalkoff, R.J., "Extending Fuzzy Systems Concepts for Control of a Vitrification Melter," *Proc. Second Annual Joint Conference on Information Sciences*, Wrightsville Beach, NC, Sept, 1995, p. 9-12 (invited paper).
- Schalkoff, R.J., Shaaban, K.M., and Carver, A.E., "Image Processing Algorithm Design and Implementation for Real-Time Autonomous Inspection of Mixed Waste" , *Proc. SPIE Visual Communications and Image Processing Conference*, Vol. 2727, Orlando, FL., March 1996, p. 749-760.
- Gurbuz, S., Carver, A., and Schalkoff, R.J., "Surface Blemish Detection from Passive Imagery Using Learned Fuzzy Set Concepts", *Proc. IEEE Southeastcon '97*, April 1997, p. 310-314.
- Schalkoff, R.J., "Geometric Elements of the Direct and Autonomous Virtualization of Quadric Environments", *Proceedings Robotics '98, American Society of Civil Engineers*, Albuquerque, NM, April 1998, p.71-77.
- Geist, R., Vernon, D., and Schalkoff, R.J., "Rendering Inversion in the Automated Construction of Virtual Environments", *Proceedings Robotics '98, American Society of Civil Engineers*, Albuquerque, NM, April 1998, p. 85-91.
- Schalkoff, R.J., Carver, A.E., and Gurbuz, S., "Image Segmentation Using Trainable Fuzzy Set Classifiers", *SPIE Proc. Visual Information Processing VIII*, Vol. 3716, Orlando, Fl., April 1999, p. 9-17.
- Schalkoff, R.J., and Shaaban, K.M., "Image Processing Meta-Algorithm Development Via Genetic Manipulation of Existing Algorithm Graphs", *SPIE Proc. Visual Information Processing VIII*, Vol. 3716, Orlando, Fl., April 1999, p. 61-70.

Geist, R., Rasche, K., Westall, J., and Schalkoff, R., "Lattice-Boltzmann Lighting," *Rendering Techniques 2004 (Proc. Eurographics Symposium on Rendering)*, Norrköping, Sweden, June, 2004, pp. 355 - 362, 423.

PUBLICATIONS: In Preparation

Schalkoff, R.J., *Intelligent Systems: Principles, Paradigms and Pragmatics*, in preparation.

PUBLICATIONS: Technical Reports

"A Glass Blending Algorithm for TVS Using Neural Networks", (Final Report for WSRC Task Order #130), TR 0915-5555-0597F , Department of Electrical and Computer Engineering, Clemson University, May, 1997.

"Fuzzy Control System for a Vitrification Melter" (Final Report for WSRC Task Order #130), TR 0915-5555-1095F , Department of Electrical and Computer Engineering, Clemson University, October 31, 1995.

"Software Structure and Interim Code for a Modular and Extendable Image Processing System", TR-04 3093-0915I, Department of Electrical and Computer Engineering, Clemson University, April 1993.

"Planning with Subgoals Generated from Abstraction Space," TR-010293-0915F, Department of Electrical and Computer Engineering, Clemson University, February 1993.

"Artificial Neural Network Implementation of Binary Morphological Operators, Part I: Background and Extended Training Results," TR-040192-0915F, Department of Electrical and Computer Engineering, Clemson University, April 1992.

"Artificial Neural Network Implementation of Binary Morphological Operators, Part II: General Results," TR-050192-0915F, Department of Electrical and Computer Engineering, Clemson University, May 1992.

"A Decomposition and Parallel Architecture for the Geometric Transformation of Digital Images," TR-083188-0915F, Department of Electrical and Computer Engineering, Clemson University, August 1988.

"Image Labelling Via a Neural Network Approach and a Comparison with Alternative Approaches," TR-112587-3101F, Department of Electrical and Computer Engineering, Clemson University, August 1988.

"Integration of Artificial Intelligence into the Undergraduate Engineering Curriculum: Rationale, A Proposal Course Structure and Unresolved Issues," TR-010588-0915P, Department of Electrical and Computer Engineering, Clemson University, January 1988.

"Object Structure and Motion Determination from an Image Sequence Using Spatio-Temporal Primitives and a Rule-Based System," TR-112987-2696F, Department of Electrical and Computer Engineering, Clemson University, November 1987.

"Visual Information Acquisition, Processing and Display," TR-100187-2906F, Department of Electrical and Computer Engineering, Clemson University, June 1987.

"Scene Modelling and Algorithm Development for Automatic Video Tracking Systems," ECS-8204472, Electrical Engineering Department, Worcester Polytechnic Institute, February 1985.

PUBLICATIONS: Other Scholarly Publications

Schalkoff, R.J., "Review of MuLisp 86 Ver. 5.02," Byte, Vol. 11, No. 10, October 1986, p. 249-254.

Schalkoff, R.J., Landes, H.S., and Wirtz, M.J., "Innovations in the Faraday Machines Laboratory," ERM Magazine, Vol. 12, No. 1, December 1979.

PRESENTATIONS

Schalkoff, R.J., "Tutorial on Image Motion Analysis," presented at Electronic Imaging International, October 1991. (1/2 day seminar for industrial, government and academic attendees).

Schalkoff, R.J., Baxa, E.G., and Glidewell, S.R., "Lockheed-Georgia/ Clemson Sensor Testbed Status Report," presented at Lockheed Corp. Microelectronics and Signal Processing Symposium, Lockheed Palo Alto Research Laboratory, Palo Alto, CA, October 7-9, 1986.

Schalkoff, R.J., "An Introduction to Fuzzy Systems in Engineering," IEEE Student Branch, Dec. 1, 1994.

"An Intelligent Inspection and Survey Robot", DOE Forum on Robotics for Environmental Remediation, Albuquerque, NM, July 23-25, 1996.

"Engineering Without Understanding (Or How I learned to Love Fuzzy Systems Techniques)", Sigma Xi Annual Banquet, April 17, 1998.

"Advanced Sensing and Control Techniques to Facilitate Semi- Autonomous Decommissioning of Hazardous Sites", First Annual DOE Environmental Management Science Program Workshop, Rosemont, Ill, July 27-30, 1998.

"Advanced Sensing and Control Techniques to Facilitate Semi- Autonomous Decommissioning of Hazardous Sites", EMSP National Workshop, Atlanta, GA, April 24-27.

SPONSORED RESEARCH

- "Scene Modelling and Algorithm Development for Automatic Video Tracking Systems", National Science Foundation, (1980-1982), Principal Investigator, \$40,000.
- "Scene Modelling and Algorithm Development for Automatic Video Tracking Systems", (Renewal), National Science Foundation (1982-1984) Principal Investigator, \$48,000.
- "Robotic Adaptive Scene Tracking/Multimodal Electronic Systems Integration", Wright-Patterson AFB, (1983-1984) Co-Principal Investigator, \$92,000.
- "Estimation and Structural Analysis of Image Motion Using Weak Solution-Based Spatio-Temporal Features", National Science Foundation, (1985-1988), \$92,000.
- "Development of a Multiple Electronic Sensor Acquisition and Display Workstation for Advanced Tactical Surveillance Systems Studies," Lockheed Georgia Company, January-August 1986, Co-Principal Investigator, \$42,897.
- "Technology Assessment of Small Business Computer-Based Workstation for Visual Information Acquisition, Processing and Display," NCR Corporation, June 1986 -September 1987, \$33,085.
- "Intelligent Inspection and Survey Robot," U.S. Dept. of Energy, Co-principal investigator (Intelligent Image Processing), Phases 1-2-3, 8/92-12/97, \$4,100,000 total project funding; my expenditures were \$808,822.
- "High-Speed Digital Neural Networks," NSF, Co-Principal Investigator, August 1992-April 1995, \$210,000/yr.
- "Design and Implementation of Expert System Control Algorithms Using Multivalued Logic," Westinghouse Savannah River (through (SCUREF), May 1, 1994-December 31, 1996, \$73,872.
- "Advanced Sensing and Control Techniques to Facilitate Semi-Autonomous Decommissioning of Hazardous Sites", U.S. Dept. of Energy, Principal Investigator, 9/96-9/00, \$870,733.
- "Virtual Servoing of Serpentine Robots for Enhanced Manipulation", NSF/EPSCoR, Co-Investigator, 1/99-12/01, \$400,000.
- "Modeling", (Thrust 1, Topic 1), The Center for Advanced Engineering Fibers and Films (CAEFF), National Science Foundation Engineering Research Center, 1 month/yr (current).

OTHER SPONSORED ACTIVITY

- "Development of a Modern Educational Power Systems/Control Laboratory",
Westinghouse Educational Foundation, (1980-1982) Principal Investigator, \$100,000.
- "Purchase of Image Acquisition and Analysis Equipment", National Science Foundation,
(1981-1982), \$34,000.
- "Engineering Research Equipment Grant: Image Acquisition and Analysis System,"
National Science Foundation, August 1986, \$88,605.
- "Modeling, Simulation and Virtualization of Physical Phenomena" (with R. Geist, et.al),
NSF, 1997-2000. Purchase of SGI Reality Monster, \$400,000.
- Robotic Equipment Grant: "Barrett Robot Hand System", National Science Foundation,
\$190,000, OIA-9977310, 9/1/99 - 9/1/00.

MEMBERSHIPS AND AWARDS

- Fellow, Society of Photo-Optical Instrumentation Engineers (SPIE).
- Senior Member, Institute of Electrical and Electronic Engineers (IEEE).
- Member, Tau Beta Pi, Eta Kappa Nu and Sigma Xi.
- Member, Association for Computing Machinery (ACM).
- Member, American Association for Artificial Intelligence (AAAI).
- Member, IEEE Computer Society Pattern Analysis and Machine Intelligence Technical
Committee.
- 1998 Faculty Researcher of the Year Award, Sigma Xi, Clemson University Chapter (see
<http://ece.clemson.edu/misc/schalkoff.htm>).
- 1999 Clemson University Board of Trustees Award for Faculty Excellence.
- 1999 Provost's Award for Scholarly Achievement.
- 2000 Clemson University Board of Trustees Award for Faculty Excellence.
- 2001 Clemson University Board of Trustees Award for Faculty Excellence.
- Joseph Samuel Satin Distinguished Fellow in Electrical Engineering (WPI), 1984.

CONSULTING EXPERIENCE

Norton Company, Worcester, MA, Industrial Ceramics Division, Design of Igniters (Proprietary).

Dolan-Jenner Industries, Woburn, MA, Integration of Fiber Optics with Computer Vision Systems.

Electronic Space Systems Corporation, Concord, MA, Development of Computer Control Algorithms for Solar Concentrator Positioning.

Electroswitch Corporation, Weymouth, MA, Design of Binary-Encoded Switches for Computer Interface.

Raytheon Company, Missile Systems Division, Bedford, MA, Registration Techniques for High-Resolution IR Imagery.

NCR Corporation, Microelectronics Division, Applications of the NCR 45CG72 Geometric Arithmetic Parallel Processor (GAPP).

Applied Intelligent Systems, Inc., Ann Arbor, MI, Image registration software.

GRADUATE STUDENT ADVISING- Doctoral

L. Topa (Ph.D., EE), "A Rule-Based Expert System for the Determination of Object Structure and Motion Information From a Sequence of Digital Images," December 1987.

X. Wang (Ph.D., EE), "A Model-Based Vision System for Multiple Object 3-D Motion Interpretation," December 1988.

M. Mousavi (Ph.D., EE), "Computer Stereo Vision for 3-D Object Location Using a Neural Network," August 1990.

K.A. Liburdy (Ph.D., CpE), "Object Classification in High Level Vision: A Unification Based Approach," May 1991.

S.M. Banks (Ph.D., CpE), "A Feature Structure-Based Representation and Manipulation Tool for Model-Based Vision," May 1995.

K. M. Shaaban (Ph.D., EE), "Alternative Training Algorithms for Autoassociative Recurrent Neural Networks," Dec. 1995.

A. E. Carver (Ph.D., EE), "Photometric Stereo," December 1997.

GRADUATE STUDENT ADVISING- Masters

- H. Nag (M.S., CpE), "A Decomposition and Parallel Architecture for the Geometric Transformation of Digital Images," August 1988.
- T. Jamison (M.S., CpE), "Visual Classification of 2-D Polygonal Objects Using a Neural Network Architecture," December 1988.
- C. Cox (M.S., EE), "An Application of Artificial Feedforward Neural Networks to Binary Image Classification and Motion Estimation," May 1990.
- S. Nugroho (M.S., EE), "Learning by Generalization-Incremental vs. Batch Approaches," December 1990.
- R.D. Ferrell (M.S., CpE), "An Attributed Relational Graph Matching Procedure and Distance Measure for Structural Pattern Classification," May 1991.
- R.R. Kinner (MEng, EE), "A Menu Driven Trouble Shooter for the Digital Conferencing and Switching System", May 1991.
- U.M. Balasubramanian (M.S., CpE), "Artificial Neural Network Design for Image Morphology," May 1993.
- C. Herwig (M.S., CpE), "Connectionist Approach to Binary Morphological Transformations," May 1992.
- M. Rawles (MEng, EE), "Underwater Video System", October 1992.
- S. King (M.S., EE), "Generating Plans Using Artificial Neural Networks," December 1992.
- J. Millard (M.S., CpE), "Planning Using Abstraction Spaces," December 1992.
- M. Kraess (M.S., EE), "A Vision Module for the Determination of Surface Parameters", May 1993.
- A. Busboom (M.S., EE), "Direct Surface Parameter Estimation Using Structured Light", August 1994.
- J. Stafford, Jr. (MEng, EE), "Channel Processor Software Design", November, 1994.
- D. Overby (MEng, EE), "ModCat: A Computerized Service Models Catalog", April 1995.
- W. Sorgel (M.S., EE), "Active Stereo Vision," August 1995.
- A. Garrison (M.S., EE), "Fuzzy Controller Design and Implementation," December 1995.
- F.Gray (M.S., EE), "Neural Network Control of a Vitrification Melter", May 1997.

- S. Gurbuz, (M.S., EE), "Adaptive Image Segmentation Using Pipelined Hardware", December 1996.
- S. Mahoney, (M.S., EE), "Vision Head Design for Quadric Parameter Estimation", December 1998.
- C. Rumpf, (M.S., CpE), "Implementation of Quadric Parameter Estimation Algorithms", December 1998.
- Yu Saiyue (M.S., EE), "Autonomous Virtualization of Quadric Environments", August 1999.
- Raghavan Venugopal, (M.S.,CpE), "Recalibration of Moving Sensors for Autonomous Virtualization", May 2001.
- Karthitheyian Subramanian (M.S.,EE), "Meta-Algorithms for Image Processing", December 2001.
- Kiran Jayanthi (M.S., EE), "Automatic Shape Recognition Using B-Splines and Fuzzy Set Concepts", May 2002.

POSTDOCTORAL STUDENTS

- Dr. Khaled M. Shaaban, Electrical Engineering Dept., Assiut University, Assiut Egypt, July-October 1988.
- Dr. Jae Heum Joo, Department of Computer Science, Jisan College, Pusan, Korea, January 2001-January 2002.

UNDERGRADUATE STUDENT ADVISING

- Honors Program (various courses), Clemson University.
- Undergraduate Honors Research Project Advisor.
- NSF Research Experience for Undergraduates (Clemson Summer Undergraduate Research Experience Program), Advisor, Summers 1997, 1998 and 1999.

OTHER ADVISING

- Advisor for SC Governor's School for Science and Mathematics.

TEACHING

- Courses Taught

At Clemson University**Graduate:**

- ECE 847 Digital Image Processing
- ECE 856 Pattern Recognition
- ECE 855 Artificial Intelligence
- ECE 893 Stochastic Processes and Applications
- ECE 872 Artificial Neural Networks

Undergraduate/Graduate:

- ECE 302 Linear Control Systems
- ECE 352 Programming Systems
- ECE 410/610 Digital Control Systems
- ECE 429/629 Computer Architecture
- ECE 442/642 Knowledge Engineering
- ECE 450/451 Computer System Design Project

At Worcester Polytechnic Institute**Graduate:**

- EE 545 Digital Image Processing
- EE 500 State Space Analysis of Linear Systems
- EE 541 Synthesis of Linear Control Systems
- EE 543 Uncertain Dynamic Systems

Undergraduate:

- ES 4012 Control Engineering II
- EE 4802 Digital Computer Organization
- EE 2002 Fundamentals of Electrical Engineering II
- EE 3202 Instrumentation Systems

UNIVERSITY AND PUBLIC SERVICE

Committees:

Department:

Executive Committee
Advisory Committee (elected)
Promotion and Tenure Committee (Chairman)
Post-Tenure Review Committee
Graduate Committee (Chairman)
Curriculum Committee
Communications and Digital Signal Processing Subject Area Committee
Computer Systems Architecture Subject Area Committee
Faculty Recruiting Committee (Chairman)
Dept. Head Recruiting Committee
Library Representative

College:

College of Engineering Computer Advisory Committee
Post-Tenure Review Committee (Mechanical Engineering)

University:

Faculty Senate
Faculty Senate Policy Committee
Faculty Senate Research Committee
University Computer Advisory Committee
University Faculty Grievance Committee
Class of '39 Award for Excellence Selection Committee

BOOK REVIEWS

Natural Language Communication with Pictorial Information Systems, Computer, Vol. 19, No. 2, p. 98, February 1986.

POP-11: A Practical Language for Artificial Intelligence, Image & Vision Computing, Vol. 4, No. 2, p. 120-121, May 1986.

Mapping Information: The Graphic Display of Quantitative Information, Computer, Vol. 17, No. 11, p. 133, November 1984.

OTHER PROFESSIONAL ACTIVITY

Associate Editor, *IEEE Transactions on Image Processing*.

Editorial Board, *Image and Vision Computing*.

Elected Faculty Senator to represent College of Engineering (1988-1991).

ECE Graduate Program Coordinator, 1988-1989. Responsibilities of this half-time administrative position included chairing the Graduate Committee, which makes policies for departmental graduate programs, making M.S. and Ph.D. admissions decisions and financial aid recommendations, coordinating M.S. and Ph.D. exams, monitoring the graduate student budget, appointments and payroll, interacting with the Graduate School, and coordinating graduate student recruiting.

Technical Program Chairman, 19th Southeastern Symposium on System Theory, Clemson, SC, March 15-17, 1987.

Reviewer for:

- IEEE Transactions on Biomedical Engineering
- IEEE Transactions on Circuits and Systems for Video Technology
- Image and Vision Computing
- IEEE Transactions on Systems, Man and Cybernetics
- IEEE Transactions on Pattern Analysis and Machine Intelligence
- IEEE Journal of Robotics and Automation
- IEEE Transactions on Education
- IEEE Transactions on Neural Networks
- IEEE Computer
- IEEE Transactions on Image Processing
- IEEE Transactions on Knowledge and Data Engineering
- IEE Proceedings on Vision, Image and Signal Processing
- Information Sciences
- Journal of Real-Time Imaging
- Computer Vision, Graphics and Image Processing
- Computer Vision and Image Understanding
- McGraw-Hill, (Computer Science/Engineering)
- John Wiley, (Electrical and Computer Engineering)
- Kluwer Academic Publishers
- NSF Research Proposal Referee (various programs and divisions)
- Reviewer for DOE (Engineering Research Program, Office of Basic Energy Sciences)

- Reviewer for ARO

Participant, VLSI Institute for University Professors, Digital Equipment Corporation, Summer, 1983.

Participant, "Sensing and Neutralizing Mines," Sponsored by U.S. Army Belvoir RD&E Center and Army Research Office, Charleston, SC, October 16-17, 1986.

EXTRACURRICULAR ACTIVITIES

Bicycling, scuba diving, rock climbing, sailboarding, music.

REFERENCES

Upon Request