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Research Interests

Multi-sensor fusion, image enhancement, non-linear image processing algorithms and optimization for remote sensing; compression and restoration, image classification, and computer vision algorithms; neural networks.

Accomplishments

- Co-developed and patented a new non-linear image enhancement algorithm that provides simultaneous dynamic range compression and color rendition. Co-developed and patented techniques to optimize the algorithm. Co-developed the commercial software package *PhotoFlair* that implements this algorithm.
- Taught graduate and undergraduate courses at the Electrical and Computer Engineering Department at the Old Dominion University, and at the Computer Science Department, and the Applied Science Department at the College of William & Mary.
- Developed computer simulations for an end-to-end model of imaging that includes image gathering, compression, and restoration. This simulation performs system design trade-offs.
- Conducted research on the optimal integration of electro-optical design with digital image processing including lossy and lossless image compression.
- Developed the lossy wavelet compression algorithm and code, and the cloud detection code for the Small Spacecraft Technology Initiative (SSTI) Clark mission.

Educational Background

- *Ph.D. Electrical Engineering*,
University of Virginia, August 1989.
Major: Pattern Recognition and Image Processing.
Minors: Digital Computer Systems, Control Systems.
Ph.D. Dissertation: *Algorithms for a Neural Network Implementation of Autonomous Visual Flight Control Using Optical Trajectories*
- *M.S. Electrical Engineering*,
University of Virginia, August 1986.
Major Areas of Study: Image Processing, Control Systems.
Master's Thesis: *Motion Detection Using A Biologically Based Sensor*
- *B.A. Physics and Mathematics*, magna cum laude,
Ripon College, Ripon, Wisconsin, May 1984.

Research and Work Experience

- Old Dominion University, Norfolk, Virginia
Virginia Modeling, Analysis, and Simulation Center (VMASC)
Associate Professor of Electrical and Computer Engineering (July 2006–present)
 - Classes taught:
 - ECE 481/581: Digital Signal Processing
 - ECE 783/883: Digital Image Processing
 - ECE 695/895: Imaging Technologies for Homeland Security
 - MSIM 695: Imaging Technologies for Homeland Security
 - College of William & Mary, Williamsburg, Virginia
Research Assistant Professor of Computer Science (July 1996–May 2001)
Research Associate Professor of Applied Science (May 2001–July 2006)
 - Conducting research on
 - * multi-sensor fusion for better visibility in poor visibility conditions
 - * multi-sensor fusion for environment understanding in unstructured environments
 - * image enhancement for consumer, medical, forensic, and video applications
 - * integrated compression and restoration of sensor data from different sensor sources.
- Adjunct Assistant Professor of Computer Science (May 1996–present)
- Taught the following graduate courses:
 - * Digital Image Processing
 - * Text and Data Compression
 - Taught the following undergraduate course:
 - * Discrete Structures in Computer Science
 - * Computer Networks
 - * Computer Architecture
- TruView Imaging Company, Hampton, Virginia
Vice President, Research & Development (1996–present)
 - Optimized and developed software for image enhancement based upon the non-linear, Multiscale Retinex algorithm that culminated in the release of *PhotoFlair for Windows* in December 2001 and for *PhotoFlair for Mac OS X* in December 2002 .
 - Investigating the application of the Multiscale Retinex algorithm to fields such as medical imaging, and forensic imaging.
- Science and Technology Corporation, Hampton, Virginia
Research Scientist — NASA Langley Research Center
(September 1989 – June 1996)
 - Conducted research in integrated image compression, restoration, and enhancement.

- University of Virginia
 - Department of Electrical Engineering:
Graduate Research Assistant, Computer and Control Laboratory,
(August 1984 – August 1987, January 1988 – August 1989)
 - Department of Electrical Engineering:
Graduate Teaching Assistant, *Digital Logic Design*,
(August 1987 – December 1987)
 - Department of Pharmacology:
Programmer and Assistant System Administrator,
(August 1987 – August 1988)

Personal Information

- **Citizenship:** United States of America (naturalized 1993)
- **Date of birth:** 19 January, 1962
- **Marital Status:** Married
- **Sex:** Male

Honors & Affiliations

- Faculty Teaching Award, ECE Department, 2008.
- Senior Member IEEE, 2007–present.
- The NASA Public Service Medal, 2005.
- The Willcox & Savage Excellence in Innovation Award, 2005.
- Certificates of Recognition for Patent Grants, 2005.
- Certificate of Special Recognition for nomination to NASA Invention of the Year Award, 2004.
- NASA Group Achievement Award for the Space Shuttle Columbia Investigation Team, 2004.
- The NASA Langley Paul F. Holloway *Non-Aerospace Technology Transfer* Award, 2003.
- The NASA Space Act Award, 1999.
- The NASA Langley Research Center H.J.E. Reid Award for *Outstanding Research Paper*, 1998.
- Listed in *Marquis Who's Who in Science and Engineering*, 1997.
- Ripon College Outstanding Young Alumni Award, 1994.
- Member IEEE, 1989–2007.
- Member SPIE, 1990,1995–present.
- Member OSA, 2001–present.
- Tau Beta Pi (National Engineering Honor Society), 1989.
- Student Member IEEE, 1986–1987.
- Phi Beta Kappa (National Liberal Arts Honor Society), 1984.
- Sigma Pi Sigma (National Physics Honor Society), 1983.
- Senior Mathematics Award, Ripon College, 1984.
- William Harley Barber Physics Award, Ripon College, 1984.
- Laurel Society (Ripon College Honor Society), 1984.
- Ripon College Dean's List, 1981–1984.

Patents

1. “A Method for Improving Digital Images,” US Patent #5,991,456, (1999). Australia Patent #713706 (international number: US97/07996) (2000). EPO Patent #0901671 (Belgium, Denmark, Finland, France, Germany, United Kingdom, Ireland, Italy, Spain, Netherlands, Sweden, and Switzerland) (2003). Canada Patent #2256670 (2006).
2. “Method of Improving A Digital Image As A Function of Its Dynamic Range,” US Patent #6,834,125, (December 2004).
3. “Method of Improving A Digital Image Having White Zones,” US Patent #6,842,543, (January 2005).
4. “System and Method for Identification and Quantification of Sonar Targets in Liquid Medium,” US Patent #7,221,621, (May 2007).

Research Grants and Cooperative Agreements

1. “Smart Sensor Processing for Automatic Runway Hazard Detection,” NASA Langley Research Center Cooperative Agreement #NNL07AA02A, \$565,000, March 01, 2007–Feb 28, 2011.
2. “Multi Sensor Concepts for Wave Detection and Avoidance,” \$101K: *US Navy, Combatant Craft Division*. (with W. Lawrence (Electrical Engineering Technology) and V. Asari (ECE)), 2007–2008.
3. “Multi-Sensor Fusion and Enhancement for Terrain Verification,” NASA Langley Research Center Cooperative Agreement #NNL04AA02A, \$433,820, March 01, 2004–Feb 28, 2007.
4. “Multi-sensor Fusion and Enhancement for Object Detection,” NASA Langley Research Center Cooperative Agreement #NNL04AA51G, \$10,789, May–July, 2004.
5. “Development and application of non-linear image enhancement and multi-sensor fusion techniques for hazy and dark imaging conditions,” NASA Langley Research Center Cooperative Agreement #NCC-1-01030, \$361,702, 2001–2004.
6. “Development of Image Processing Algorithms for Identification and Quantification of Biological Targets Detected by Side Scan Sonar: Application to Fisheries Stock Assessments from Robotic Platforms,” Sea Grant Technology Program, U.S. Department of Commerce, \$89,675 (with M. R. Patterson, and R. Mann, Virginia Institute of Marine Science), 2001–2002.
7. “Information Estimation in Non-linear Encoded Signals,” NASA Langley Research Center Contract #L70511D, \$99,856 (with S. K. Park and N. Halyo), 2000–2001.
8. “Robust Adaptive Data Encoding and Restoration,” NASA Langley Research Center Cooperative Agreement #NCC-1-258, \$310,000 (with S. K. Park), 1997–2000.
9. “Information-Adaptive Image Coding and Restoration,” NASA Langley Research Center Grant #NAG1-1847, \$150,000 (with S. K. Park and R. Gartenberg), 1996–1997.

Editorships

1. Editor, Proceedings of *Visual Information Processing (IX–XVII)* (variously with S. K. Park, R. A. Schowengerdt, S. E. Reichenbach, M. A. Neifeld)

2. Editorial Board *Applied Optics*: Topical Editor for image processing and computational imaging, 2004–current.
3. Guest Editor (with David J. Brady, Duke University), *Applied Optics* special topics issue on *Integrated Analysis and Design of Analog and Digital Processing in Imaging Systems*, October 2002.

Program Committees and Chairmanships

1. Chair SPIE Conference on *Visual Information Processing IX–XVII* (1999–2008).
2. Member of the Executive Committee of SPIE Defense & Security (previously Aerosense) Symposium (2000–2008).
3. Program Committee: SPIE conference on *Investigative Image Processing III* (2003).
4. Member Technical and Program Committee, “Integrated Computational Imaging Systems,” Inaugural Meeting, Albuquerque, New Mexico, 2001.
5. Program Committee: SPIE Conference on *Visual Information Processing V–VII* (1996–1998).

Books and Book Chapters

1. “Data Compression,” in *Handbook of Computer Science and Engineering*, Second Edition, Tucker, A. (ed.), CRC Press, (2004).
2. *Visual Communication: An Information Theory Approach*, Kluwer Academic Publishers, (1997) (with F. O. Huck, C. L. Fales).
3. “On the Assessment of Visual Communication,” in *Handbook of Statistics*, Vol. 10, Bose, N. and C. R. Rao (eds.), North-Holland Publishing Company, (1993) (with F. O. Huck, C. L. Fales, R. Alter-Gartenberg).
4. “Multiresponse Imaging: Information and Fidelity,” in *Multidimensional Processing of Video Signals*, Giovanni L. Sicuranza and Sanjit K. Mitra (eds.), Kluwer Academic Publishers, (1992) (with R. Alter-Gartenberg, C. L. Fales, F. O. Huck, S. E. Reichenbach).

Journal Articles

1. “Retinex Processing for Automatic Image Enhancement,” *Journal of Electronic Imaging*, (January 2004) (with D. J. Jobson, G. A. Woodell).
2. “Information-theoretic Assessment of Sampled Imaging Systems,” *Optical Engineering*, (May 1999) (with F. O. Huck, C. L. Fales, R. Alter-Gartenberg, S. K. Park).
3. “Fidelity Analysis of Sampled Imaging Systems,” *Optical Engineering*, (May 1999) (with S. K. Park).
4. “A Multi-Scale Retinex For Bridging the Gap Between Color Images and the Human Observation of Scenes,” *IEEE Transactions on Image Processing*, Special Issue on Color Processing, (July 1997) (with D. J. Jobson, G. A. Woodell).
5. “Properties and Performance of a Center/Surround Retinex,” *IEEE Transactions on Image Processing*, (March 1997) (with D. J. Jobson, G. A. Woodell).

6. "An Information Theory of Visual Communication," *Philosophical Transactions of the Royal Society A: Physical Sciences and Engineering*, (October 1996) (with F. O. Huck, C. L. Fales).
7. "Image Gathering and Digital Restoration," *Philosophical Transactions of the Royal Society A: Physical Sciences and Engineering*, (October 1996) (with C. L. Fales, F. O. Huck, R. Alter-Gartenberg).
8. "Artificial Neural-Networks in Space Station Optimal Attitude Control," *Acta Astronautica*, Vol. 35, No. 2/3, (1995) (with R. R. Kumar, H. Seywald, S. M. Deshpande).
9. "Electro-optical design for efficient visual communication," *Optical Engineering*, Vol. 34, No. 3, (1995) (with F. O. Huck, C. L. Fales, D. J. Jobson).
10. "Visual Communication: Information and Data Transmission," *Journal of Visual Communications and Image Representation*, Vol. 5, No. 3, (1994) (with F. O. Huck, C. L. Fales, R. Alter-Gartenberg).
11. "Transform-Coding Image Compression for Information Efficiency and Restoration," *Journal of Visual Communication and Image Representation*, Vol. 4, No. 3, (1993) (with S. E. Reichenbach, R. Narayanswamy).
12. "Visual Communication: Information and Fidelity," *Journal of Visual Communications and Image Representation*, Vol. 4, No. 2, (1993) (with F. O. Huck, C. L. Fales, R. Alter-Gartenberg, S. E. Reichenbach).
13. "Multiresolution Image Gathering and Restoration," *Journal of Visual Communication and Image Representation*, Vol. 3, No. 4, (1992) (with C. L. Fales, F. O. Huck, R. Alter-Gartenberg).
14. "Image Gathering and Digital Restoration for Fidelity and Visual Quality," *Computer Vision, Graphics, and Image Processing: Computer Models and Image Processing*, Vol. 53, No. 1, (1991). (with F. O. Huck, R. Alter-Gartenberg).

Conferences and Presentations

1. "Image Enhancement for Improving Face Detection under Non-uniform Lighting Conditions," IEEE International Conference on Image Processing, ICIP 2008, (2008) (with N. Unaldi, P. Sankaran, K. V. Asari).
2. "Adaptive methods of two-scale edge detection in post-enhancement visual pattern processing," Visual Information Processing XVII, Proc. SPIE 6978, (2008) (with D. J. Jobson, and G. A. Woodell).
3. "Scene context dependency of pattern constancy of time series imagery," Visual Information Processing XVII, Proc. SPIE 6978, (2008) (with G. A. Woodell and D. J. Jobson).
4. "Nonlinear technique for the enhancement of extremely high contrast color images," Visual Information Processing XVII, Proc. SPIE 6978, (2008) (with N. Unaldi, S. Arigela, K. V. Asari).
5. "A fast and robust wavelet-based dynamic range compression and contrast enhancement model," Visual Information Processing XVII, Proc. SPIE 6978, (2008) (with N. Unaldi, K. V. Asari, S. Erkanli).
6. "Hazard detection on runways using image processing techniques," Enhanced and Synthetic Vision 2008, Proc. SPIE 6957, (2008) (with G. S. Rajput).

7. "Automatic determination of runway edges in poor visibility conditions," IS&T/SPIE's 20th Annual Symposium, Electronic Imaging 2008, Image Processing: Algorithms and System VI, (2008) (with S. S. V. Gogineni).
8. "Robust edge-detection algorithm for runway-edge detection," IS&T/SPIE's 20th Annual Symposium, Electronic Imaging 2008, Image Processing: Machine Vision Applications, (2008) (with S. Tandra).
9. "Smart sensor processing for automatic runway hazard detection: Smart Visual Awareness System (SVAS)," Aviation Safety Technical Conference, (2007) (with D. J. Jobson, G. A. Woodell) (presentation only).
10. "Automated, on-board terrain analysis for precision landings," *Visual Information Processing XV*, Proc. SPIE 6246, (2006) (with D. J. Jobson, G. A. Woodell, G. D. Hines).
11. "A Comparison of Visual Statistics for the Image Enhancement of FORESITE Aerial Images with Those of Major Image Classes" *Visual Information Processing XV*, Proc. SPIE 6246, (2006) (with D. J. Jobson, G. A. Woodell, G. D. Hines).
12. "Advanced image processing of aerial imagery," *Visual Information Processing XV*, Proc. SPIE 6246, (2006) (with G. A. Woodell, D. J. Jobson, G. D. Hines).
13. "Real-time enhancement, registration, and fusion for an enhanced vision system", *Enhanced and Synthetic Vision 2006*, Proc. SPIE 6226, (2006), (with G. D. Hines, D. J. Jobson, G. A. Woodell).
14. "Change Detection Experiments using Low Cost UAVs," AIAA Infotech@Aerospace, (2005) (with M. J. Logan, T. L. Vranas, M. A. Motter, G. D. Hines).
15. "Image enhancement, image quality, and noise," Photonic Devices and Algorithms for Computing VII, Proc. SPIE 5907, (2005) (with G. D. Hines, D. J. Jobson, G. A. Woodell) (Invited paper).
16. "Noise, edge extraction and visibility of features," *Visual Information Processing XIV*, Proc. SPIE 5817, (2005) (with D. J. Jobson).
17. "Detecting changes in terrain using unmanned aerial vehicles," Proc. SPIE 5817, *Visual Information Processing XIV*, (2005) (with G. D. Hines, and M. J. Logan).
18. "Enhancement of imagery in poor visibility conditions," , " *Sensors, and Command, Control, Communications, and Intelligence (C3I) Technologies for Homeland Security and Homeland Defense IV* Proc. SPIE 5778, (2005) (with G. A. Woodell, G. D. Hines, D. J. Jobson).
19. "Real-time enhanced vision system," "Enhanced and Synthetic Vision 2005", Proc. SPIE 5802, (2005) (with G. D. Hines, D. J. Jobson, G. A. Woodell, S. D. Harrah).
20. "Single-scale Retinex using digital signal processors," *GSPx Technical Conference*, (2004) (with G. D. Hines, D. J. Jobson, G. A. Woodell).
21. "Impact of multiscale retinex computation on performance of segmentation algorithms," *Visual Information Processing XIII*, Proc. SPIE 5438, (2004) (with D. J. Jobson, G. A. Woodell, G. D. Hines).
22. "The automatic assessment and reduction of noise using edge pattern analysis in nonlinear image enhancement," *Visual Information Processing XIII*, Proc. SPIE 5438, (2004) (with D. J. Jobson, G. A. Woodell, G. D. Hines).

23. "DSP implementation of the multiscale retinex image enhancement algorithm," *Visual Information Processing XIII*, Proc. SPIE 5438, (2004) (with G. D. Hines, D. J. Jobson, G. A. Woodell).
24. "Enhanced images for checked and carry-on baggage and cargo screening," *Sensors, and Command, Control, Communications, and Intelligence (C3I) Technologies for Homeland Security and Homeland Defense III*, Proc. SPIE 5403, (2004) (with G. A. Woodell, D. J. Jobson, G. D. Hines).
25. "Information Theoretic Analysis of Noise Sources in Image Formation," *Visual Information Processing XII*, Proc. SPIE 5108, (2003) (with D. J. Jobson).
26. "Feature Visibility Limits in the Nonlinear Enhancement of Turbid Images," *Visual Information Processing XII*, Proc. SPIE 5108, (2003) (with D. J. Jobson, G. A. Woodell).
27. "Multisensor Image Registration For An Enhanced Vision System," *Visual Information Processing XII*, Proc. SPIE 5108, (2003) (with G. D. Hines, D. J. Jobson, G. A. Woodell).
28. "Decreasing habitat disturbance by improving fish stock assessments: a new method of remote species identification and quantification," Symposium on Effects of Fishing Activities on Benthic Habitats: Linking Geology, Biology, Socioeconomics, and Management, (2002) (with D. F. Doolittle, M. R. Patterson, R. Mann).
29. "Enhancing Medical Images Using the Multiscale Retinex," *Sensor Science and Technology Forum*, Eastern Virginia Medical School, (2002). (Invited presentation)
30. "The statistics of visual representation," *Visual Information Processing XI*, Proc. SPIE 4736, (2002) (with D. J. Jobson, G. A. Woodell). (Invited paper)
31. "Multi-sensor fusion and enhancement using the Retinex image enhancement algorithm," *Visual Information Processing XI*, Proc. SPIE 4736, (2002) (with D. J. Jobson, G. A. Woodell, G. D. Hines).
32. "Retinex processing for automatic image enhancement," *Human Vision and Electronic Imaging VII*, SPIE Symposium on Electronic Imaging, Proc. SPIE 4662, (2002) (with D. J. Jobson and G. A. Woodell).
33. "Information capacity of sampling-limited systems," *Integrated Computational Imaging Systems*, Albuquerque, New Mexico, (2001). (Invited paper)
34. "Retinex image enhancement: applications to medical images," *New Partnerships in Medical Diagnostic Imaging: a NASA advanced technology workshop*, Greenbelt, Maryland, (2001). (with G. A. Woodell, D. J. Jobson). (Invited talk)
35. "The spatial aspect of color and scientific implications of Retinex image processing," *Visual Information Processing X*, S. K. Park and Z. Rahman (eds.), Proc. SPIE 4388, (2001) (with D. J. Jobson, G. A. Woodell). (Invited paper)
36. "Impact of nonlinear Retinex/Local Normalization on the information rate," *Visual Information Processing X*, S. K. Park and Z. Rahman (eds.), Proc. SPIE 4388, (2001) (with N. Halyo, S. K. Park). (Invited paper)
37. "A Multiscale Retinex for Improved Performance in Multispectral Image Classification," *Visual Information Processing IX*, S. K. Park and Z. Rahman (eds.), Proc. SPIE 4041, (2000) (with B. Thompson, S. K. Park).

38. "Retinex Pre-processing for Improved Multi-Spectral Image Classification," *Visual Information Processing VIII*, S. K. Park and R. D. Juday (eds.), Proc. SPIE 3417, (1999) (with B. Thompson, S. K. Park).
39. "Resiliency of the Multiscale Retinex Image Enhancement Algorithm," Proceedings of the IS&T Sixth Color Imaging conference: Color Science, Systems, and Applications, Scottsdale, AZ, (1998) (with G. A. Woodell, D. J. Jobson).
40. "Informationally Optimized Image-gathering and Restoration," presented at the IS&T's 50th Annual Conference, Cambridge, MA, (1997) (with F. O. Huck, C. L. Fales).
41. "A Comparison of the Multiscale Retinex With Other Image Enhancement Techniques," Proceedings of the IS&T's 50th Annual Conference, Cambridge, MA, (1997) (with G. A. Woodell, D. J. Jobson).
42. "Retinex Image Processing: Improved Fidelity To Direct Visual Observation," IS&T Fourth Color Imaging conference: Color Science, Systems, and Applications, Scottsdale, AZ, (1996) (with D. J. Jobson, G. A. Woodell).
43. "Multiscale Retinex for Color Image Enhancement," in Proceedings of the IEEE International Conference on Image Processing, Lausanne, Switzerland, (1996) (with D. J. Jobson, G. A. Woodell).
44. "On the Information-Theoretic Assessment of Visual Communication," in Proceedings of the IEEE International Conference on Image Processing, (1996) (with F. O. Huck, C. L. Fales).
45. "Multiscale Retinex for Dynamic Range Compression and Color Rendition," *Applications of Digital Image Processing XIX*, Andrew G. Tescher, Ed., Proc. SPIE 2847, (1996) (with D. J. Jobson, G. A. Woodell).
46. "Integrated wavelet compression and restoration," *Wavelet Applications in Signal and Image Processing IV*, Michael A. Unser, Akram Aldroubi, Andrew F. Laine, eds., Proc. SPIE 2825, (1996).
47. "Wavelet coding for remote sensed data," *1996 Data Compression Conference*, (1996).
48. "Properties of a center/surround Retinex Part One: Signal processing design," *NASA Contractor Report #198194*, (1995).
49. "Information theoretic assessment of visual communication with wavelet coding," *Visual Information Processing IV*, F. O. Huck and R. D. Juday, Editors, Proc. SPIE 2488, (1995).
50. "Information theoretic assessment of visual communication with subband coding," *SPIE Symposium on Visual Communications and Image Processing*, Proc. SPIE 2308, (1994) (with C. L. Fales, F. O. Huck).
51. "Assessment of image coding by information theory," *Visual Information Processing III*, F. O. Huck and R. D. Juday, Editors, Proc. SPIE 2239, (1994) (with F. O. Huck, C. L. Fales).
52. "Combining optical design with focal-plane processing for improved performance," *Visual Information Processing III*, F. O. Huck and R. D. Juday, Editors, Proc. SPIE 2239, (1994) (with F. O. Huck, C. L. Fales, D. J. Jobson).
53. "Redundancy reduction in image coding," *Visual Information Processing II*, F. O. Huck and R. D. Juday, Editors, Proc. SPIE 1961, (1993) (with R. Alter-Gartenberg, C. L. Fales, F. O. Huck).

54. "Information efficiency in visual communication," *Visual Information Processing II*, F. O. Huck and R. D. Juday, Editors, Proc. SPIE 1961, (1993) (with R. Alter-Gartenberg).
55. "Artificial Neural-Networks in Space Station Optimal Attitude Control," *World Space Congress*, Washington, D.C., (1992) (with R. R. Kumar, H. Seywald, S. M. Deshpande).
56. "Discrete Cosine Transform Coding: Information and Fidelity," *Visual Information Processing I*, F. O. Huck and Richard D. Juday, Editors, Proc. SPIE 1705, (1992) (with R. Alter-Gartenberg, S. E. Reichenbach).
57. "Multiresolution Coding: Information Efficiency and Fidelity," *Visual Information Processing I*, F. O. Huck and Richard D. Juday, Editors, Proc. SPIE 1705, (1992) (with R. Alter-Gartenberg)
58. "Information, Entropy and Fidelity in Visual Communication" *Visual Information Processing I*, F. O. Huck and R. D. Juday, Editors, Proc. SPIE 1705, (1992) (with F. O. Huck, C. L. Fales, R. Alter-Gartenberg).
59. "Multiresolution Imaging: Information and Fidelity," 8th Israeli Conference on Artificial Intelligence and Computer Vision, Tel-Aviv, (1991) (with R. Alter-Gartenberg, C. L. Fales, F. O. Huck, S. E. Reichenbach).
60. "Multiresponse Imaging System for Improved Resolution," *Communication and Image Processing: Hierarchical Image-Coding*, John E. Woods, Editor, Proc. SPIE 1605, (1991) (with R. Alter-Gartenberg, C. L. Fales, F. O. Huck, S. E. Reichenbach).
61. "Artificial Scenes and Simulated Imaging," *Stochastic and Neural Methods in Signal Processing, Image Processing and Computer Vision*, Proc. SPIE 1569, (1991) (with S. E. Reichenbach, R. Alter-Gartenberg, S. K. Park).
62. "Restoration of Subband Coded Images," *Proceedings of the ICASSP*, Toronto, Canada, (1991) (with R. Narayanswamy, S. E. Reichenbach).
63. "Image Restoration Beyond the Sampling Passband," *Proceedings of the ICASSP*, Toronto, Canada, (1991). (with R. Alter-Gartenberg, F. O. Huck, C. L. Fales).
64. "Wiener-Matrix Restoration Beyond the Sampling Passband," *Infrared Imaging Systems: Design Analysis, Modeling, and Testing*, Gerald C. Holst, Editor, Proc. SPIE 1488, (1991) (with R. Alter-Gartenberg, C. L. Fales, F. O. Huck).
65. "Information Theoretical Assessment of Image Gathering and Coding for Digital Restoration," presented at SPSE's 43rd Annual Conference, Rochester, New York, (1990) (with F. O. Huck, S. E. Reichenbach).
66. "A New Sensor for Automatic Flight Control," *Signal and Data Processing of Small Targets 1990*, Oliver E. Drummond, Editor, Proc. SPIE 1305, (1990) (with R. M. Inigo, E. S. McVey).
67. "Information Theoretical Assessment of Digital Imaging Systems," *Infrared Imaging Systems: Design Analysis, Modeling, and Testing*, Gerald C. Holst, Editor, Proc. SPIE 1309, (1990) (with S. John, F. O. Huck, S. E. Reichenbach).
68. "Algorithms for Autonomous Visual Flight Control," *Proceedings of IJCNN*, Washington, District of Columbia, (1989) (with R. M. Inigo, E. S. McVey). .
69. "Artificial Neural Computer for Image Tracking," *Proceedings of the SPIE Conference*, California, (1989) (with E. S. McVey, R. M. Inigo, J. Minnix, J. Sigda).

70. "A Neural Network Implementation of Autonomous Visual Flight Control Using Optical Flow," Poster Presentation, International Neural Network Society's First Annual Meeting, Boston, Massachusetts, (1988) with J. Doner, R. M. Iñigo, E. S. McVey).
71. "A New Sensor for Machine Vision," *Proceedings of IFAC International Conference on Low Cost Sensors*, Valencia, Spain, (1986) (with R. M. Iñigo, E. S. McVey, C. Hsin, J. Minnix).