

Curriculum Vita

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Education

Ph.D. Electrical Engineering, University of Tennessee, Knoxville, Tennessee, 2012
M.S. Electrical Engineering, North Carolina State University, Raleigh, North Carolina, 1990
B.S. Electrical Engineering, University of Tennessee, Knoxville, Tennessee, 1988

Experience

Dr. Karnowski has 22 years of experience as an R&D Staff Member at ORNL focusing on areas of image and signal processing, machine vision and machine learning, and software implementations of these technologies on various platforms. My work has been focused on cutting-edge, innovative technologies for manufacturing (such as the Automated Image Retrieval work which improves the ability of semiconductor engineers to diagnose problems in their manufacturing processes), homeland security (the Large Area Imager and Roadside Tracker, two technologies for gamma radiation imaging that combine unique visualization and machine vision capabilities to produce innovative instruments), and medical applications (the TRIAD network, which allows low-cost screening of diabetes patients through a novel network of walk-in clinics and machine vision / machine learning technology). The transformative nature of these technologies is evident in their applications through technology transfer, R&D 100 awards, and my patent portfolio which includes four patents and three applications currently under review as well as several other invention disclosures and copyrights.

Positions

Oak Ridge National Laboratory, Oak Ridge, TN
1990 - 2012 R&D Staff Member

Honors

1997 Federal Laboratory Consortium Award for Excellence in Technology Transfer, Spatial Signature Analysis
1998 American Museum of Science and Energy Award, Spatial Signature Analysis
2001 R&D 100 Award, R&D Magazine – Automated Image Retrieval
2002 ORNL Director's Award for Science and Technology, Automated Image Retrieval
2002 Federal Laboratory Consortium Award for Tech Transfer (Southeast), Automated Image Retrieval
2007 R&D 100 Award, R&D Magazine – Large Area Imager
2010 R&D 100 Award, R&D Magazine – Biosciences: TRIAD Network
2011 ORNL Director's Award for Science and Technology, Roadside Tracker Video and Gamma Imaging

Publications

1. Karnowski, T.P., et. al., "Motion estimation accuracy for visible-light/gamma-ray imaging fusion for portable portal monitoring", Proceedings SPIE, v. 7538, 2010
2. Karnowski, T.P., et. al., "Design of Dual-Road Transportable Portal Monitoring System for Visible Light and Gamma-Ray Imaging", Proceedings of SPIE, v. 7665, 2010
3. Arel, I. and Rose, D. and Karnowski, T., "A deep learning architecture comprising homogeneous cortical circuits for scalable spatiotemporal pattern inference", NIPS Workshop on Deep Learning for Speech Recognition and Related Applications, 2009
4. Young, S. and Arel, I. and Karnowski, T.P. and Rose, D., "A Fast and Stable Incremental Clustering Algorithm", IEEE Seventh International Conference on Information Technology, pp. 204-209, 2010
5. Karnowski, Thomas; Aykac, D.; Chaum, E.; Giancardo, L.; Li, Y.; Tobin, K; Abramoff, M. "Practical Considerations for Optic Nerve Location in Telemedicine", IEEE Engineering in Medicine and Biology Society, 31st Annual International Conference of the IEEE , Sept. 2009
6. Karnowski, Thomas P.; Govindasamy, V. Priya; Tobin, Kenneth W.; Chaum, Edward; Abramoff, M.D., "Retina lesion and microaneurysm segmentation using morphological reconstruction methods with ground-truth data," Engineering in Medicine and Biology Society, 2008. EMBS 2008. 30th Annual International Conference of the IEEE , pp.5433-5436, 20-25 Aug. 2008
7. Ziock, K. P., Collins, J. W., Cunningham, M. F., Fabris, L., Gee, T. F., Goddard, J. S., Habte, F., and Karnowski, T. P., "The Use of Gamma-Ray Imaging to Improve Portal Monitor Performance," Conference Record of the 2007 IEEE Nuclear Science Symposium and Medical Imaging Conference, Honolulu, Hawaii, 2007.

8. Tobin, K. W., Chaum, E., Govindasamy, V. P., and Karnowski, T. P., "Detection of Anatomic Structures in Human Retinal Imagery," *IEEE Transactions on Medical Imaging* 26(12), pp. 1729-1739, December 2007.
9. Karnowski, T. P., Govindasamy, V. P., Tobin, K. W., and Chaum, E., "Locating the Optic Nerve in Retinal Images: Comparing Model-Based and Bayesian Decision Methods," 28th Annual International Conf. of the IEEE EMBS, August 2006.
10. Tobin, K. W., Bhaduri, B. L., Bright, E. A., Cheriyyadat, A., Karnowski, T. P., Palathingal, P. J., Potok, T. E., and Price, J. R., "Automated Feature Generation in Large-Scale Geospatial Libraries for Content-Based Indexing," *Journal of Photogrammetric Engineering and Remote Sensing* 72(5), May 2006
11. Hausladen, P., Bingham, P., Karnowski, T., Mullens, J., and Mihalczko, J., "Development of a Tomographic Imaging System for HEU Components," Presentation at the Fall 2005 INMM Central Region Chapter Meeting Conference: Challenges to Safeguards and Security, October 12, 2005.
12. Karnowski, T. P., Kercher, A. K., Hunn, J. D., and Maxey, L. C., "A Simple Optical System for Real-Time Size Measurements of TRISO Fuel Pellets," *Proceedings of Machine Vision Applications in Industrial Inspection XIII*, SPIE Vol. 5679, February 2005, pp. 62-73
13. Karnowski, T.P., Allard, L., Joy, D., Clonts, L., "System considerations for maskless lithography", *Proceedings of the SPIE: Emerging Lithographic Techniques VIII*, Santa Clara, CA February 2004
14. Price, J.R., Bingham, P.R., Tobin, K.W., and Karnowski, T.P., "Semiconductor Sidewall Shape Estimation using Top-down CD-SEM Image Retrieval", *IEEE/SME/SPIE 6th International Conference on Quality Control by Artificial Vision*, *Proceedings of the SPIE* Vol. 5132, May 2003.
15. Price, J.R., Bingham, P.R., Tobin, K.W., Karnowski, T.P., "Estimating Cross-section Semiconductor Structure by Comparing Top-down SEM Images", *Machine Vision Applications in Industrial Inspection XI*, *Proc. SPIE*, Vol. 5011, March 2003.
16. Tobin, K.W., Lakhani, F., Karnowski, T.P., "An Industry Survey of Automatic Defect Classification Technologies, Methods, and Performance", *Design, Process Integration, and Diagnostics in IC Manufacturing*, *Proceedings of the SPIE* Vol. 4692, March 2002.
17. Tobin, K. W., Karnowski, T.P., Arrowood, L.F., Ferrell, R.K., Goddard, J.S., Lakhani, F., "Content-based Image Retrieval for Semiconductor Process Characterization", *EURASIP Journal on Applied Signal Processing*, Special Issue on Applied Visual Inspection, Vol. 2002, No. 7, 2002.
18. Karnowski, T.P., Tobin, K.W., Ferrell, R.K., Lakhani, F., "Using an Image Retrieval System for Image Data Management", *Design, Process Integration, and Diagnostics in IC Manufacturing*, *Proceedings of the SPIE* Vol. 4692, March 2002.
19. Gleason, S.S., Ferrell, R.K., Karnowski, T.P., Tobin, K.W., "Detection of Semiconductor Defects Using A Novel Fractal Encoding Algorithm", *Design, Process Integration, and Diagnostics in IC Manufacturing*, *Proceedings of the SPIE* Vol. 4692, March 2002.
20. Tobin, K. W., Karnowski, T.P., Arrowood, L.F., Ferrell, R.K., Goddard, J.S., Lakhani, F., "Content-based Image Retrieval for Semiconductor Process Characterization", *EURASIP Journal on Applied Signal Processing*, Special Issue on Applied Visual Inspection, Vol. 2002, No. 7, July 2002.
21. Tobin, K.W., Karnowski, T.P., "Revolutionizing Defect Image Management", *SPIE's OE Magazine*, Vol 1, No. 7, July 2001. Tobin, K.W., Karnowski, T.P., Arrowood, L.F., and Lakhani, F., "Field Test Results of an Automated Image Retrieval System", 12th Annual IEEE/SEMI Advanced Semiconductor Manufacturing Conference and Workshop, Munich, Germany, April 23-24, 2001
22. Tobin, K.W., Karnowski, T.P., Lakhani, F., "Integrated Applications of Inspection Data in the Semiconductor Manufacturing Environment", *Metrology-based Control for Micromanufacturing*, *Proceedings of the SPIE* Vol. 4275, 2001, pp. 31-40.
23. Karnowski, T.P., Tobin, K.W., Arrowood, L.F., Goddard, J.S., Ferrell, R.K., and Lakhani, F. "Field Test Results of an Image Retrieval System for Semiconductor Yield Learning", *Metrology-based Control for Micro-manufacturing*, *Proceedings of the SPIE* Vol. 4275, 2001, pp. 41-52.
24. Karnowski, T.P., Gleason, S.S., and Tobin, K.W., "Fuzzy Logic Connectivity in Semiconductor Defect Clustering," *SME Technical Paper MS00-240*, Society of Manufacturing Engineers, Dearborn, MI, 2000.
25. Tobin, K.W., Karnowski, T.P., Lakhani, F., "Technology Considerations for Future Semiconductor Data Management Systems", *Semiconductor Fabtech*, Vol. 12, ICG Publishing, Ltd., London, England, Spring 2000.
26. Tobin, K.W., Karnowski, T.P., and Lakhani, F. "Managing Defect Image Databases for Semiconductor Yield Monitoring and Control", *Global Semiconductor*, Sterling Publications, London, England, February 2000.
27. Tobin, K.W., Karnowski, T.P., Lakhani, F., "The Use of Historical Defect Imagery for Yield Learning", *The 11th Annual IEEE/SEMI Advanced Semiconductor Manufacturing Conference and Workshop*, Fairmont Copley Plaza Hotel, Boston, MA, September 12-14, 2000.
28. Tobin, K.W., Karnowski, T.P., Lakhani, F., "A Survey of Semiconductor Data Management Systems Technology", *Metrology, Inspection, and Process Control for Microlithography*, *Proc. SPIE*, Vol. 3998, pp. 248-257, June 2000.

29. Karnowski, T.P., Tobin, K.W., Ferrell, R.K., and Lakhani, F., "Content Based Image Retrieval for Semiconductor Manufacturing", Machine Vision Applications in Industrial Inspection, Proc. SPIE, Vol. 3966, 2000, pp. 162-172, March 2000.
30. Gee, T.F., Karnowski, T.P., Tobin, K.W., "Multiframe Combination and Blur Deconvolution of Video Data", IS&T/SPIE's 12th International Symposium on Electronic Imaging: Science and Technology, San Jose Convention Center, January 2000.
31. Karnowski, T.P., Tobin, K.W., Jensen, D., Lakhani, F., "The Application of Spatial Signature Analysis to Electrical Test Data: Validation Study", Metrology, Inspection, and Process Control for Microlithography XIII, Proc. SPIE, Vol. 3677, 1999, pp. 530-541.
32. Tobin, K.W., Karnowski, T.P., and Ferrell, R.K., "Image Retrieval in the Industrial Environment", Machine Vision Applications in Industrial Inspection VII, Proc. SPIE, Vol. 3652, January 1999, p. 184-192.
33. Hunt, M.A., Karnowski, T.P., Tobin, K.W., and Simpson, M.L., "Tristimulus Color Measurement of Printed Textile Patterns Using the POCS Algorithm", IS&T/SPIE's 11th International Symposium on Electronic Imaging: Science and Technology, San Jose Convention Center, January 1999.
34. Tobin, K.W., Karnowski, T.P., Gleason, S.S., Jensen, D., Lakhani, F., "Using Historical Wafermap Data for Automated Yield Analysis", Journal of Vacuum Science Technology, Summer 1999.
35. Tobin, K.W., Karnowski, T.P., Gleason, S.S., Jensen, D., Lakhani, F., "Using Historical Wafermap Data for Automated Yield Analysis", Journal of Vacuum Science Technology, Summer 1999.
36. K. Tobin, T. Karnowski, S. Gleason, D. Jensen, F. Lakhani, "Integrated Yield Management", 196th Meeting of the Electrochemical Society, Inc., Oct. 17-22, Honolulu, Hawaii, 1999.
37. Tobin, K.W., Gleason, S.S., Karnowski, T.P., Bennett, M.H., "Semiconductor Defect Data Reduction for Process Automation and Characterization", Journal of Process and Analytical Chemistry, Vol. 3, Nos. 3, 4, Spring 1998.
38. Tobin, K.W., Gleason, S.S., Karnowski, T.P., Guidry, D., "Using SSA to Measure the Efficacy of Automated Defect Data Gathering", Micro, Canon Communications, LLC, Los Angelis, CA, April 1998.
39. Gleason, S.S., Tobin, K.W., and Karnowski, T.P., "Rapid Yield Learning Through Optical Defect and Electrical Test Analysis", SPIE's Metrology, Inspection, and Process Control for Microlithography XII, Santa Clara Convention Center, February 1998.
40. Tobin, K.W., Gleason, S.S., and Karnowski, T.P., "Adaptation of the Fuzzy K-Nearest Neighbor Classifier for Manufacturing Automation", Machine Vision Applications in Industrial Inspection, Proc. SPIE, Vol. 3306, 1998, pp. 122-130.
41. Karnowski, T.P., Gleason, S.S., and Tobin, K.W., "Fuzzy Connectivity of Semiconductor Defect Events", SPIE's 10th International Symposium on Electronic Imaging: Science and Technology, San Jose Convention Center, January 1998.
42. Gleason, S.S., Tobin, K.W., Karnowski, T.P., "An Integrated Spatial Signature Analysis and Automatic Defect Classification System", 191st Meeting of the Electrochemical Society, Inc., May 1997.
43. Tobin, K.W., Gleason, S.S., Karnowski, T.P., Cohen, S. L., and Lakhani, F., "Automatic Classification of Spatial Signatures on Semiconductor Wafermaps", Metrology, Inspection, and Process Control for Microlithography XI, Proc. SPIE, Vol. 3050, p. 434-444, July, 1997.
44. Tobin, K.W., Gleason, S.S., Karnowski, T.P., Cohen, S.L., "Feature Analysis and Classification of Manufacturing Signatures on Semiconductor Wafers", Machine Vision Applications in Industrial Inspection V, Proc. SPIE, Vol. 3029, p. 12-25, April 1997.
45. Tobin, K.W., Gleason, S.S., Karnowski, T.P., Bennett, M.H., "An Image Paradigm for Semiconductor Defect Data Reduction", Metrology, Inspection, and Process Control for Microlithography X, Proc. SPIE Vol. 2725, p. 194-205, May 1996.
46. Gleason, S.S., Tobin, K.W., and Karnowski, T.P., "Spatial Signature Analysis of Semiconductor Defects for Manufacturing Problem Diagnosis", Solid State Technology, PennWell Corp., Tulsa, OK, July 1996.
47. Breeding, J.E., and Karnowski, T.P., "A method for efficient fractional sample delay generation for real-time frequency-domain beamformers", presented at The International Conference on Signal Processing Applications and Technology, Boston MA 1995.
48. Karnowski, T.P.; VanderLugt, A., "Generalized filtering in acoustooptic systems using area modulation", Applied Optics v. 30, 1991

Current Research Support

1. Video and Gamma Imaging Fusion
Department of Homeland Security, 2009-2012
Development of a unique instrument to combine video and gamma ray imaging for portal monitoring
2. Automated Screening for Diabetic Retinopathy by Content Based Image Retrieval
National Eye Institute, NIH, R-01 EY017065, Principal Investigator, 7/2005- 6/2012
Population based screening and detection of diabetic retinopathy using content-based image retrieval