

VITA

MELBA M. CRAWFORD

EDUCATION

Bachelor of Science, University of Illinois, Urbana, Civil Engineering, 1970
Master of Science, University of Illinois, Urbana, Civil Engineering, 1973
Doctor of Philosophy, Ohio State University, Industrial and Systems Engineering, 1981

PROFESSIONAL EXPERIENCE

Purdue University, Professor, 2006 - present
Associate Dean of Engineering for Research, 2010-present
Interim Associate Dean of Engineering for Research, 2009-2010
Assistant Dean for Interdisciplinary Research in Agriculture and Engineering, 2006-2010
Director, Laboratory for Applications of Remote Sensing, 2006-present
The University of Texas at Austin, Professor, 1991-2005
The University of Texas at Austin, Associate Professor, 1986-1991
The University of Texas at Austin, Assistant Professor, 1980-1986
The University of Texas at Dallas, Instructor, 1977-1980

STUDENTS AND RESEARCH SUPERVISION

4 Postdoctoral researchers, 35 M.S. and 20 Ph.D. students completed degrees, 5 Ph.D. students in progress, 1 M.S. student in progress.

RESEARCH AND TEACHING ACTIVITIES

Current research interests focus on development of advanced methods for analysis of remotely sensed data, including: 1) manifold learning, 2) classification, 3) active learning, 4) data fusion, and 5) remote sensing applications in agriculture, forestry, and natural resources. Founded an interdisciplinary research and applications development program in space-based and airborne remote sensing at the University of Texas Center for Space Research. Currently heads the Laboratory for Applications of Remote Sensing at Purdue University. Recent remote sensing applications research includes methods for estimation of residue cover for conservation tillage applications, land use/land cover mapping and monitoring from hyperspectral sensors, multiresolution topographic mapping via SAR interferometry and laser altimetry, and applications of laser altimetry for hydrologic modeling, vegetation characterization, and resource exploration.

University teaching has included graduate and undergraduate courses in operations research, probability, mathematical statistics, multivariate statistics, regression, time series analysis, statistical methods for image processing, and remote sensing science and applications. Professional educational service activities include Director of the Purdue Summer Undergraduate Research Program (SURF) and Education Director for the IEEE Geoscience and Remote Sensing Society.

HONORS AND AWARDS

UT Engineering Foundation Faculty Excellence Award, 1987, 1990
UT Engineering Foundation Faculty Fellowship #3, 1988-1991
General Dynamics Departmental Teaching Excellence Award, 1990
Halliburton Education Foundation Award for Excellence in Teaching, 1991
Outstanding Graduate Faculty Award, Graduate School, University of Texas, 1993
Faculty Research Assignment, 1997 (U. of Arizona and U. of Wollongong)

Charlotte Maer Patton Centennial Fellow in Engineering, 1991-1998
 Engineering Foundation Endowed Professorship #1, 1999-2005
 NASA Outstanding Service Award, EO-1 Science Team, 2002
 Outstanding Paper Award, *IICAI-2003*, Hyderabad, India, Dec. 18-20, 2003
 Jefferson Senior Science Fellow, U.S. State Department, 2004-2005
 Meritorious Honor Award, Delegation to World Conference on Disaster Reduction, U.S. State Department, 2005
 Purdue Chair of Excellence in Earth Observation, 2006-present
 Fellow, Institute for Electrical and Electronics Engineers, 2007
 Fellow, Academic Leadership Program, Committee on Institutional Cooperation, 2007-2008
 Woman of Purdue, Mortar Board Honoree, 2009
 Mortar Board, Honorary Member, 2009-2010
 Purdue Provost Fellow for Globalization Initiatives, 2009

PROFESSIONAL ACTIVITIES

IEEE Geoscience and Remote Sensing Society
 International Administrative Committee, 1998-2005
 Education Director, 1998-1999
 Data Fusion Committee, 1999-present
 Vice President for Professional Activities, 2000-2001
 Co-Chair, IEEE Workshop on Advances in Techniques for Analysis of Remotely Sensed Data: An Honorary Workshop for Prof. David A. Landgrebe, 2003
 Vice President for Conferences and Symposia, 2004-2010
 Executive Vice President – 2011-2012
 NASA EO-1 Science Validation Team, 2000-2003
 NASA Earth System Science and Applications Advisory Committee, 2001-2004
 Science Advisor to National Geospatial-Intelligence Agency, 2005
 Editorships, IEEE Transactions on Geoscience and Remote Sensing
 Associate Editor for Hyperspectral Remote Sensing, 2003 - present
 Associate Editor, Special Issue on Hyperspectral Data Analysis, 2000
 Associate Editor, Special Issue on EO-1, 2002
 Associate Editor, Special Issue on Landsat, 2004
 Associate Editor, Special Issue on Advances in Techniques for Analysis of Remotely Sensed Data, 2005
 Associate Editor, Special Issue on Hyperspectral Image and Signal Processing, 2010
 Reviewer, IEEE Transactions on Geoscience and Remote Sensing, IEEE Geoscience and Remote Sensing Letters, International Journal of Pattern Analysis and Applications, International Journal of Remote Sensing, Photogrammetric Engineering and Remote Sensing, International Journal of Information Fusion
 Reviewer, L'Oreal Women in Science Fellowship Program, 2005-2009
 Reviewer, Fulbright Faculty Fellowship Program, 2005-2008
 Member, NSF Post-Earthquake Geotechnical Reconnaissance Activity Advisory Panel, 2005 - present
 Member, NSF Facilities Assessment Steering Committee, National Center for Atmospheric Research, 2006-2008
 Member, Advisory Board to NASA Socioeconomic Data and Applications Center (SEDAC), 2006-2010
 U.S. State Department, Advisor to the Office of the Science Advisor to the Secretary of State, 2006-2011
 Member, Global Dialogue on Emerging Science and Technology Delegation to Africa, 2008

Member, NSF National Ecological Observatory Network (NEON) Advisory Board, 2009-present

Member, IEEE Advisory Committee to S. African Government on Human Capacity Development in Space Applications and Engineering, 2008-present

Recent External Committees and Review Panels

National Ecological Observatory Network, member, 2009 – present

National Geospatial Intelligence Agency, member, 2010

NASA Terrestrial Ecology Research Proposal Panel, member, 2011

Army Research Office Environmental Science Review, head, 2011

National Foundation of Science, Iceland, member, 2011

USDA Research Panel Review, Managing Agricultural Watersheds and Landscapes, head, 2011

UNIVERSITY ADMINISTRATIVE ACTIVITIES AND SERVICE (since 1990)

University of Texas at Austin

Chairman, Graduate Studies Committee, ME Department, 1989 - 1994

Member, Administrative Committee, Graduate Assembly, 1993-1994, 1994-1996

Member, Women's Athletic Council, 1991-1994

Chairman, Academic Committee, Women's Athletic Council, 1993-1994

Member, Graduate Assembly, 1990-1996

Area Coordinator, Operations Research Group, 199-1996

Member, University Ad Hoc Committee to Evaluate Administrators, 1994

Member, University Committee on Graduate Students, 1995-1996

Member, Academic Committee, Graduate Assembly, 1991-1992, 1995-1996

Member, Faculty Computer Committee, 1994-1996

Member, Graduate School Committee on Graduate Student Affairs, 1995

Member, Graduate School Ad Hoc Committee on Digital Dissertations, 1995-1996

Member, University Reaccreditation Committee, 1996

Member, Ad Hoc Faculty Committee for Presidential Search, 1998

Member, UT Faculty Council, 2002-2004

Member, Executive Committee, Faculty Council, 2002-2003

Vice Chairman, Faculty Welfare Committee, Faculty Council, 2002-2003

Chairman, Mechanical Engineering Faculty Review Committee, 2001-2003

Member, Faculty Advisory Committee, Undergraduate Research Journal, 2004

Associate Director, Environmental Science Institute, 2002-2004

Purdue University

Director, Summer Undergraduate Research Fellowship (SURF) Program, 2008-present

Director, Laboratory for Applications of Remote Sensing, 2006-present

Member, Civil Engineering Graduate Committee, 2007-2008

Member, Advisory Committee, Center for Crop Biosecurity and Invasive Plant Pests, 2008-present

Member, Advisory Committee, Center for the Environment, 2007-present

Member, Advisory Committee, Environmental Science and Engineering Interdisciplinary Graduate Program (ESE), 2008-present

Member, Council on Women, 2006-present

Member, Purdue University Strategic Plan Committee on Synergies, 2008

Member, Purdue Climate Change Research Center Executive Committee

Participation in Centers and Divisions, 2006-present
 Division of Ecological and Environmental Engineering
 Center for the Environment
 Climate Change Research Center

PUBLICATIONS

A. Refereed Archival Journals

- S.P. Miaou, D. Maidment, D., and M.M. Crawford, "Response of Daily Water Use to Rainfall in Austin, Texas," *Water Resources Research*, vol. 21, no. 4, 425-432, April 1985.
- W. Uddin, F.B. McCullough, and M.M. Crawford, "Statistical Forecasts of Airline Passenger Load in Austin, Texas," *Transportation Research Board Record*, vol. 1025, 7-13, 1985.
- Q.C. Lu, M.M. Grady, and M.M. Crawford, "An Adaptive Algorithm for Short-Term Multinode Load Forecasting in Power Systems," *IEEE Trans. on Circuits and Systems*, vol. 35, no. 8, 1004-1010, August 1988.
- M. Sutarwala, P.S. Schmidt, and M.M. Crawford, "An Expert System Model for Melt Shop Configuration and Operation," *Trans. of the American Foundrymen's Society*, 1988.
- M. Sutarwala, P.S. Schmidt, and M.M. Crawford, "Design and Operation of an Induction Melting System with Gas Preheat," *Trans. of the American Foundrymen's Society*, 1988.
- Q.C. Lu, W.M. Grady, and M.M. Crawford, "Adaptive Nonlinear Predictor with Orthogonal Escalator Structure for Short-Term Load Forecasting," *IEEE Trans. on Power Systems*, vol. 4, no. 1, 158-164, February 1989.
- N. Khazenie and M.M. Crawford, "Spatial-Temporal Random Field Model for Contextual Classification of Satellite Imagery," *IEEE Trans. on Geoscience and Remote Sensing*, vol. 28, no. 4, 529-539, 1990.
- S. Lee, J.R. Wilson, and M.M. Crawford, "Modeling of Sea States as Nonhomogeneous Poisson Processes," *Communications in Statistics*, vol. 20, no.2/3, 777-809, 1991.
- S. Lee and M.M. Crawford, "Applications of an Adaptive Reconstruction System to a Sequence of Nonstationary Image Data," *IEEE Trans. on Geoscience and Remote Sensing*, vol. 29, no. 4, 494-508, 1991.
- K. Kim and M.M. Crawford, "Adaptive Parametric Estimation and Classification of Remotely Sensed Imagery Using a Pyramid Structure," *IEEE Trans. on Geoscience and Remote Sensing*, vol. 29, 481-493, 1991.
- J. Lundberg, M.M. Crawford, and B.D. Tapley, "Application of Cluster Analysis and Orbit Determination to the Data Association of Multiple Target Tracking in Space," *J. Guidance and Control*, December, *Astrodynamics 1991, Advances in the Astronautical Sciences*, 1991.
- A.J. Richardson, M.M. Crawford, J.H. Everitt, and K.R. Summy, "Monitoring the Rio Grande Valley Cotton Stalk Destruction Program with Satellite Imagery," *Geocarto International*, no. 2, 1992.
- W.M. Grady, L.A. Groce, T.M. Huebner, Q.C. Lu, and M.M. Crawford, "Enhancement, Implementation, and Performance of an Adaptive Short-Term Load Forecasting Algorithm," *IEEE Transactions on Power Systems*, vol. 6, no. 4, 1404-1410, Nov. 1991.
- N. Lamei, K. Hutchison, M.M. Crawford, and N. Khazenie, "Cloud Type Discrimination via Multi-spectral Textural Analysis," *Optical Engineering*, vol. 33, 1303 - 1313, 1995.
- B. Gutelius, W.E. Carter, R.L. Shrestha, E. Medvedev, R. Gutierrez, J.C. Gibeaut, M.M. Crawford, and S. Smith, "Engineering Applications of Airborne Scanning Lasers: Reports from the Field," *Photogrammetric Engineering and Remote Sensing*, Highlight article, vol. LXIV, no. 4., 246-253, 1998.
- R. Gutierrez, A.L. Neuenschwander, J.C. Gibeaut, M.M. Crawford, S. Kumar, W. Gutelius, R. Sherma, and E. MacPherson, "Multi-Sensor Analysis of Coastal Hazards and Environments

- using Airborne Laser Terrain Mapping and Synthetic Aperture Radar,” Supplement to *Eos, Trans. AGU*, vol. 79, no.45, F200-F201, 1998.
- M.M. Crawford, S. Kumar, M.R. Ricard, J.C. Gibeaut, and A.L. Neuenschwander, “Fusion of Airborne Polarimetric and Interferometric SAR Data for Classification of Coastal Environments,” *IEEE Trans. on Geoscience and Remote Sensing*, vol. 37, no. 3, 1306-1315, 1999.
- R.I. Lonard, F.W. Judd, J.H. Everitt, D.E. Escobar, M.R. Davis, M.M. Crawford, and M.D. Desai, “Evaluation of Color-Infrared Photography for Distinguishing Riparian Forest Vegetation of the Lower Rio Grande in Texas,” *Texas Journal of Forest Ecology and Management*, vol. 128, 75-81, 2000.
- J. Carter, M.M. Crawford, P. Lehman, G. Nikolaenko, G., and J. Trelogan, “The Chora of Chersonesos in Crimea, Ukraine,” *American Journal of Archaeology*, vol. 104, 707-741, 2000.
- S. Kumar, J. Ghosh, and M.M. Crawford, “A Hierarchical Multiclassifier System for Hyperspectral Data Analysis,” *Lecture Notes in Computer Science*, Ed. F. Roli and J. Kittler, vol. 1857, 270-279, 2000.
- S. Kumar, J. Ghosh, and M.M. Crawford, “Best-Bases Feature Extraction Algorithms for Classification of Hyperspectral Data,” *IEEE Trans. on Geoscience and Remote Sensing*, vol. 39, no. 7, 1368-1380, 2001.
- K.C. Slatton, M.M. Crawford, and B.L. Evans, “Fusing Interferometric Radar and Laser Altimeter Data to Estimate Surface Topography and Vegetation Heights,” *IEEE Trans. on Geoscience and Remote Sensing*, vol. 39, no. 11, 2470-2482, 2001.
- S. Kumar, J. Ghosh, and M.M. Crawford, “Hierarchical Fusion of Multiple Classifiers for Hyperspectral Data Analysis,” *International J. Pattern Analysis and Applications*, vol. 5, no.2, 210-220, 2002.
- J.T. Morgan, A. Henneguelle, M.M. Crawford, J. Ghosh, and A.L. Neuenschwander, “Adaptive Feature Spaces for Land Cover Classification with Limited Ground Truth Data,” *Lecture Notes in Computer Science*, Ed. F. Roli and J. Kittler, vol. 2364, 189-200, 2002.
- M. Jung and M.M. Crawford, “Model Based Simulation of Multispectral Images Based on Remotely Sensed Data,” *Simulation Modelling Practice and Theory*, vol. 11, no. 2, 151-169, 2003.
- J.T. Morgan, J. Ham, M.M. Crawford, A. Henneguelle, and J. Ghosh, “Adaptive Feature Spaces for Land Cover Classification with Limited Ground Truth Data,” (substantively different from *Lecture Notes in Computer Science* version), *Int. J. Pattern Recognition and Artificial Intelligence*, vol. 18, no. 5, 777-799, 2004.
- S. Lee and M.M. Crawford, “Unsupervised Multistage Image Classification Using Hierarchical Clustering with a Bayesian Similarity Measure,” *IEEE Trans. on Image Processing*, vol. 14, no.3, 312-320, 2005.
- J. Ham, Y. Chen, M. Crawford, and J. Ghosh, “Investigation of the Random Forest Framework for Classification of Hyperspectral Data,” *IEEE Trans. on Geoscience and Remote Sensing*, vol. 43, no. 3, 492-501, 2005.
- A.L. Neuenschwander, M.M. Crawford, and S. Ringrose, “Results of the EO-1 experiment - Use of Earth Observing-1 Advanced Land Imager (ALI) data to Assess the Vegetational Response to Flooding in the Okavango Delta, Botswana,” *International Journal of Remote Sensing*, vol. 26, no. 19, 4321-4337, 2005.
- E.M. Rathje, M.M. Crawford, K. Woo, and A. Neuenschwander, “Damage Patterns from Satellite Images from the 2003 Bam, Iran Earthquake,” *Earthquake Spectra*, Earthquake Engineering Research Institute), 21(S1), pp. S295-307, 2005.
- J. Kelmelis, L. Schwartz, C. Christian, M. M. Crawford, and D. King, “Use of Geographic Information in Response to the Sumatra-Andaman Earthquake and Indian Ocean Tsunami of December 26, 2004,” *Photogrammetric Engineering and Remote Sensing*, 72(8), 862-876, 2006. (article also translated into Spanish for distribution in S. America).

- S. Rajan, J. Ghosh and M. M. Crawford, "Exploiting Class Hierarchies for Knowledge Transfer in Hyperspectral Data", *IEEE Trans. on Geoscience and Remote Sensing*, 44(11), 3408-3417, 2006.
- S. Rajan, J. Ghosh and M.M. Crawford, "An Active Learning Approach to Hyperspectral Data Classification," *IEEE Trans. on Geoscience and Remote Sensing*, 46(4), 1231-1242, 2008.
- K.C. Slatton, M.M. Crawford, L.D. Chang, "Modeling Temporal Variations in Multipolarized Radar Scattering from Intertidal Coastal Wetlands," *ISPRS Journal of Photogrammetry and Remote Sensing*, 63, 559-577, 2008.
- J. Jung, M. Crawford, S. Lee, "Complexity Estimation Based Work Load Balancing for a Parallel LIDAR Waveform Decomposition Algorithm," *Korean Journal of Remote Sensing*, 25(6), 2009, pp. 1-10.
- L. Ma, M. M. Crawford, and J. W. Tian, "Anomaly detection for hyperspectral images based on robust locally linear embedding," *Journal of Infrared, Millimeter, and Terahertz Waves*. 31(6), 753-762, 2010.
- Ma, L. and M.M. Crawford, and J.W. Tian, "Generalized Supervised Local Tangent Space Alignment for Hyperspectral Image Classification," *Electronics Letters*, 46(7), 498-499, 2010.
- L. Ma and M.M. Crawford, "Local Manifold Learning Based K-Nearest Neighbor for Hyperspectral Image Classification," *IEEE Transactions on Geoscience and Remote Sensing*, 48(11), 4099-4109, 2010.
- W. Kim and M.M. Crawford, "Adaptive Classification of Hyperspectral Image Data using Manifold Regularization Kernel Machines," *IEEE Trans. on Geoscience and Remote Sensing*, 48(11), 4110-4121, 2010.
- W. Kim, M.M. Crawford, and S. Lee, "Integrating Spatial Proximity with Manifold Learning for Hyperspectral Data," *Korean Journal of Remote Sensing* 26(6), 693-703, 2010.
- W. Di and M.M. Crawford, "Active Learning via Multi-View and Local Proximity Co-regularization for Hyperspectral Image Classification," *IEEE Journal of Selected Topics in Signal Processing*, 5(3), 618-628, 2011.
- J. Jung and M.M. Crawford, "Decomposition of Waveform LIDAR Data for Terrestrial Applications," *IEEE Geoscience and Remote Sensing Letters*, in press.
- W. Di and M.M. Crawford, "View Generation for Multi-view Maximum Disagreement Based Active Learning for Hyperspectral Image Classification," *IEEE Transactions on Geoscience and Remote Sensing*, in press
- W. Kim and M. M. Crawford, "Region-based Landmark Selection for Manifold Learning via a Spatially Induced Sparse Kernel," *IEEE Geoscience and Remote Sensing Letters*, in review.
- B. Naz, L. Bowling, and M. Crawford, "Spatial and Temporal Glacier Changes in the Central Karakoram Himalaya Derived from Landsat Satellite and Climate Data," *J. Glaciology*, in review.
- B. Naz, L. Bowling, M. Crawford, "Quantification of Glacier Changes Using ICESat Elevation Data and the SRTM Digital Elevation Model in the Upper Indus Basin," *Journal of Glaciology*, in review.

B. Conference Proceedings

- S.E. Hoffman., M.M. Crawford, and J.R. Wilson, "An Integrated Model of Offshore Drilling Vessel Operations," *Proc. 1983 Winter Simulation Conference*, Piscataway, NJ: Institute of , Electrical and Electronics Engineers, 45-53, Dec 1983.
- J.N. Robinson, and M.M. Crawford, "Spatial-Temporal Statistical Models of Biomass Indicators Using Remote Sensing Data," *Proc. 1st Conf. on Applied Analysis in Aerospace, Industry, and Medical Sciences*, Houston, Texas, 23-32, November 1985.
- B. Balakrishnan, T.S. Kelso, S. Lee, J.B. Lundberg, M.M. Crawford, and B.D. Tapley, "Application of Clustering Techniques for the Detection, Classification, and Estimation of Multiple Targets in Space," *Proc. 26th Aerospace Sciences Meeting, AIAA-88-0571*, Reno, Nevada, Jan. 1987.

- Q.C. Lu, W.M. Grady, and M.M. Crawford, "Adaptive Nonlinear Predictor with Orthogonal Escalator Structure for Short-Term Load Forecasting," *Proc. IEEE 1988 Power Engineering Society Meeting*, 88SM 717-1, 1-9, Portland Oregon, July 24-29, 1988.
- W. Kastak and M.M. Crawford, "A Two-Stage Algorithm for Registration of Remotely Sensed Images," *Proc. 1989 International Geoscience and Remote Sensing Symposium*, Vancouver, B.C., 1283-1286, July 10-14, 1989.
- Richardson, A.J., Crawford, M.M., Dron, L., Everitt, L., and Summy, R., "Evaluation of Agricultural Management Applications in the Rio Grande Valley Using SPOT Imagery," *Proc. 1989 International Geoscience and Remote Sensing Symposium*, Vancouver, B.C., 816-818, July 10-14, 1989.
- Gallegos, S.C., Gray, T.I., and Crawford, M.M., "A Study into the Responses of the NOAA-n AVHRR Reflective Channels over Water Targets," *Proc. 1989 International Geoscience and Remote Sensing Symposium*, Vancouver, B.C., 712-715, July 10-14, 1989.
- Lee, S., and Crawford, M.M., "Statistically Based Unsupervised Hierarchical Image Segmentation Algorithm with a Blurring Corrector," *Proc. 1989 International Geoscience and Remote Sensing Symposium*, Vancouver, B.C., 630-633, July 10-14, 1989.
- Kastak, W. and Crawford, M.M., "A Two-Stage Algorithm for Registration of Remotely Sensed Images," *Proc. 1989 International Geoscience and Remote Sensing Symposium*, Vancouver, B.C., July 10-14, 1989.
- Lee, S., and Crawford, M.M., "An Adaptive Reconstruction System for Spatially Correlated Multi-Spectral, Multi-Temporal Images," *Proc. 1989 International Geoscience and Remote Sensing Symposium*, Vancouver, B.C., 513-516, July 10-14, 1989.
- O'Keefe, S.D., and Crawford, M.M., "An Automated Method for Estimating Oceanic Flow Fields from Satellite Imagery," *Proc. 1989 International Geoscience and Remote Sensing Symposium*, Vancouver, B.C., 315-317, July 10-14, 1989.
- Khazenie, N., and Crawford, M.M., "Spatial-Temporal Random Field Model for Contextual Classification of Satellite Imagery," *Proc. 1989 International Geoscience and Remote Sensing Symposium*, Vancouver, B.C., 497-502, July 10-14, 1989.
- S. Lee and M.M. Crawford, M.M., "Applications of an Adaptive Reconstruction System to a Sequence of Nonstationary Image Data," *Proc. 1990 International Geoscience and Remote Sensing Symposium*, College Park, MD, 1637-1640, May 20-24, 1990.
- K. Kim and M.M. Crawford, "Adaptive Parametric Estimation and Classification of Remotely Sensed Imagery Using a Pyramid Structure," *Proc. 1990 International Geoscience and Remote Sensing Symposium*, College Park, MD, 1633-1636, May 20-24, 1990.
- S.D. O'Keefe and M.M. Crawford, "Automated Mapping of Oceanic Flow Fields from Satellite Imagery," *Proc. 1990 International Geoscience and Remote Sensing Symposium*, College Park, MD, 2477-2480, May 20-24, 1990.
- J. Lundberg, M.M. Crawford, and B.D. Tapley, "Application of Cluster Analysis and Orbit Determination to the Data Association of Multiple Target Tracking in Space," *Astrodynamics 1991, Advances in the Astronautical Sciences*, August 1990.
- M.M. Crawford, W. Kastak, K. Kim, P.F. Lau, A. Richardson, and A. Vali, "Comparison of Segmentation and Classification of SPOT XS and Merged XS/Panchromatic Data," *Proc. 1991 International Geoscience and Remote Sensing Symposium*, Helsinki, Finland, 2197-2201, June 3-6, 1991.
- C. McDonnell and M.M. Crawford, "Unsupervised Training for Image Segmentation via Spatial Clustering and Nonparametric Spectral Distance Measures," *Proc. 1992 International Geoscience and Remote Sensing Symposium*, Houston, TX, 1398-1400, May 26-29, 1992.
- S.T. Acton, and M.M. Crawford, "A Mean Field Solution to Anisotropic Edge Detection of Remotely Sensed Images," *Proc. 1992 International Geoscience and Remote Sensing Symposium*, Houston, TX, 8445-847, May 26-29, 1992.

- N. Lamei, N. Khazenie, and M.M. Crawford, "Multi-Spectral Texture Analysis for Cloud Feature Discrimination," *Proc. 1992 International Geoscience and Remote Sensing Symposium*, Houston, TX, 1011-1013, May 26-29, 1992.
- K. Kim and M.M. Crawford, "Adaptive Nonparametric Estimation and Classification of Remotely Sensed Imagery Using a Pyramid Structure," *Proc. 1992 International Geoscience and Remote Sensing Symposium*, Clear Lake, TX, 1412-1414, May 26-29, 1992.
- N. Lamei, K. Hutchison, and M.M. Crawford, "Cloud Type Discrimination via Multispectral Textural Analysis," *Proc. 1993 International Symposium on Optical Engineering and Photonics in Aerospace and Remote Sensing*, Orlando, FL, vol. 1934, 49-61, April 1993.
- P.F. Lau, and M.M. Crawford, "Efficient Edge Detection in Remote Sensing Imagery by Scale Adaptation and Recursive Half-Space Filtering," *Proc. 1993 International Symposium on Optical Engineering and Photonics in Aerospace and Remote Sensing*, Orlando, FL, 424-434, April 1993.
- G. Usanmaz and M.M. Crawford, "Hierarchical, Data Adaptive Supervised Nonparametric Image Classification," *Proc. 10th Australian Conference on Remote Sensing*, Melbourne, Australia, 335-342, March 1-4, 1994.
- S. Lee and M.M. Crawford, "Adaptive Reconstruction of Sequential AVHRR Imagery of Texas via Dynamic Compositing Using an Exponentially Weighted Polynomial Function," *Proc. 1994 International Geoscience and Remote Sensing Symposium*, Pasadena, Ca., 64-66, August 8-12, 1994.
- S. Lee and M.M. Crawford, "Multitemporal Classification of Texas AVHRR Imagery Using Harmonic Components," *Proc. 1994 International Geoscience and Remote Sensing Symposium*, Pasadena, CA, 2528-2530, August 8-12, 1994.
- S. Lee, and M.M. Crawford, "Unsupervised Multistage Segmentation Using Markov Random Fields and the Maximum Entropy Principle," *Proc. 1st International Conference on Image Processing*, 192-196, Austin, TX, 192-196, November 13-16, 1994.
- S.T. Acton, A.C. Bovik, and M.M. Crawford, "Anisotropic Diffusion Pyramids for Image Segmentation," *Proc. 1st International Conference on Image Processing*, 478-482, Austin, TX, November 13-16, 1994.
- S. Lee, and M.M. Crawford, "Statistical Reconstruction and Feature Tracking of Temporally Irregular Data Sequences," *Proc. 1995 International Geoscience and Remote Sensing Symposium*, Florence, Italy, 352-354, July 10-14, 1995.
- S. Lee, and M.M. Crawford, "Multistage Unsupervised Classification of Spatially Continuous Imagery," *Proc. 1995 International Geoscience and Remote Sensing Symposium*, Florence, Italy, 1165-1167, July 10-14, 1995.
- J. Jung and M.M. Crawford, "Simulation of Landscape via Random Field Models," *IEEE Southwest Symp. Image Analysis and Interpretation*, San Antonio, TX, 18 - 24, April 8-9, 1996.
- J. Jung and M.M. Crawford, "Contextual Simulation of Landscape Based on Remotely Sensed Data," *Proc. 1996 International Geoscience and Remote Sensing Symposium*, Lincoln, Nebraska, 1870-1873, May 27-31, 1996.
- K.C. Slatton, M.M. Crawford, J.C. Gibeaut, and R. Gutierrez, "Modeling Wetland Vegetation Using Polarimetric SAR," *Proc. 1996 International Geoscience and Remote Sensing Symposium*, Lincoln, Nebraska, 263-265, May 27-31, 1996.
- M.R. Ricard, A.L. Neuenschwander, M.M. Crawford, and J.C. Gibeaut, "Fusion of Optical and SAR Data for Classification of Wetland Environments," *Proc. 1997 International Geoscience and Remote Sensing Symposium*, Singapore, 667-669, August 10-14, 1997.
- K.C. Slatton, M.M. Crawford, and J.C. Gibeaut, "Removal of Residual Errors from TOPSAR-Derived Digital Elevation Models for Operational Products," *Proc. 1997 International Geoscience and Remote Sensing Symposium*, Singapore, 457-459, August 10-14, 1997.

- M.M. Crawford and M.R. Ricard, "Hierarchical Classification of SAR Data Using a Markov Random Field Model," *IEEE Southwest Symposium on Image Processing*, Tucson, AZ, 81-86, April 5-7, 1998.
- F.W. Judd, R.I. Lonard, M.M. Crawford, and M.D. Desai, "Evaluation of Color-Infrared Photography for Distinguishing Annual Changes in Riparian Forest Vegetation of the Lower Rio Grande in Texas," *Proc. 1st International Conference on Geospatial Information in Agriculture and Forestry*, I-421-I-432, Lake Buena Vista, FL, June 1-3, 1998.
- R.I. Lonard, F.W. Judd, J.H. Everitt, D.E. Escobar, M.R. Davis, and M.M. Crawford, "Evaluation of Multispectral Videography for Distinguishing Marshes in the Coastal Prairie of Southern Texas," *Proc. North American Prairie Conference*, 226-234, U of Nebraska-Kearney, July 1998.
- A.L. Neuenschwander, M.M. Crawford, and M.J. Provancha, "Mapping of Coastal Wetlands via Hyperspectral AVIRIS Data," *Proc. 1998 International Geoscience and Remote Sensing Symposium*, Seattle, WA, 189-191, July 6-10, 1998.
- O.I. Kwon, M.M. Crawford, and V.R. Baker, "Variable Resolution Topographic Mapping of Ancient Fluvial Landscapes in Australia," *Proc. 1998 International Geoscience and Remote Sensing Symposium*, Seattle, WA, 2360-2362, July 6-10, 1998.
- M.R. Ricard and M.M. Crawford, "Multiscale Hierarchical Classification of Wetland Environments Using SAR Data," *Proc. 1998 International Geoscience and Remote Sensing Symposium*, Seattle, WA, 354-356, July 6-10, 1998.
- R. Gutierrez, J.C. Gibeaut, M.M. Crawford, M.P. Mahoney, S. Smith, W. Gutelius, D. Carswell, E. MacPherson, E., 1998, "Airborne Laser Swath Mapping of Galveston Island and Bolivar Peninsula, Texas," *Proc. 5th International Conference on Remote Sensing for Marine and Coastal Environments*, San Diego, CA, Oct. 5-7, vol.1, I236-I243, 1998.
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- M. Jung and M.M. Crawford, "Stochastic Model for Spatial Processes," *Proc. 2000 International Geoscience and Remote Sensing Symposium*, Honolulu, Hawaii, July 24-28, 325-328, 2000.
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- W. White, M.M. Crawford, S. Erzurumlu, T. Tremblay, and J. Raney, "Analysis of EO-1 ALI Data to Determine the Local Impacts of Hurricane Iris on Broadleaf Forests in Belize, Central, America," *Proc. 2002 International Geoscience and Remote Sensing Symposium*, Toronto, Canada, June 24-28, 3127-3128, 2002.
- K.C. Slatton, M.M. Crawford, and L. Teng, "Multiscale Fusion of INSAR data for Improved Topographic Mapping," *Proc. 2002 International Geoscience and Remote Sensing Symposium*, Toronto, Canada, June 24-28, 69-71, 2002.
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- International Geoscience and Remote Sensing Symposium*, Toulouse, France, July 21-25, 297-299, 2003.
- D. Korycinski, M.M. Crawford, and J.W. Barnes, "Adaptive Feature Selection for Hyperspectral Data Analysis," SPIE Conference on Image and Signal Processing for Remote Sensing IX, Barcelona, Spain, September 9-12, *SPIE Proceedings*, vol. 5238, 213-225, 2003.
- E. M. Rathje and M.M. Crawford, "Earthquake Damage Identification Using High-Resolution Satellite Images from the 2003 Northern Algeria Earthquake," *Workshop on Application of Remote Sensing Technologies for Disaster Response*, University of California, Irvine, CA, September 12.
- M.M. Crawford, J. Ham, Y. Chen, and J. Ghosh, "Random Forests of Binary Hierarchical Classifiers for Analysis of Hyperspectral Data," *Proc. IEEE Workshop on Advances in Techniques for Analysis of Remotely Sensed Data*, Goddard Space Flight Center, Greenbelt, MD, Oct 27-28, (publication via CD), 2003.
- A. Henneguelle, J. Ghosh, and M.M. Crawford, "Polyline Feature Extraction for Land Cover Classification Using Hyperspectral Data," *Proc. IICAI-2003*, Hyderabad, India, Dec. 18-20, (publication in progress via CD), 2003.
- E.M. Rathje, and M.M. Crawford, "Using High Resolution Satellite Imagery to Detect Damage from the 2003 Northern Algeria Earthquake," *13th World Conference on Earthquake Engineering*, Vancouver, Canada, August 1-6, Paper No. 2911, 2004.
- Y. Chen, M.M. Crawford, and J. Ghosh, "Integrating Support Vector Machines in a Hierarchical Output Decomposition Framework," *Proc. 2004 International Geoscience and Remote Sensing Symposium*, Anchorage, Alaska, Sept. 20-24, 949-952, 2004.
- Y. Chen, M.M. Crawford, and J. Ghosh, "Applying Nonlinear Manifold Learning on Hyperspectral Data," *Proc. 2005 International Geoscience and Remote Sensing Symposium*, Seoul, Korea, July 25-29, 4311-4314, 2005.
- E.M. Rathje, K. Woo, K., M.M. Crawford, and A. Neuenschwander, "Earthquake Damage Identification using Multi-Temporal High-Resolution Optical Satellite Imagery," *Proc. 2005 International Geoscience and Remote Sensing Symposium*, Seoul, South Korea, July 25-29, 5045-5048, 2005.
- R. Gutierrez, A. Neuenschwander, and M.M. Crawford, "Development of Laser Waveform Digitization for Airborne LIDAR Topographic Mapping Instrumentation," *Proc. 2005 International Geoscience and Remote Sensing Symposium*, Seoul, South Korea, July 25-29, 1154-1157, 2005.
- Y. Chen, M.M. Crawford, and J. Ghosh, "Improved Manifold Learning for Land Cover Classification via Intelligent Landmark Selection," *Proc. 2006 International Geoscience and Remote Sensing Symposium*, July 31-August 4, Denver, Colorado, 545-548, 2006.
- S. Rajan, "An Active Learning Approach for Knowledge Transfer for Hyperspectral Data Analysis," *Proc. 2006 International Geoscience and Remote Sensing Symposium*, July 31-August 4, Denver, Colorado, 541-544, 2006.
- Y. Chen, M. Crawford and J. Ghosh, "Knowledge Based Stacking of Hyperspectral Data for Land Cover Classification," *Proc. 2007 IEEE Symposium on Computational Intelligence and Data Mining*, April 1-5, Honolulu, Hawaii, 316-322, 2007.
- W. Kim, Y. Chen, M. Crawford, J. Tilton, and J. Ghosh, "Multiresolution Manifold Learning for Classification of Hyperspectral Data," *Proc. 2007 International Geoscience and Remote Sensing Symposium*, July 23-27, Barcelona, Spain, 3785-3788, 2007.
- W. Kim, M. Crawford, and J. Ghosh, "Spatially Adapted Manifold Learning for Classification of Hyperspectral Imagery with Insufficient Labeled Data," *Proc. 2008 International Geoscience and Remote Sensing Symposium*, July 7-11, Boston, MA, I:213-217, 2008.
- J. Jung and M. Crawford, "A Two-Stage Approach for Decomposition of ICESat Waveforms," *Proc. 2008 International Geoscience and Remote Sensing Symposium*, July 7-11, Boston, MA, III:680-683, 2008.

- J. Monty, C.S.T. Daughtry, and M. Crawford, "Assessing Crop Residue Cover Using Hyperion Data," *Proc. 2008 International Geoscience and Remote Sensing Symposium*, July 7-11, Boston, MA, II:303-306, 2008.
- B. Naz, L. Bowling, and M. Crawford, "Quantification of Glacier Changes using ICESAT Elevation Data and the SRTM Digital Elevation Model in the Western Karakoram Himalaya Region, American Geophysical Union Meeting, December 9-12, San Francisco, California, 2008.
- M. Crawford and W. Kim, "Manifold Learning for Multi-classifier Systems via Ensembles," *Proc. 2009 Multiclassifier Systems Conference*, June 10-12, Reykjavik, Iceland, Lectures in Computer Science, Springer-Verlag, 519-528, 2009.
- J. Monty, M. Crawford, C. Daughtry, "Residue Cover Estimation from Hyperspectral Image Data," *Proc. 2009 IEEE Geoscience and Remote Sensing Symposium*, July 13-17, Cape Town, South Africa, V401-404, 2009.
- W. Kim and M. Crawford, "A Novel Adaptive Classification Method for Hyperspectral Data Using Manifold Regularization Kernel Machines," *Proc. IEEE GRSS Workshop on Hyperspectral Image and Signal Processing - Evolution in Remote Sensing*, August 25-28, Grenoble, France, DOI: 978-1-4244-4687-2, 2009.
- J. Jung, M. Crawford, S. Lee, "Work Load Balancing for a Parallel LIDAR Waveform Decomposition Algorithm," *Proc. 2009 International Symposium on Remote Sensing*, October 28-30, Busan, S. Korea, 174-177, 2009.
- D. Grant, J. Bethel, and M. Crawford, "Direct Point Correspondence for LIDAR Strip Adjustment Using Iterative Network Matching," *International Laser Mapping Forum*, March 3-5, Denver, 2010.
- A. Neuenschwander, M.M. Crawford, L. A. Magruder, C. A. Weed, R. Cannata, D. Fried, R. Knowlton, and R. Heinrichs, "Terrain Classification of LADAR data over Haitian Urban Environments Using a Lower Envelope Follower and Adaptive Gradient Operator," *Proc. SPIE*, April 5-10, Orlando, FL, 2010.
- D. Grant, J. Bethel, and M. Crawford, "A Correspondence-Based Strategy for Automatic Registration of Terrestrial Laser Scanning Data," *Proc. American Society of Photogrammetry and Remote Sensing Conference*, April 26-30, San Diego, CA, 2010.
- J. Jung, M. Crawford, and S. Lee, "Stability and Scalability Assessment of Complexity Estimation Based Work Load Balancing Approach for a Parallel LIDAR Waveform Decomposition Algorithm," *Proc. American Society of Photogrammetry and Remote Sensing Conference*, April 26-30, San Diego, CA, 2010.
- W. Di and M.M. Crawford, "Locally Consistent Graph Regularization Based Active Learning for Hyperspectral Image Classification," *Proc. IEEE GRSS Workshop on Hyperspectral Image and Signal Processing - Evolution in Remote Sensing*, June 14-16, Reykjavik, Iceland, DOI:10.1109/WHISPERS.2010.5594891, 1-4, 2010.
- J. Jung and M.M. Crawford, "Integration of Waveform LIDAR and Hyperspectral Data to Estimate Structural Attributes of Tropical Forests," *2010 IEEE Geoscience and Remote Sensing Symposium*, July 26-30, Honolulu, Hawaii, 2010.
- L. Ma, M.M. Crawford, "Anomaly Detection for Hyperspectral Images Using Local Tangent Space Alignment," *Proc. 2010 International Geoscience and Remote Sensing Symposium*, July 26-30, Honolulu, Hawaii, 824-827, 2010.
- W. Di, and M. M. Crawford, "Multi-view Adaptive Disagreement Based Active Learning for Hyperspectral Image Classification," *2010 IEEE Geoscience and Remote Sensing Symposium*, July 26-30, Honolulu, Hawaii, 1374-1377, 2010.
- H.H. Yang and M.M. Crawford, "Temporal Hyperspectral Image Classification by Aligning Manifolds," *Proc. IEEE GRSS Workshop on Hyperspectral Image and Signal Processing - Evolution in Remote Sensing*, June 7-9, Lisbon, Portugal, DOI:10.1109/WHISPERS.2011.6080958, 1-4, 2011.

- H.H. Yang and M.M. Crawford, "Manifold Alignment for Multitemporal Hyperspectral Image Classification," *2011 IEEE Geoscience and Remote Sensing Symposium*, July 25-29, Vancouver, BC, 2011, 4332-4335, 2011.
- W. Di and M. M. Crawford, "Critical Class Oriented Active Learning for Hyperspectral Image Classification," *2011 IEEE Geoscience and Remote Sensing Symposium*, July 25-29, Vancouver, BC, 2011, 3899-3902, 2011.
- M. Galloza and M.M. Crawford, "Exploiting Multisensor Spectral Data to Estimate Crop Residue Cover for Management of Agricultural Water Quality," *2011 IEEE Geoscience and Remote Sensing Symposium*, July 25-29, Vancouver, BC, 3668-3671, 2011.

C. Book Chapters

- J. Ghosh, S. Kumar, and M. Crawford, "Discovery of Class Hierarchies via Output Space Decomposition," in *Advanced Methods for Knowledge Discovery from Complex Data*, Series: Advanced Information and Knowledge Processing, S. Bandyopdhyay, U. Maulik, L.B. Holder, D.J. Cook (Eds), Springer Verlag, London, 2005.
- M. Crawford, L. Ma, W. Kim, "Exploring Nonlinear Manifold Learning for Classification of Hyperspectral Data," in *Optical Remote Sensing: Advances in Signal Processing and Exploitation Techniques*, S. Prasad, J. Chanussot, L. Bruce (Eds), Springer Verlag, London, 2011.

D. Tutorials

- M. Crawford, "Multitemporal Methods for Analysis of Remotely Sensed Data," Okavango Research Center, Gaborone, Botswana, March 2002.
- M. Crawford and J. Pearlman, "Hyperspectral Image Processing and Analysis for Land Cover Characterization," International Geoscience and Remote Sensing Symposium, Anchorage, Alaska, September, 2004.
- M. Crawford and J. Ghosh, Advanced Methods in Classification of Hyperspectral Data," University of Trento, Trento, Italy, October 2007.
- M. Crawford, "Multispectral and Hyperspectral Classification of Remotely Sensed Data," XIV Brazilian Symposium of Remote Sensing, Natal, Brazil, April 2009.

INVITED PRESENTATIONS (2010-11)

A. Keynote Presentations

- "Advanced Sensing and Information Extraction: Synergies for Optical Sensing," National Geospatial and Intelligence Agency, National Academy of Sciences, Washington, D.C., May 17, 2010
- "Advances in Manifold Learning for Classification of High Dimensional Remote Sensing Data," Imaging Without Boundaries: Exploring the Science, Technology, and Applications of Imaging and Visualization, Beckman Institute for Advanced Science and Technology, University of Illinois, Urbana, October 16, 2010
- "Remote Sensing: No Longer Just a Pretty Picture," Notre Dame GIS Day, Notre Dame University, South Bend, IN, Nov 19, 2010
- "Nonlinear Manifolds for Feature Extraction: Opportunities and Challenges, Lisbon, Portugal, June 7, 2011.

B. Other Invited Presentations (2010-11)

- "Feature Extraction Full Waveform LiDAR Data For Estimation of Forest Structural Characteristics," Optical Science of America, Tucson, Arizona, June 7, 2010
- "Advanced Remote Sensing from EO-1 Hyperion," EO-1 Decadal Meeting, Goddard Space Flight Center, Greenbelt, Maryland, November 30, 2010.

“Advances in Manifold Learning for Classification of High Dimensional Remote Sensing Data in Dynamic Environments”, Invited Presentation, University of Florida, Department of Computer and Information Science, November 12, 2010.

“Nonlinear Manifolds for Feature Extraction: Opportunities and Challenges for Analysis of Remotely Sensed Data, Waterloo, Ontario, CA, August 2, 2011

RESEARCH FUNDING

University of Texas at Dallas Grant, “Detection, Identification, and Estimation of Changes in Time Series,” \$5,700, 1980-1981.

Bureau of Engineering Research, University of Texas at Austin, “Identification of Multivariate Transfer Function Models,” \$3,000, 1981.

University Research Institute Summer Research Award, “Hydrologic Forecasting Via an Adaptive Kalman Filter,” \$6,068, 1982.

ARCO Oil and Gas Company, “Multivariate Time Series Models of Sea State Variables,” \$37,533, 1983-84.

University Research Institute, Research Grant, “Time Series Modeling of Vibration in Heavy Equipment,” \$4,800, 1984.

National Oceanographic and Atmospheric Administration, “Time Series Modeling of Extreme Weather Indicators,” \$4,000, 1984.

Electric Power Research Institute, “Electricity Form Value Studies,” (with Philip S. Schmidt), \$141,700, 1985.

University Research Institute Research Grant, “Data Analysis Support for a Time Series Approach to Predicting Hurricane Landfall,” \$3,000, 1985.

Advanced Technology Research Program, State of Texas, “Applications of Satellite Remote Sensing to the Identification of Time Varying Surface Features,” (with Byron Tapley), \$250,000, 1986.

Cray Research Inc., “Multitarget Tracking and Detection,” with Byron Tapley, \$75,042, 1986-1987.

Gas Research Institute, “Optimal Utilization of Energy Resources in Foundry Operations,” (with Philip S. Schmidt), \$45,279, 1986.

Electric Power Research Institute, “Dielectric/Convective Drying,” (with Philip S. Schmidt and Theodore L. Bergman), \$493,000, 1986.

Texas A&M University Sea Grant College Program, “Causal Mechanisms of *Ptychodiscus Brevis* Red Tides on the Texas Coast,” (with Eleanor Cox, A&M University) \$130,000, 1987.

Electric Power Research Institute, “Dielectrically-Enhanced Drying,” (with P.S. Schmidt, T.L. Bergman, and J.A. Pearce), \$881,000, 1987-89.

Texas Advanced Technology Research Program, “Monitoring Cotton Plough Up for Regional Control of Boll Weevils via Multispectral Satellite Imagery,” \$348,300, 1988.

Texas Advanced Technology Program, “Applications of Satellite Remote Sensing in Monitoring Surface Phenomena and Circulation in the Gulf of Mexico,” (with Byron Tapley), \$188,571, 1990.

Texas Advanced Research Program, “Reconstruction and Segmentation of Images of Spatial-Temporal Stochastic Processes,” \$141,177, 1990.

Evans-Hamilton, Inc., “Nelson Eddy Analysis Project,” \$7000, 1990.

NSF and NASA, “Disturbance, Spatial Heterogeneity, and Biotic Diversity in Arid Australia,” (with E. Pianka), NSF \$200,000; NASA, \$250,000, 1991-1994.

US Department of Agriculture, “Remote Sensing in Mapping Insect Habitats in Panama,” \$42,000, 1991-92.

Texas Advanced Technology Research Program, “Integration of Satellite Data and Buoy Surface Conditions with Circulation Models in the Gulf of Mexico,” (with B.D. Tapley), \$222,000, 1992-94.

- US Department of Agriculture, "Classification of Screwworm Habitat in Panama Using Satellite Remote Sensing and Spatial Modeling," \$43,500, 1992-93.
- Texas General Land Office, "Applications of Satellite Remote Sensing in Monitoring Surface Phenomena and Circulation in the Gulf of Mexico for Emergency Response to Oil Spills," (with B.D. Tapley), \$219,500, 1992-93.
- NASA, "Investigation of Airborne SAR in Mapping Vegetation in Western Australia," (with B.D. Tapley and E. Pianka), NASA, \$27,800, 1993.
- US Department of Agriculture, "Multi-Source Data Fusion in Classification of Forest Habitat," \$35,000, 1993-94.
- Cray Research, "Fusion of Data from Multiple Satellite Sensors into Numerical Climate Models," \$39,500, 1993-94.
- Lockheed Austin Division, "Classification of Cirrus Clouds in Remote Sensing Data via Texture Methods," \$15,400, 1993-1994.
- U.S. Air Force, "Acquisition and Analysis of AVHRR Data from the NOAA Satellites for Mapping Cirrus Clouds" (with B.D. Tapley), \$16,500, 1994-95.
- NASA, "Multiresolution Information Archival and Analysis System for EOSDIS," (with D. Fussell, A. Bovik, H. Vin, and B. Tapley), \$750,000, 1994-1996.
- NASA, "Acquisition and Processing of AVHRR Data from NOAA Satellites," \$24,276, 1995
- NASA, "Multiresolution Image Analysis for Environmental Mapping Applications," (with M. Desai, UTSA), \$450,000, 1995-99.
- NASA, "Detecting Small-Scale Topographic Changes and Relict Geomorphic Features on Barrier Islands Using SAR," (with J. Gibeaut and R. Gutierrez), \$254,700, 1995-98.
- Conoco, "Acquisition and Processing of ARGOS Buoy Data From the NOAA Satellites," \$10,461, 1996.
- General Research Corporation, "Fusion of Infrared and Radar Imagery for Feature Extraction," \$35,966, 1995-96.
- Texas Higher Education Coordinating Board, "Remote Sensing of Rio Grande Floodplain Vegetation," \$69,767, 1996-97.
- Texas SpaceGrant, "Remote Sensing of Texas Coastal Wetlands via Airborne and Optical SAR Imagery," \$35,000, 1996-97.
- U.S. AID, "Mapping Deforestation in Belize from 1992 - 1996," (with the UT Bureau of Economic Geology), \$35,000, 1997-98.
- Army Research Office, "Multisensor Approach to Mapping 2D and 3D Geologic Features from Remotely Sensed Imagery," (with V. Baker, U of Arizona) \$215,000, 1998-2001.
- NASA, "Patterns of Shoreline Change and Hurricane Washover on Barrier Islands," (with James Gibeaut and B. Schutz) \$600,000, 1998-2002.
- Texas Higher Education Coordinating Board, "Remote Sensing of Marshes at the Mouth of the Rio Grande," \$84,783, 1998-2000.
- US AID, "Mapping Deforestation in Belize," \$7500, 1996-1998.
- NASA JPL, "High Resolution Digital Elevation Model (DEM) Generation Using Radar Interferometry and GPS/Laser Altimeter Data: Innovative Data Fusion Beyond Shuttle Radar Topographic Mission (SRTM)," \$100,000, 1998-99.
- Petroleos de Venezuela, S.A., (with the UT Bureau of Economic Geology), "Environmental Mapping of the Orinoco Delta from Remotely Sensed Data," \$200,000, 1998-99.
- NASA, "Remote Sensing, GIS and the Ancient Territory: A Project for the Chora of Chersonesos Sevastopol, Ukraine," \$300,000, 1998-2003.
- European Space Agency, "Development of Interpretation Techniques for Mapping Ecological Change in the Okavango Delta Botswana Using Historic ERS SAR Data," Data Grant, 1998-2001.
- European Space Agency, "Investigation of the Chora of Chersonesos Sevastopol, Ukraine Using ERS Radar, Data Grant, 1998-2001.

- European Space Agency, "A Study of Change on Kamchatka Peninsula Using ERS-1/2," Data Grant, 1998-2001.
- European Space Agency, "Multi-baseline Studies of SAR Interferometry Using ERS and Envisat," Data Grant, 1999-2004.
- Schlumberger, "Collaborative Studies for LightSAR," \$40,000, 1999-2001.
- Texas Parks and Wildlife Department, "Development of a Remote Sensing Based Forecasting Capability for Red Tide Events in the Gulf of Mexico," \$48,000, 1999-2001.
- Dynamac Corporation, "Mapping Terrestrial Vegetation at the Kennedy Space Center," \$45,000, 1999-2001.
- U.S. Environmental Protection Agency, "Regional Ecological Resource Assessment of the Rio Grande Riparian Corridor: A Multidisciplinary Approach to Understanding Anthropogenic Effects on Riparian Communities in Semi-Arid Environments," (with J. Raney, UT Bureau of Economic Geology), \$642,000, 1999-2003.
- NASA, "Improved Estimation of Surface Topography and Vegetation Structure by Combining Interferometric SAR with Laser Altimetry," \$44,000, 1999-2001.
- Schlumberger Foundation, "Multisensor Topographic Mapping," \$30,000, 1999-2002.
- Texas SpaceGrant Consortium, "Investigations in Lidar Error Sources for Enhanced Terrain Mapping," \$45,000, 1999-2001.
- NASA, "Floodplain Modeling Based on Data Fusion of Polarimetric SAR Interferometry and Laser Altimetry," (with Jakob van Zyl, JPL), \$300,000, 1999 -2002.
- NASA, "Evaluation and Validation of EO-1 and Landsat-7 Imagery Through an Analysis of Land Cover/Land Use and Rates of Deforestation in Belize, Central America," (with UT Bureau of Economic Geology), \$225,000, 2000-2002.
- Edwards Aquifer Authority, "Mapping of Irrigated Lands in Central Texas Using Multispectral Satellite Imagery," \$30,000, 2000.
- University of Texas, "Paleoflooding in the Rio Panuco Watershed, Mexico," (UT Interdisciplinary Research Initiative, with Paul Hudson, Geography Department), \$200,000, 2000-2001.
- Office of Naval Research and Army Research Office, "Characterization of the Beach Zone using Airborne LIDAR," \$200,000, 2001-2003.
- NIMA, "Fusion of INSAR and LIDAR for Improved Topographic Mapping, Error Correction, and Sensor Independent Updating," \$452,000, 2001-2004.
- Army Research Office, "Laser Waveform Digitizer and Upgrade for Airborne LIDAR System," (DURIP equipment grant, with B. Schutz), \$170,000, 2002-2004.
- U.S. Geological Survey, "LIDAR Feature Extraction and Classification," \$17,000, 2002-2003.
- U.S. Air Force, "Hyperspectral Mapping from Hyperion," \$15,000, 2002-2003
- NSF, "Extraction and Interpretation of Information from Large-Scale Hyperspectral Data for Mapping and Monitoring Wetland Ecosystems," (with J. Ghosh), \$300,000, 2003-2006.
- U.S. Geological Survey, "Using High-Resolution Satellite Imagery to Provide Rapid Post-Earthquake Damage Detection," (with E. Rathje), \$71,000, 2004-2005.
- NSF, "Collection and Processing of Satellite Data from the 2003 Tokachi-Oki (Hokkaido) Japan Earthquake for Determination of Permanent Ground Deformations," (with E. Rathje), \$30,100, 2004.
- NASA, "Toward the Development of Advanced Data Products from EOS Terra and Aqua Direct Broadcasts for Air Quality Management in the State of Texas," (with K. Hutchison), \$420,000, 2004-2006.
- Texas Commission on Environmental Quality (TCEQ), "Satellite Remote Sensing Applications to Improve Performance of Biogenic Emissions Models for Texas Air Quality Analyses," (with G. Wells), \$431,400, 2005-2006.
- National Geospatial-Intelligence Agency, "Remote Sensing Support for the U.S. State Department," \$77,100, 2005.

- Purdue Center for the Environment, “Quantifying Carbon Sequestrations across Indiana’s Forest Landscapes ,” (with G. Shao (PI), P. Pope, C. Michler, Qianlai Zhuang), 2007, \$30,000, 2007.
- Purdue Center for the Environment, “Preliminary Analysis for *in situ* and Satellite based Particulate Matter (PM) Mapping Capabilities for Environmental Air Quality Modeling and Impact Studies,” (with D. Niyogi (PI), G. Rochon, and Harshvardhan) \$28,000, 2007.
- National Science Foundation, “III-CXT: Collaborative Research: Advanced Learning and Knowledge Transfer Approaches to Remote Sensing and Forecast Modeling for Understanding Land-Use Change, (with G. Ghosh and B. Pijanowski), \$851,000, 2007-2012.
- Inha University, Korea, “Fusion Methods for Hyperspectral and LIDAR Data, \$46,700, 2009-2011.
- National Science Foundation, “A Paradigm Shift in Ecosystem and Environmental Modeling: A High Performance Computing and Machine Learning Approach,” (with Q. Zhuang (PI), H. Zhang, J. Zhang, Dongbin Xiu), \$1,615,600, 2010-2014.
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