# Xuejun Liao

130 Hudson Hall
Department of Electrical
and Computer Engineering
Box 90291, Duke University
Durham, NC 27708-0291

Office: 3457 CIEMAS
Phone: (919) 660-5548, (919) 236-3386
Fax: (919) 660-5293
Email: xjliao@ee.duke.edu
Homepage: `http://www.ee.duke.edu/~xjliao/`

## Research Interests

Machine learning, signal processing, and their applications

## Education

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|---|---|
| Ph.D., Electrical Engineering, Xidian University, China | 1999 |
| MS, Electrical Engineering, Hunan University, China | 1993 |
| BS, Electrical Engineering, Hunan University, China | 1990 |

## Publications

### Journal Papers

1. John Paisley, **Xuejun Liao**, Lawrence Carin, "Active Learning and Basis Selection for Kernel-Based Linear Models: A Bayesian Perspective", appearing in *IEEE Transactions on Signal Processing*, May, 2010
2. Hui Li, **Xuejun Liao**, and Lawrence Carin, "Multi-task Reinforcement Learning in Partially Observable Stochastic Environments", *Journal of Machine Learning Research (JMLR)*, 10 (2009), 1131-1186
3. Qiuhua Liu, **Xuejun Liao**, Hui Li, Jason R. Stack, and Lawrence Carin, "Semisupervised Multitask Learning", *IEEE Transactions on Pattern Analysis and Machine Intelligence*, Vol 31, No 6, June 2009, pages 1074-1086
4. J. R. Stack, G. Dobeck, **X. Liao**, L. Carin, "Kernel Matching Pursuits with Arbitrary Loss Functions", *IEEE Transactions on Neural Networks*, Vol 20, No 3, March 2009, pages 395-405
5. **X. Liao**, L. Carin, "Migratory Logistic Regression for Learning Concept Drift Between Two Data Sets With Application to UXO Sensing", *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 46, No. 12, December 2008
6. Q. Liu, **X. Liao**, L. Carin, "Detection of Unexploded Ordnance via Efficient Semisupervised and Active Learning", *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 46, No. 9, September 2008, pages 2558-2567
7. D. Williams, **X. Liao**, Y. Xue, L. Carin, B. Krishnapuram, "On Classification with Incomplete Data", *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 29(3):427-436, March 2007
8. D. Williams, C. Wang, **X. Liao**, L. Carin, "Classification of Unexploded Ordnance with Incomplete Multi-Sensor Multi-resolution Data", *IEEE Transactions on Geoscience and Remote Sensing*, Vol. 45, No. 7, Part 2, July 2007, pages 2364-2373
9. Y. Xue, **X. Liao**, L. Carin, and B. Krishnapuram, "Multi-Task Learning for Classification with Dirichlet Process Priors", *Journal of Machine Learning Research (JMLR)*, 8:35-63, Jan, 2007
10. S. Ji, **X. Liao**, L. Carin, "Adaptive Multi-Aspect Target Classification and Detection with Hidden Markov Models", *IEEE Sensors Journal*, 5(5):1035-1042, 2005
11. E. Dura, Y. Zhang, **X. Liao**, G. Dobeck, L. Carin, "Active Learning for Detection of Mine-Like Objects in Side-Scan Sonar Imagery", *IEEE Journal of Oceanic Engineering*, 3(2):360-371, 2005

12. **X. Liao**, L. Carin, "Application of the Theory of Optimal Experiments to Adaptive Electromagnetic-Induction Sensing of Buried Targets", *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 26(8):961-972, 2004
13. Y. Zhang, **X. Liao**, L. Carin, "Detection of Buried Targets via Active Selection of Labeled Data: Application to Sensing Subsurface UXO", *IEEE Transactions on Geoscience and Remote Sensing*, 42(11):2535-2543, 2004
14. M. Nishimoto, **X. Liao**, L. Carin, "Target Identification from Multi-Aspect High-Range-Resolution Radar Signatures Using a Hidden Markov Model", *IEICE Trans. Electron.*, Vol. E87-C, No. 10, pp.1706-1714, 2004
15. **X. Liao**, P. Runkle, L. Carin, "Identification of Ground Targets From Sequential High-Range-Resolution Radar Signatures", *IEEE Transactions on Aerospace and Electronic Systems*, 38(4):1230-1242, 2002
16. **X. Liao**, Z. Bao, "Signal Reconstruction from Accumulation of Bispectral Radial Slices", *Optical Engineering*, 39(8):2065-2074, 2000
17. **X. Liao**, Z. Bao, "Radar Target Recognition Based on Parameterized High Resolution Range Profiles", *International Journal of Pattern Recognition and Artificial Intelligence*, 14(7):979-986, 2000
18. **X. Liao**, Z. Bao, "System Reconstruction from Accumulation of Polyspectra", *Electronics Letters*, 35(15):1229-1230, 1999
19. **X. Liao**, Z. Bao, "Circularly integrated Bispectra—Novel Shift Invariant Features For High-Resolution Radar Target Recognition", *Electronics Letters*, 34(19):1879-1880, 1998

**Book Chapters**

20. **X. Liao**, Y. Zhang, L. Carin, "Plan-in-advance Active Learning of Classifiers", in A. Hero et al. (Edt), *Foundations and Applications of Sensor Management*, Springer, 2007, pages 201-220
21. S. M. Lin, **X. Liao**, P. McConnell, K. Vata, L. Carin, P. Goldschmidt "Using Functional Genomic Units to Corroborate User Experiments with the Rosetta Compendium", in SM Lin and KF Johnson (Edt) *Methods of Microarray Data Analysis II*, Kluwer Academic, pp. 123-138, 2002
22. **X. Liao**, Z. Bao, "Radar Target Recognition Based on Parameterized High Resolution Range Profiles", in Jun Shen, P S P Wang, and Tianxu Zhang (Edt), *Multispectral Image Processing and Pattern Recognition*, World Scientific, Singapore, January, 2001

**Highly Referred Conference Papers**

23. C. Cai, **X. Liao**, and L. Carin, "Learning to Explore and Exploit in POMDPs", Neural Information Processing Systems, 2009, [acceptance rate = 263/1105]
24. Q. Liu, **X. Liao**, L. Carin, "Semi-Supervised Multitask Learning", *Advances in Neural Information Processing Systems*, 2007 [acceptance rate = 217/975]
25. **X. Liao**, H. Li, and L. Carin, "Quadratically Gated Mixture of Experts for Incomplete Data Classification", appearing in *The 24rd International Conference on Machine Learning (ICML)*, 2007 [acceptance rate = 152/522]
26. S. Ji, R. Parr, H. Li, **X. Liao**, and L. Carin, "Point-Based Policy Iteration", appearing in *the Twenty-Second National Conference on Artificial Intelligence (AAAI)*, 2007 [acceptance rate = 253/921]
27. H. Li, **X. Liao**, and L. Carin, "Incremental Least Squares Policy Iteration for POMDPs", *the Twenty-First National Conference on Artificial Intelligence (AAAI)*, 2006 [acceptance rate = 236/774]
28. H. Li, **X. Liao**, and L. Carin, ""Region-Based Value Iteration for Partially Observable Markov Decision Processes", *the 23rd International Conference on Machine Learning (ICML)*, 2006 [acceptance rate = 140/700]

29. **X. Liao**, L. Carin, "Radial Basis Function Network for Multi-task Learning", In Y.Weiss, B. Scholkopf, and J. Platt, editors, *Advances in Neural Information Processing Systems 18*, MIT Press, Cambridge, MA, 2006 [acceptance rate = 206/753]

30. **X. Liao**, Y. Xue, L. Carin, "Logistic Regression with an Auxiliary Data Source", In Luc De Raedt and StefanWrobel, editors, *Proceedings of the 22nd International Machine Learning Conference*, ACM Press, 2005 [acceptance rate = 62/491]

31. D. Williams, **X. Liao**, Y. Xue, L. Carin, "Incomplete-Data Classification using Logistic Regression", In Luc De Raedt and StefanWrobel, editors, *Proceedings of the 22nd International Machine Learning Conference*, ACM Press, 2005 [acceptance rate = 62/491]

**Regularly Referred Conference Papers**

32. Hui Li, **Xuejun Liao**, and Lawrence Carin, "Active learning for semi-supervised multi-task learning", Proceedings of IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), 2006, pages 1637-1640

33. Q. Liu, **X. Liao**, and L. Carin, "Learning Classifiers on a Partially Labeled Data Manifold", *Proceedings of IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, 2007 [acceptance rate = 1344/2912]

34. H. Li, **X. Liao**, and L. Carin, "A Reward-Directed Bayesian Classifier", *Proceedings of IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, 2006 [acceptance rate = 1465/3045]

35. J.R. Stack, R. Arrieta, **X. Liao**, L. Carin, "A Kernel Machine Framework for Feature Optimization in Multi-frequency Sonar Imagery", *OCEANS 2006*, Sept. 2006, Pages 1-6

36. **X. Liao**, H. Li, B. Krishnapuram, "An M-ary KMP Classifier for Multi-aspect Target Classification", *Proceedings of IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, Vol. 2, pp. 61-64, 2004

37. Y. Zhang, **X. Liao**, E. Dura, L. Carin, "Active Selection of Labeled Data for Target Detection", *Proceedings of IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, Vol. 5, pp. 465-468, 2004

38. S. Ji, **X. Liao**, L. Carin, "Adaptive Multi-Aspect Target Classification and Detection with Hidden Markov Models", *Proceedings of IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, Vol. 2, pp. 125-128, 2004

39. **X. Liao**, L. Carin, "ICA with Multiple Quadratic Constraints", *Proceedings of IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, 2003, Vol. 5, p.p. 313-316, 2003

40. Q. Liu, B. Krishnapuram, P. Pratapa, **X. Liao**, A. Hartemink, L. Carin, "Identification of Differentially Expressed Proteins Using MALDI-TOF Mass Spectra", *Conference Record of the Thirty-Eighth Asilomar Conference on Signals, Systems and Computers*, 2003

41. **X. Liao**, N. Dasgupta, S. M. Lin, L. Carin, "ICA and PLS modeling for functional analysis and drug sensitivity for DNA microarray signals", *Proceedings of IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, Vol. 4, p.p.3880-3883, 2002

42. **X. Liao**, P. Runkle, Y. Jiao, L. Carin, "Identification of ground targets from sequential HRR radar signatures", *Proceedings of IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, Vol.5, p.p. 2897 -2900, 2001

43. **X. Liao**, Z. Bao, M. Xing, "On the Aspect Sensitivity of High Resolution Range Profiles and Its Reduction Methods", *Record of the IEEE 2000 International Radar Conference*, p.p.310-315, 2000

44. **X. Liao**, Z. Bao, "Radar Target Recognition using Superresolution Range Profiles as Features", *Proceedings of SPIE*, Vol. 3545, pp.397-400, 1998

45. **X. Liao**, Z. Bao, "Two New Categories of Shift-Invariant Features of High-Resolution Radar Range Profiles", *Proceedings of Fourth International Conference on Signal Processing (ICSP)*, pp.1485-1488, 1998

**Workshop Papers**

46. Cai, C., **Liao, X.**, and Carin, L., "Nonparametric Bayesian Local Partition Model for Multi-task Reinforcement Learning in POMDPs", Nonparametric Bayes Workshop at NIPS 2009, Whislter, BC, Canada, Dec. 2009.
47. Y. Xue, **X. Liao**, L. Carin, B. Krishnapuram, "Learning multiple classifiers with Dirichlet process mixture priors", *NIPS Workshop on Open Problems and Challenges for Nonparametric Bayesian Methods in Machine Learning*, 2005
48. H. Li, L. He, **X. Liao**, S. Ji, L. Carin, "Region-Based Value Iteration and Its Application to Robot Navigation in a Minefield", *NIPS Workshop on Machine Learning Based Robotics in Unstructured Environments*, 2005
49. **X. Liao**, L. Carin, "A New Algorithm for Independent Component Analysis With or Without Constraints", *Proceedings of the Second IEEE Sensor Array and Multichannel (SAM) Signal Processing Workshop*, pp.413-417, 2002
50. M. Nishimoto, **X. Liao**, L. Carin, "Target Identification from Multi-Aspect High-Range-Resolution Radar Signatures Using Hidden Markov Model", *4th Asia-Pacific Engineering Research Forum on Microwaves and Electromagnetic Theory*, Fukuoka, Japan, November 16-17, 2002
51. **X. Liao**, L. Carin, "Constrained Independent Component Analysis of DNA Microarray Signals", *Proceedings of Workshop on Genomic Signal Processing and Statistics (GENSIPS)*, Raleigh, NC, October 11-13, 2002

## Research Experiences

Assistant Research Professor
Department of Electrical and Computer Engineering
Duke University — January 2008 — present

- ❑ Working in machine learning, signal processing, and bioinformatics.

Postdoctoral Research Associate
Department of Electrical and Computer Engineering
Duke University — April 2000 — December 2007

- ❑ Worked in the areas of signal processing, machine learning, planning under uncertainty, bioinformatics, etc.
- ❑ Invented or co-invented numerous methods and algorithms in the above areas.
- ❑ Analysis of real data from various modalities, including DNA micro-arrays for gene expression analysis, mass spectrometers for protein analysis, high range resolution (HRR) radar, ground-penetrating radar (GPR), electromagnetic induction (EMI), side-scan sonar, etc.

Research Assistant
National Key Laboratory for Radar Signal Processing
Xidian University, China — September 1995 — March 2000

- ❑ Worked in the areas of radar imaging and target recognition, array signal processing, and statistical signal processing.
- ❑ Invented the methods and algorithms: accumulated bispectral radial slices, accumulated polyspectra, circularly integrated bispectrum, generalized-weighted-normalized-correlation.
- ❑ Discovered the equation for HRR angular correlation.

Research Member
Institute of Intelligent Instrumentation
Hunan University, China — May 1993 — August 1995

- ❑ Worked on software development for industrial applications.

Research Assistant
Department of Electrical Engineering
Hunan University, China — September 1990 — April 1993

- ❑ Studied hybrid expert systems based on production rules and neural computation.

**Teaching Experiences**

Department of Electrical Engineering, Hunan University, China

- ✎ Teaching assistant of the undergraduate course *Electronic Circuits Design* (Spring 1992)
- ✎ Lecturer; instructed three undergraduate courses:
  - ❑ *Signal Analysis* (Fall 1993, Fall 1994)
  - ❑ *Principles of Microprocessors* (Spring 1994)
  - ❑ *Measurement and Instrumentation* (Spring 1995)

National Key Laboratory for Radar Signal Processing, Xidian University, China

- ✎ Teaching assistant of the graduate course *Stochastic Processes* (Fall 1998)

**Industrial Experiences**

Worked on an industrially-contracted project "a universal sensor interface". Developed a graphics toolbox for the PP40 micro-plotter, in assembly language of single chip microprocessors. Developed an instrument-specific BASIC interpreter in C. — 1993—1994

Worked for Changsha Cigarette Factory on a computer-aided monitoring and management system. — Summer 1991

**Memberships**

Senior Member of IEEE (since January 2004)

**Professional Services**

Reviewer of
Optimal Engineering,
IEEE Transaction on Aerospace and Electronic Systems,
IEEE/ACM Transactions on Computational Biology and Bioinformatics,
Neurocomputing,
American Control Conference,
EURASIP Advances in Signal Processing,
IEEE Transactions on Neural Networks,
Journal of Selected Topics in Signal Processing,
IET Image Processing,
Neural Processing Letters

Co-organisor of the ICAPS Workshop "POMDPs, Classification and Regression: Relationships and Joint Utilization", June 7, 2006, UK
Workshop Homepage

**Awards**

***SERDP Project of the Year Award (Co-performer), 2005***
Official Announcement

**Computer Skills**

Hardware: Z80, Intel 8031/8051, Intel 80x86

Programming Languages: C/C++, Pascal, Matlab, Assembly, Fortran, BASIC, Perl, Java

Operating Systems: Windows, Linux/UNIX

Tools: MS Office, LaTex, HTML

**References**


Prof. Lawrence Carin
Dept. of Electrical & Computer Engineering
Duke University, Box 90291
Durham, NC 27708

Phone: (919) 660-5270
Fax: (919) 660-5293
Email: lcarin@ee.duke.edu
Homepage: `http://www.ee.duke.edu/~lcarin/`

Prof. Leslie Collins
Dept. of Electrical and Computer Engineering
Duke University, Box 90291
Durham, NC 27708

Phone: (919) 660-5260
(919) 660-5212
Email: lcollins@ee.duke.edu
Homepage: `http://www.ee.duke.edu/research/collins`

Prof. Ronald Parr
Department of Computer Science
Duke University, LSRC/Box 90129
Durham, NC 27708

Phone: (919) 660-6537, (919) 660-4016
Fax: (919) 660-6519
Email: parr@cs.duke.edu
Homepage: `http://www.cs.duke.edu/~parr/`

Prof. David Dunson
Institute of Statistics & Decision Sciences
Box 90251, Duke University
Durham, NC 27708-0251

Phone: (919) 684-8025, (919) 541-3033
Fax: (919) 541-4311
Email: dunson@stat.duke.edu
Homepage: `http://www.isds.duke.edu/~dunson/`

Prof. Alexander Hartemink
Department of Computer Science
Box 90129, Duke University
Durham, NC 27708-0129

Phone: (919) 660-6514
Fax: (919) 660-6519
Email: amink@cs.duke.edu
Homepage: `http://www.cs.duke.edu/~amink/`