

# Curriculum Vitae

James Ting-Ho Lo

## HIGHLIGHTS OF RESEARCH:

James Ting-Ho Lo's research interests have included optimal filtering, system control and identification, active noise and vibration control, machine learning, and real-time clustering. In 1992, he solved the long-standing notorious problem of optimal nonlinear filtering in its most general setting and obtained a best paper award.

Subsequently, he conceived and developed adaptive neural networks with long- and short-term memories, accommodative neural network for adaptive processing without online processor adjustment, and robust/adaptive neural networks with a continuous spectrum of robustness; which constitute an effective systematic general approach to robust or/and adaptive processing for system control/identification/estimation and signal processing.

He has been developing a convexification method for avoiding nonglobal minima in data fitting (e.g., training deep neural networks and estimating regression models), which is ready for application and is nearing a complete solution of the long-standing notorious "local minimum problem", a main obstacle in data fitting.

In recent years, Dr. Lo has also been developing a low-order model of biological neural networks. The model comprises biologically plausible models of axonal/dendritic trees, synapses, spiking/nonspiking somas, unsupervised/supervised learning mechanisms, a maximal generalization scheme, and feedbacks with different delay duration; which integrate into a biologically plausible learning/retrieving algorithm and answer numerous fundamental questions in neuroscience.

**ADDRESS:** 3100 Seneca Chief Trail  
Ellicott City, MD 21042

**PHONES:** (410) 455-2432 (UMBC)  
(410) 461-4138 (Home)

**EMAIL:** jameslo@umbc.edu

**PERSONAL** Citizenship: U.S.A.

**EDUCATION:** B.S. 1964 National Taiwan University Mechanical Engineering  
Ph.D. 1969 University of Southern California Aerospace Engineering  
(Systems Science)

## ACADEMIC EXPERIENCE:

<b>1980–</b>	University of Maryland Baltimore County	Professor	Teaching and Research
<b>1972–1980</b>	University of Maryland Baltimore County	Assistant/ Assoc. Prof.	Teaching and Research
<b>1971–1972</b>	Harvard University	Research Fellow	Research
<b>1969–1971</b>	Stanford University	Lecturer & Res. Assoc.	Teaching and Research

## INDUSTRIAL EXPERIENCE:

**1989–** Maryland Technology Corporation Consulting on neural networks

1. Contributed to the development of a low-order model of biological neural networks.
2. Contributed to the development of a method of convexifying and deconvexifying error criteria in data fitting, solving the local-minimum problem in training deep learning machines and in estimating nonlinear regression models in statistics.
3. Contributed to the development of robust and/or adaptive neural filtering.
4. Contributed to the development of accommodative neural networks for adaptive processing without online adjustment of the neural network weights.
5. Contributed to the development of adaptive neural networks with long- and short-term memories and applications to adaptive system identification, model reference adaptive control, adaptive filtering, adaptive channel equalization, etc.
6. Contributed to the development of a neural network approach to optimal filtering and its applications to active control of acoustic and structural vibration, image/video fusion, GPS-aided inertial navigation, satellite attitude estimation, etc.

**1988–** AAI Corporation      Consulting on Neural Networks:  
**1991**

1. Wrote a research and development proposal on automatic target recognition.

**1986–** Martin Marietta      Consulting on Digital Signal Processing:  
**1987**      Baltimore Aerospace

1. Discovered eigenstructure methods for array sensor localization.
2. Discovered algorithms of determining array sensor gain and phase using eigenstructure analysis.
3. Wrote an IRAD proposal on multi-target tracking.

**1984–** Defense Electronic Division      Consulting on ASW Systems:  
**1985**      Gould, Inc.

1. Derived the exponentially weighted and the finite-memory Kalman filtering equations for frequency/bearing tracking;
2. Introduced radial characteristics using Doppler shifts for ASW contact management;
3. Developed a graph-theoretic approach for line/source association.

**1984–** Westinghouse Electric Corp.      Consulting on ESM/ECM Systems:  
**1984**

1. Conceived three approaches for simultaneous ambiguity resolution and emitter location for two-element interferometers;
2. Developed the straight line resolution/location algorithm.

**1982–** UTL Corporation.      Principal Engineer for R & D: (Position of Chief  
**1983**                                  Scientist offered and declined)

1. Developed various algorithms for target location using DOA, TDOA, INS, and/or TACAN data;

2. Developed various algorithms for running fix of the aircraft position and for in-flight clock/INS calibration using DOA-TDOA data;
3. Solved miscellaneous problems encountered in the design of an advanced ESM/ECM system.

**1981**– COMSAT Laboratories. Consulting on Satellite Attitude Estimation:

**1982**

1. Carefully modelled various attitude sensors and integrating gyros;
2. Derived and simplified the extended Kalman filtering equations for satellite attitude estimation for large angle maneuvers.

**1977**– Goddard Space Flight Center/NASA. Consulting on Satellite Attitude

**1978**

Estimation:

1. Developed an optimal scheme for the satellite attitude estimation using star tracker and integrating gyro measurements.

**1975**– Chesapeake Instrument Div., Consulting on Accoustic Signal

**1976**

Estimation:

1. Surveyed and compared existing nonlinear adaptive filters for ASW applications.

#### **HONORS RECEIVED:**

1. **Invited speaker** at the 2018 Gulf Coast Deep Learning (GCDL) Workshop in Lafayette, Louisiana, USA. An honorarium of \$1,000 was received.
2. **Invited plenary speaker** on “Deep Learning and a New Approach to Machine Learning” at the 2017 International Conference on Neural Information Processing (ICONIP 2017), Guangzhou, China. The hotel expenses were covered and an honorarium of \$1,500 was received.
3. **Invited plenary speaker** on “How do the bio neural networks encode, learn, memorize, recall and generalize” at the 2013 International Symposium on Neural Networks (ISNN 2013), Dalian, China.
4. **Invited speaker** at the prestigious 2003 Workshop on Neural Computing for Signal Processing, Lake Louise, Canada.
5. **Nomination for the Best Paper Award** in the area of “Theoretical Developments in Computational Intelligence,” in the 2001 Conference on Artificial Neural Networks in Engineering.
6. **Nomination for the Best Paper Award** in the area of “Theoretical Developments in Computational Intelligence,” in the 2001 Conference on Artificial Neural Networks in Engineering.
7. **Nomination for the Best Paper Award** in the area of “Theoretical Developments in Computational Intelligence,” in the 1998 Conference on Artificial Neural Networks in Engineering.
8. **One of the six U.S. statisticians/mathematicians/engineers** invited by Technion (Israel Institute of Technology) to give talks at the International Workshop on Nonlinear Time Series for Signal Processing and Control in 1998 with all expenses covered. Among the invited speakers are the world famous statisticians, Clive Granger (USA, 2001 Nobel Prize Laureate), Howell Tong (Hong Kong), M. B. Priestley (UK) and Peter Robinson (UK), and the world famous mathematicians/engineers, M. Zakai (Israel), E. Masry (USA), Edward Ott (USA) and Leon Glass (Canada). All international travel expenses were covered.

9. The **Best Paper Award** in an annual research paper contest organized by the Workshop on Neural Networks 1992 Conference, sponsored by the Society of Computer Simulation, NASA, SPIE, INNS, and IEEE Neural Network Council. The winning paper, entitled “Synthetic Approach to Optimal Filtering,” reported a solution to a fundamental problem of great practical importance, **the optimal nonlinear filtering problem**, which had been a focal research topic in both mathematics and engineering for more than 30 years.
10. **One of two invited speakers from U.S.** at the Workshop on Identification and Filtering, Institute of Aeronautics and Astronautics, National Cheng Kung University, Tainan, Taiwan, October 28 – November 3, 1987. All expenses were covered and a honorarium of \$2,000 was received.
11. **Invited speaker** at the NATO ASI on Nonlinear Stochastic Problems, Algarve, Portugal, May 16 – May 28, 1982.
12. **Nomination for the 1974–1975 Best Transactions Paper award** of the IEEE Society of Automatic Control.
13. NATO Advanced Study Institute Fellowship, August 27 – September 7, 1973.
14. National Taiwan University Scholarships, 1962 and 1964.

#### RESEARCH GRANTS AND CONTRACTS:

1. **James T. Lo**, NSF grant (July 1, 2015 – June 30, 2019) \$340,736  
Project: Recurrent Deep Learning Machine for Robust, Adaptive, or Accommodative Filtering.
2. Weidong Zhu (PI) and **James T. Lo (Co-PI)**, UMBC Technology Catalyst Fund (June 1, 2015 – May 31, 2016) \$20,000  
Project: Wood Utility Pole Damage Identification using Acoustic Measurements.
3. **James T. Lo**, NSF grant (September 1, 2010 – August 31, 2014) \$295,151  
Project: Recurrent Deep Learning Machines.
4. **James T. Lo**, NSF grant (July 1, 2001 – June 30, 2006) \$232,871  
Project: Risk-Sensitive and/or Adaptive Identification of Dynamic Systems by Neural Networks.
5. **James T. Lo**, NSF grant (June 29, 1997 – June 30, 2001) \$194,490  
Project: Risk-Sensitive and/or Adaptive Identification of Dynamic Systems by Neural Networks.
6. **James T. Lo**, ARO contract (July 1, 1999 – June 30, 2002)  
Project: Robust and/or Adaptive Filtering by Neural Networks.
7. **James T. Lo**, NASA contract (January 1995 – July 1995)  
Project: Neural Filtering for Spacecraft Attitude Determination and Sensor Calibration.
8. **James T. Lo**, Naval Air Warfare Center contract (June 1994 – January 1995)  
Project: Neural Network Approach for Active Engine Noise Cancellation.
9. **James T. Lo**, Naval Surface Warfare Center (August 1993 – February 1994)  
Project: Neural Filtering for Fusing TV and Thermal Images.

10. **James T. Lo**, USAF contract (July 1993 – January 1994)  
Neural Filtering for INS and GPS Integration.
11. **James T. Lo**, USAF Rome Laboratory (July 1991 – June 1994) \$175,000  
Neural Network Approach to Nonlinear Filtering.
12. **James T. Lo**, ONR grant (November 1, 1990 – April 30, 1992)  
Project: Statistical Approach to Training Multilayer Perceptrons.
13. **James T. Lo**, ONR contract (July 1, 1988 – January 31, 1991)  
Project: Maximizing the Convergence Rate of the EM Algorithm for the Multiple Broadband Signal Estimation and Detection.
14. **James T. Lo**, NASA contract (July 1, 1978 – June 30, 1979)  
Project: Feasibility Study on an Optimal Spacecraft Attitude Estimation Algorithm.
15. **James T. Lo**, Four AFOSR grants (**A proposal was submitted every 2 years, June 1, 1974 – August 31, 1982**)  
Project: Detection, Estimation, and Control on Group Manifolds.

#### **BOOKS:**

1. *Nonlinear Dynamical Systems - Feedforward Neural Network Perspectives*, John Wiley & Sons, 2001 (with Sandberg, Fancourt, Principe, Katagiri and Haykin).
2. *Synthetic System Theory*, in preparation.

#### **U.S. PATENTS:**

1. Artificial Neural Networks based on a Low-Order Model of Biological Neural Networks, U.S. Patent 8,990,132 B2, issued 03/24/2015.
2. A Cortex-Like Learning Machine for Temporal and Hierarchical Pattern Recognition, U.S. Patent 8,457,409 B2, issued 06/04/2013.
3. Convexification Method of Training Neural Networks and Estimating Regression Models, U.S. Patent 7,082,420 B2, issued 7/25/06.
4. Active Acoustic and Structural Vibration Control without Online Controller Adjustment and Path Modeling, U.S. Patent 6,601,054 B1, issued 7/29/03 (with L. Yu).
5. Neural Systems with Range Reducers and/or Extenders, U.S. Patent 6,601,051, issued 7/29/03 (with L. Yu).
6. Railway Operation Monitoring and Diagnosing Systems, U.S. Patent 6,125,311, issued on 26 September 2000.
7. Recursive Neural Filters, U.S. Patent 5,963,929, issued on 05 October 1999.
8. Robust Neural Systems, U.S. Patent 5,987,444, issued on 16 November 1999.
9. Nonadaptively Trained Neural Networks for Adaptive Processing, U.S. Patent 5,748,847, issued on May 5, 1998.
10. Optimal Filtering by Neural Networks with Range Extenders and/or Reducers, U.S. Patent 5,649,065, issued on 15 July 1997 (with L. Yu).

11. Optimal Filtering by Recurrent Neural Networks, U.S. Patent 5,408,424, issued on 18 April 1995.

#### U.S. PROVISIONAL PATENT APPLICATIONS:

1. Efficient General Real-Time Hierarchical Clustering Method and System, disclosed 6/26/2018 to UMBC Office of Technology Development; filed 08/07/18 to USPTO.
2. The provisional patent applications that were converted into US Patents are omitted here.

#### PUBLICATIONS:

1. **James Ting-Ho Lo**, Developing a cortical learning machine for real-time, photographic, unsupervised and hierarchical learning, accepted for publication in the survey book, *Gulf Coast Deep Learning AI Apps 2018*, Elsevier, to appear in 2019.
2. Yu Guo, Fei Wang, and **James Ting-Ho Lo**, Nonlinear system identification based on recurrent neural networks with shared and specialized memories, *Proceedings of the 2017 11th Asian Control Conference (ASCC)*, pp. 2054-2059, IEEE Xplore, Gold Coast Convention Centre, Australia December 17-20, 2017.
3. **James Ting-Ho Lo**, Yichuan Gui, and Yun Peng, Solving the Local-Minimum Problem in Training Deep Learning Machines, *Proceedings of the 2017 International Conference on Neural Information Processing*, pp. 166-174, edited by Shengli Xie, Yuanqing Li, Dongbin Zhao, Dongbin Zhao, and El-Sayed M. El-Alfy, Guangzhou, China, November 15-17, 2017.
4. **James Ting-Ho Lo**, How Do Biological Neural Networks Encode, Learn, Memorize, Recall and Generalize as a “Learning Machine”?, Presented at the Conference on Cognitive Computational Neuroscience (CCN), New York, New York, September 6-8, 2017
5. **James Ting-Ho Lo**, Yichuan Gui, and Yun Peng, Training Deep Neural Networks with Gradual Deconvexification, *Proceedings of the 2016 International Joint Conference on Neural Networks*, edited by Plamen P. Angelov, Emilio Del Moral Hernandez and Lipo Wang, Vancouver, British Columbia, Canada, July 2016.
6. **James Ting-Ho Lo** and Yu Guo, Accommodative Neural Filters, *Proceedings of the 2016 International Joint Conference on Neural Networks*, edited by Plamen P. Angelov, Emilio Del Moral Hernandez and Lipo Wang, Vancouver, British Columbia, Canada, July 2016.
7. Zhiguang Wang, Tim Oates, and **James Ting-Ho Lo**, Adaptive Normalized Risk-Averting Training For Deep Neural Networks, *Proceedings of the 30th Conference on Artificial Intelligence*, edited by Dale Schurmans and Michael Wellman, Phoenix, Arizona, USA, February 2016.
8. **James Ting-Ho Lo**, Yichuan Gui, and Yun Peng, The Normalized Risk-Averting Error Criterion for Avoiding Nonglobal Local Minima in Training Neural Networks, *Neurocomputing*, Vol. 149, pp. 3-12, 2015.
9. Yichuan Gui, **James Ting-Ho Lo**, and Yun Peng, A Pairwise Algorithm for Training Multilayer Perceptrons with the Normalized Risk-Averting Error Criterion, *Proceedings of International Joint Conference on Neural Networks*, Beijing, China, July 4-9, 2014.
10. **James Ting-Ho Lo**, Yichuan Gui, and Yun Peng, Overcoming the Local-Minimum Problem in Training Multilayer Perceptrons by Gradual Deconvexification, *Proceedings of International Joint Conference on Neural Networks*, pp. 635-640, Dallas, Texas, USA, August 4-9, 2013.

11. **James Ting-Ho Lo**, Yichuan Gui, and Yun Peng, Overcoming the Local-Minimum Problem in Training Multilayer Perceptrons by the NRAE-MSE Training Method, *Advances in Neural Networks - ISNN 2013*, Chengan Guo, Zeng-Guang Hou, Zhigang Zeng (Eds.), pp. 440-447 Springer-Verlag Berlin Heidelberg, 07/04/2013-07/06/2013.
12. **James Ting-Ho Lo**, Yichuan Gui, and Yun Peng, Overcoming the Local-Minimum Problem in Training Multilayer Perceptrons with the NRAE Training Method, *Advances in Neural Networks - ISNN 2012*, J. Wang, G.G. Yen, and M.M. Polycarpou (Eds.), pp. 440-447, Springer-Verlag Berlin Heidelberg, 2012.
13. **James Ting-Ho Lo**, A Cortex-Like Learning Machine for Temporal Hierarchical Pattern Clustering, Detection, and Recognition, *Neurocomputing*, Vol. 78, pp. 89-103, 2012.
14. **James Ting-Ho Lo**, A Low-Order Model of Biological Neural Networks, *Neural Computation*, Vol. 23, No. 10, pp. 2626-2682, 2011.
15. **James Ting-Ho Lo**, A Low-Order Model of Biological Neural Networks for Hierarchical or Temporal Pattern Clustering, Detection and Recognition, *Proceedings on the 2011 International Joint Conference on Neural Networks*, IEEE Xplore, The IEEE Press, July 31 - August 5, 2011.
16. **James Ting-Ho Lo**, Functional Model of Biological Neural Networks, *Cognitive Neurodynamics*, Vol. 4, No. 4, pp. 295-313, November 2010.
17. **James Ting-Ho Lo**, Unsupervised Hebbian learning by recurrent multilayer neural networks for temporal hierarchical pattern recognition, *Proceedings of the 44th Annual Conference on Information Systems and Sciences*, March 2010.
18. **James Ting-Ho Lo**, Convexification for Data Fitting, *Journal of Global Optimization*, Vol. 46, pp. 307-315, February 2010.
19. **James Ting-Ho Lo**, Adaptive Capability of Recurrent Neural Networks with Fixed Weights for Series-Parallel System Identification, *Neural Computation*, Vol. 21, No. 11, pp. 3214-3227, 2009.
20. **James Ting-Ho Lo**, Neural Filtering, *Scholarpedia*, Vol. 4, No. 8, page 7868, 2009.
21. **James Ting-Ho Lo**, Probabilistic Associative Memories, *Proceedings of the 2008 International Joint Conference on Neural Networks*, pp. 3895 - 3903, IEEE Xplore, The IEEE Press, August 2008.
22. **James Ting-Ho Lo**, Adaptive Neural Filters with Fixed Weights, *Proceedings of the 2007 International Joint Conference on Neural Networks*, pp. 2147 - 2152, IEEE Xplore, The IEEE Press, August 2007 (with Justin Nave).
23. **James Ting-Ho Lo** and Lei Yu, Recursive Neural Filters and Dynamical Range Transformers, Invited paper, *Proceedings of The IEEE*, Vol. 92, No. 3, pp. 514-535, March 2004.
24. **James Ting-Ho Lo** and Devasis Bassu, Adaptive versus Accommodative Neural Networks for Adaptive Series-Parallel Identification of Dynamical Systems, Part II, *Proceedings of the 2003 International Joint Conference on Neural Networks*, Volume 4, pp. 2497 - 2501, IEEE Xplore, The IEEE Press, July 2003.
25. **James Ting-Ho Lo** and Devasis Bassu, Adaptive Parallel Identification of Dynamical Systems with Uncertain Stable and Periodic Trajectories, *Proceedings of the 2003 International Joint Conference on Neural Networks*, Volume 2, pp. 914-918, IEEE Xplore, The IEEE Press, July 2003.

26. **James Ting-Ho Lo**, Feng Li, and Devasis Bassu, Adaptive Series-Parallel Identification of Dynamical Systems with Uncertain Bifurcations and Chaos, *Proceedings of the 2003 International Joint Conference on Neural Networks*, Volume 2, pp. 1553-1557, IEEE Xplore, The IEEE Press, July 2003.
27. **James Ting-Ho Lo**, Mathematical Underpinning of Adaptive Capability of Recurrent Neural Networks with Fixed Weights, *Proceedings of the 2003 International Joint Conference on Neural Networks*, Volume 2, pp. 1541-1546, IEEE Xplore, The IEEE Press, 2003.
28. **James Ting-Ho Lo**, Existence and Uniqueness of Risk-Sensitive Estimation, *IEEE Transactions on Automatic Control*, pp. 1945-1948, November 2002 (with Thomas Wanner).
29. **James Ting-Ho Lo** and Devasis Bassu, Robust Identification of Uncertain Dynamical Systems where Adaptation is Impossible, *Proceedings of the 2002 International Joint Conference on Neural Networks*, vol. 2, pp. 1558-1563, IEEE Xplore, The IEEE Press, May 2002.
30. **James Ting-Ho Lo** and Devasis Bassu, Robust Approximation of Uncertain Functions where Adaptation is Impossible, *Proceedings of the 2002 International Joint Conference on Neural Networks*, vol. 2, pp. 1956-1961, IEEE Xplore, The IEEE Press, May 2002.
31. **James Ting-Ho Lo**, Minimization through Convexitization in Training Neural Networks, *Proceedings of the 2002 International Joint Conference on Neural Networks*, vol. 2, pp. 1889-1894, IEEE Xplore, The IEEE Press, May 2002.
32. **James Ting-Ho Lo** and Devasis Bassu, Adaptive Multilayer Perceptrons with Long- and Short-Term Memories, *IEEE Transaction on Neural Networks*, Vol. 13 No. 1, pp. 22-33, IEEE Xplore, The IEEE Press, January 2002.
33. **James Ting-Ho Lo**, Risk-Averting Criteria for Training Neural Networks, *Proceedings of the Eighth International Conference on Neural Information Processing*, pp. 476-481, Shanghai, China, 2001.
34. **James Ting-Ho Lo** and Devasis Bassu, Avoiding Poor Local Minima in Training Multilayer Perceptrons, *Proceedings of the Eighth International Conference on Neural Information Processing*, pp. 1327-1332, Shanghai, China, 2001.
35. **James Ting-Ho Lo**, Virtually Convex Criteria for Training Neural Networks, *Proceedings of the 2001 Conference on Artificial Neural Networks in Engineering*, St. Louis, Missouri.
36. **James Ting-Ho Lo** and Devasis Bassu, Robust Identification of Dynamical Systems by neurocomputing, *Proceedings of the 2001 International Joint Conference on Neural Networks*, Vol. 2, pp. 1285-1290, IEEE Xplore, The IEEE Press, July 2001.
37. **James Ting-Ho Lo** and Devasis Bassu, Adaptive versus Accommodative Neural Networks for Adaptive System Identification, *Proceedings of the 2001 International Joint Conference on Neural Networks*, Vol. 2, pp. 1279-1284, IEEE Xplore, The IEEE Press, July 2001.
38. **James Ting-Ho Lo** and Devasis Bassu, Training Multilayer Perceptrons in the Presence of Measurement Outliers, *Proceedings of the 2001 International Joint Conference on Neural Networks*, Vol. 3, pp. 2030-2035, IEEE Xplore, The IEEE Press, July 2001.
39. **James Ting-Ho Lo** and Devasis Bassu, An Adaptive Method of Training Multilayer Perceptrons, *Proceedings of the 2001 International Joint Conference on Neural Networks*, Vol. 3, pp. 2013-2018, IEEE Xplore, The IEEE Press, July 2001.
40. **James Ting-Ho Lo**, Mathematical Justification of Risk-Sensitive Neural Filtering, *Proceedings of the 2000 Conference on Information Sciences and Systems*, Vol. I, pp. WA1-7 - WA1-11, Princeton, New Jersey, 2000.



41. **James Ting-Ho Lo** and Devasis Bassu, Risk-Sensitive Multilayer Perceptrons, *Proceedings of the 2000 Conference on Information Sciences and Systems*, Vol. I, Princeton, New Jersey, 2000.
42. **James Ting-Ho Lo** and Devasis Bassu, Mathematical Justification of Recurrent Multilayer Perceptrons with Long- and Short-Term Memories, *Proceedings of the 1999 International Joint Conference on Neural Networks*, Volume 1, pp. 364 - 369, IEEE Xplore, The IEEE Press, 1999.
43. **James Ting-Ho Lo**, Devasis Bassu, nd Justin Nave, Training Recurrent Neural Networks with Noisy Input Measurements, *Proceedings of the 1999 International Joint Conference on Neural Networks*, Washington, D.C., 1999.
44. **James Ting-Ho Lo**, Statistical Method of Pruning Neural Networks, *Proceedings of the 1999 International Joint Conference on Neural Networks*, Washington, D.C., 1999.
45. **James Ting-Ho Lo**, Initializing Multilayer Perceptrons with Interconnected Neurons, *Proceedings of the 1999 International Joint Conference on Neural Networks*, Washington, D.C., 1999.
46. **James Ting-Ho Lo** and Devasis Bassu, Adaptive Multilayer Perceptrons, *Proceedings of the 1999 International Joint Conference on Neural Networks*, Washington, D.C., 1999.
47. **James Ting-Ho Lo** and Richard S. Bucy, Seminal Contributions of Bob Bass to Control, *Proceedings of the 1998 American Conference on Control*, Philadelphia, Pennsylvania, 1998.
48. **James Ting-Ho Lo**, Mathematical Justification of Multilayer Perceptrons with Long- and Short-Term Memories, *Intelligent Engineering Systems through Artificial Neural Networks*, Vol. 8, pp. 23-29, ASME Press, New York, 1998 (nominated for the Best Paper Award for "Theoretical Developments in Computational Intelligence.")
49. **James Ting-Ho Lo**, Multilayer Perceptrons and Radial Basis Functions are Universal Robust Approximators, *Proceedings of the 1998 International Joint Conference on Neural Networks*, pp. 1311-1314, Anchorage, Alaska, 1998.
50. **James Ting-Ho Lo**, Universal Neuroapproximation of Dynamic Systems for Robust Identification, *Proceedings of the 1998 International Joint Conference on Neural Networks*, pp. 2429-2434, Anchorage, Alaska.
51. **James Ting-Ho Lo**, Robust Adaptive Identification of Dynamic Systems by Neural Networks, *Proceedings of the 1997 International Conference on Neural Networks*, Vol. 2, pp.1121-1126, Houston, Texas, June 1997.
52. **James Ting-Ho Lo**, Robust Adaptive Neurofilters with or without On-Line Weight Adjustment, *Proceedings of the 1997 International Conference on Neural Networks*, Vol. 4, pp. 2245-2250, Houston, Texas, June 1997.
53. **James Ting-Ho Lo**, Overcoming Recurrent Neural Networks' Compactness Limitation for Neurofiltering, *Proceedings of the 1997 International Conference on Neural Networks*, Vol. 4, pp. 2181-2186, Houston, Texas, June 1997.
54. **James Ting-Ho Lo**, Model Reference Risk-Sensitive Control for a Deterministic Plant, *Proceedings of the 1997 Conference on Information Science and Systems*, Vol. 1, pp. 441-446, The Johns Hopkins University, Baltimore, MD, March 1997.
55. **James Ting-Ho Lo**, Robust Adaptive Neuroidentification of Dynamic Systems, *Proceedings of the 1997 Conference on Information Science and Systems*, Vol. 2, pp. 642-647, The Johns Hopkins University, Baltimore, MD, March 1997.

56. **James Ting-Ho Lo**, Blind Channel Equalization by Neural Networks with Long- and Short-Term Memories, *Intelligent Engineering Systems Through Artificial Neural Networks*, pp. 959-964, edited by C. H. Dagli, M. Akay, C. L. P. Chen, B. R. Fernandez, and J. Ghosh, ASME Press, New York, 1996.
57. **James Ting-Ho Lo**, Risk-Sensitive and Adaptive Filtering by Neural Networks with Long- and Short-Term Memories, *Intelligent Engineering Systems Through Artificial Neural Networks*, pp. 91-96, edited by C. H. Dagli, M. Akay, C. L. P. Chen, B. R. Fernandez, and J. Ghosh, ASME Press, New York, 1996.
58. **James Ting-Ho Lo**, Risk-Sensitive Identification of Dynamic Systems by Neural Network, *Proceedings of the 34th Allerton Conference on Communication, Control, and Computing*, pp. 982-990, Monticello, Illinois, October 1996.
59. **James Ting-Ho Lo**, Risk-Sensitive Approximation of Functions by Neural Networks, *Proceedings of the 34th Allerton Conference on Communication, Control, and Computing*, pp. 991-996, Monticello, Illinois, October 1996.
60. **James Ting-Ho Lo**, Adaptive System Identification by Nonadaptively Trained Neural Networks, *Proceedings of the 1996 International Conference on Neural Networks*, pp. 2066-2071, Washington, D.C., June 1996.
61. **James Ting-Ho Lo**, Model Reference Adaptive Control by Linearly Adapted Neural Networks, *Proceedings of the 1996 World Congress on Neural Networks*, pp. 125-128, San Diego, California, September 15-18, 1996.
62. **James Ting-Ho Lo**, Layer and Recursive Structures of Neural Networks, *Proceedings of the 1996 World Congress on Neural Networks*, pp. 1017-1021, San Diego, California, September 15-18, 1996.
63. **James Ting-Ho Lo**, Adaptive Optimal Filtering by Pretrained Neural Networks, *Proceedings of the 1996 World Congress on Neural Networks*, pp. 611-615, San Diego, California, September 15-18, 1996.
64. **James Ting-Ho Lo**, Adaptive System Identification Through Linear Adaptation, *Proceedings of the 1996 World Congress on Neural Networks*, pp. 496-496, San Diego, California, September 15-18, 1996.
65. **James Ting-Ho Lo**, Adaptive Communication Channel Equalization by Nonadaptively Trained Neural Networks, *Proceedings of the 1996 World Congress on Neural Networks*, pp. 809-813, San Diego, California, September 15-18, 1996.
66. **James Ting-Ho Lo**, Adaptive Neurocontrol Systems with Long- and Short-Term Memories, *Proceedings of the 1996 Conference on Information Science and Systems*, vol. 1, pp. 143-148, Princeton, New Jersey, March 1996.
67. **James Ting-Ho Lo**, Adaptive Critic Systems with Multiple-Term Memories, *Proceedings of the 1996 Conference on Information Science and Systems*, vol. 2, pp. 940-945, Princeton, New Jersey, March 1996.
68. **James Ting-Ho Lo** and Lei Yu, Adaptive Neural Filtering by Using Innovations Processes, *Proceedings of the 1995 World Congress on Neural Networks*, Washington, D.C., July 1995.
69. **James Ting-Ho Lo**, Synthetic Approach to Optimal Filtering, *IEEE Transactions on Neural Networks*, vol.5, No.5, pp. 803-811, September 1994.
70. **James Ting-Ho Lo**, Dynamical System Identification by Recurrent Multilayer Perceptrons, *Proceedings of the 1993 World Congress on Neural Networks*, Portland, Oregon, July 1993.

71. **James Ting-Ho Lo**, H. Motteler, A. Gualtieri, L. Strow, and L. McMillin Neural Nets for Temperature Retrievals, *Proceedings of the Sixth Topical Meeting on Optical Remote Sensing of the Atmosphere*, Salt Lake City, Utah, March 8-12, 1993.
72. **James Ting-Ho Lo** and Joseph H. Clements III, Recursive Direction Finding in the Presence of Sensor Array Uncertainty, Presented at the 1993 International Conference on Acoustics, Speech and Signal Processing, Minneapolis, Minnesota, April 27-30, 1993.
73. **James Ting-Ho Lo** and S. Larry Marple, Jr., Observability Conditions for Multiple Signal Direction Finding and Array Sensor Localization, *IEEE Transactions on Signal Processing*, vol.40, No.11, pp.2641-2650, November 1992.
74. **James Ting-Ho Lo** and Joseph H. Clements III, Recursive Estimation for Multiple Signal Direction Finding, *Proceedings of the Oceans'92 Conference*, Newport, Rhode Island, October 1992.
75. **James Ting-Ho Lo**, Optimal Recursive Estimation by Recurrent Multilayer Perceptrons, *Proceedings of the 1992 International Joint Conference on Neural Networks*, Beijing, China, November 1992.
76. **James Ting-Ho Lo** and Lei Yu, Derivatives of a Multilayer Perceptron and Interpretation of Training Data, *Proceedings of the 1992 International Joint Conference on Neural Networks*, Beijing, China, November 1992.
77. **James Ting-Ho Lo**, Synthetic Approach to Optimal Filtering, *Proceedings of the 1992 International Simulation Technology Conference and 1992 Workshop on Neural Networks*, pp. 475–481, Clear Lake, Texas, November 1992 (the Best Paper Award winner).
78. **James Ting-Ho Lo**, Optimal Filtering by Fourier-Hermite Polynomial Networks, *Proceedings of the 1992 International Simulation Technology Conference and 1992 Workshop on Neural Networks*, pp. 191–195, Clear Lake, Texas, November 1992.
79. **James Ting-Ho Lo** and Joseph H. Clements III, Recursive Direction Finding via RLS, *Proceedings of the Thirtieth Annual Allerton Conference on Communication, Control, and Computing*, edited by P. Van Dooren and M. W. Spong, Monticello, Illinois, October 1992.
80. **James Ting-Ho Lo**, Optimal Filtering by Recurrent Neural Networks, *Proceedings of the Thirtieth Annual Allerton Conference on Communication, Control, and Computing*, edited by P. Van Dooren and M. W. Spong, Monticello, Illinois, October 1992.
81. **James Ting-Ho Lo**, Parametric and Additive Perturbation for Global Optimization, *Proceedings of Science of Artificial Neural Networks*, SPIE Vol. 1710, edited by D. W. Ruck, pp. 600–605, The Society of Photo-Optical Instrumentation Engineers, 1992.
82. **James Ting-Ho Lo**, Neural Network Approach to Optimal Filtering, Invited paper, *World Congress of Nonlinear Analysts '92*, edited by V. Lakshmikantham, Vol. I, pp. 3705-3716, de Gruyter, 1992.
83. **James Ting-Ho Lo**, Sze-Kui Ng, and Melvin Sanders Jr., Polynomial Networks for Optimal Nonlinear Filtering, Invited paper, *World Congress of Nonlinear Analysts '92*, edited by V. Lakshmikantham, Vol. I, pp. 3655-3668, de Gruyter, 1992.
84. **James Ting-Ho Lo** and Yu Lei, Differentiating and Pruning Multilayer Feedforward Neural Networks, Invited paper, *World Congress of Nonlinear Analysts '92*, edited by V. Lakshmikantham, Vol. I, pp. 3681-3694, de Gruyter, 1992.
85. **James Ting-Ho Lo**, A New Approach to Global Optimization and Its Applications to Neural Networks, *Proceedings of the 1992 International Joint Conference on Neural Networks*, pp. IV 600–605, Baltimore, Maryland, June, 1992.

86. **James Ting-Ho Lo** and Travis Knoll, Push and Pull for Piecewise Linear Machine Training, *Proceedings of the 1992 International Joint Conference on Neural Networks*, pp. III 573–578, Baltimore, Maryland, June, 1992.
87. **James Ting-Ho Lo**, Backestimation for Training Multilayer Perceptron, *Proceedings of the 1991 International Conference on Acoustics, Speech and Signal Processing*, pp. 1065–1068, Toronto, Canada, 1991.
88. **James Ting-Ho Lo**, Maximum Likelihood Retrieval of Harmonics in Colored Noise by Cyclic Regression, *Proceedings of the Oceans '90 Conference*, pp. 369–373, Washington D.C., September 1990.
89. **James Ting-Ho Lo**, N. K. Nagaraj, and A. Rukhin, Cyclic Regression for Weighted Subspace Fitting to Find Multiple Signal Directions, *Proceedings of the Oceans '90 Conference*, pp. 518–520, Washington, D.C., September 1990.
90. **James Ting-Ho Lo**, A Large Class of Cyclic Regression Algorithms for Multiple Signal Direction Finding, *Proceedings of the 1990 Conference on Information Sciences and Systems*, pp. 818–823, Princeton, New Jersey, 1990.
91. **James Ting-Ho Lo** and S. Larry Marple, Jr., Array Sensor Localization and Calibration by Cyclic Regression, *Proceedings of the 1990 International Conference on Acoustics, Speech and Signal Processing*, pp. 2939–2942, Albuquerque, New Mexico, 1990.
92. **James Ting-Ho Lo** and S. Larry Marple, Jr., Two Observability Conditions for Array Sensor Localization, *Proceedings of the 1989 Conference on Information Sciences and Systems*, pp. 453–458, Baltimore, Maryland, 1989.
93. **James Ting-Ho Lo**, Cyclic Regression for Multiple Signal Estimation via the EM Algorithm, *Proceedings of the 22nd Asilomar Conference on Signals, Systems & Computer*, pp. 603–608, Pacific Grove, California, 1988.
94. **James Ting-Ho Lo** and Sze-Kui Ng, Series Solutions of Stochastic Differential Equations and Their Application to Nonlinear Filtering, *Proceedings of the 1988 Conference on Information Sciences and Systems*, pp. 932–937, Princeton, New Jersey, 1988.
95. **James Ting-Ho Lo**, New Maximum Likelihood Approach to Multiple Signal Estimation, *Proceedings of the 1988 International Conference on Acoustics, Speech and Signal Processing*, pp. 2889–2892, New York City, 1988.
96. **James Ting-Ho Lo**, Eigenstructure Methods for Array Sensor Localization, *Proceedings of the 1987 International Conference of Acoustics, Speech and Signal Processing*, pp. 2260–2263, Dallas, Texas, 1987.
97. **James Ting-Ho Lo**, Bilinearization of Stochastic Systems, *Control Theory and Advanced Technology*, Vol. 3, No. 3, pp. 175–188, 1987.
98. **James Ting-Ho Lo**, Optimal Estimation for the Satellite Attitude using Star Tracker Measurements, *Automatica*, Vol. 22, No. 4, pp. 477–482, 1986.
99. **James Ting-Ho Lo** and Sze-Kui Ng, Characterizing Fourier Series Representation of Probability Distributions on Compact Lie Groups, *SIAM J. Applied Mathematics*, Vol. 48, No. 1, pp. 222–228, 1988.
100. **James Ting-Ho Lo** and Sze-Kui Ng, Optimal Fourier–Hermite Expansion for Estimation, *Stochastic Processes and Their Applications*, Vol. 21, No. 2, pp. 291–304, 1986.

101. **James Ting-Ho Lo** and Sze-Kui Ng, Optimal Functional Expansion for Estimation from Counting Observations, *IEEE Trans. on Information Theory*, Vol. IT-33, No. 1, pp. 21–35, 1987.
102. **James Ting-Ho Lo**, Optimal Orthogonal Expansion for Estimation II: Signal in Counting Observations, pp. 311–338, *Nonlinear Stochastic Problems*, edited by R. S. Bucy and J. M. F. Moura, D. Reidel Publishing Company, 1983.
103. **James Ting-Ho Lo**, Optimal Orthogonal Expansion for Estimation I: Signal in White Gaussian Noise, pp. 291–310, *Nonlinear Stochastic Problems*, edited by R. S. Bucy and J. M. F. Moura, D. Reidel Publishing Company, Dordrecht, 1983.
104. **James Ting-Ho Lo** and Sze-Kui Ng, Optimal Fourier–Hermite Series Expansion for Recursive Estimation, *Proc. of the 1982 Conference on Information Sciences and Systems*, 436–442, Princeton University, Princeton, New Jersey, March 1982.
105. **James Ting-Ho Lo** and Sze-Kui Ng, Volterra Series Approach to Filtering, *Proceedings of the 19th Annual Allerton Conference on Communication, Control, and Computing*, Monticello, Illinois, September 1981.
106. **James Ting-Ho Lo**, Convolution of Exponential Fourier Densities and Recursive Filtering on the Circle, presented at the 1979 IEEE Conference on Decision and Control, San Diego, California, January 1979.
107. **James Ting-Ho Lo**, Optimal Estimation for the Satellite Attitude using Star Tracker Measurements, *Proc. of 1978 NASA Symposium on Flight Mechanics/Estimation Theory*, Goddard Space Flight Center, Greenbelt, MD, October 1978.
108. **James Ting-Ho Lo** and Shirish Chikte, Optimal Filters for Bilinear Systems with Nilpotent Lie Algebras, *IEEE Transactions on Automatic Control*, Vol. AC-24, No. 6, Dec. 1979.
109. **James Ting-Ho Lo** and Shirish Chikte, Optimal Filters for Nilpotent Associate–Algebraic Bilinear Systems, *Proc. 6th Annual Allerton Conference on Communication, Control, and Computing*, 89–98, Monticello, Illinois, Oct. 1978.
110. **James Ting-Ho Lo**, Optimal Estimation and Detection for Rotational Processes, *Proc. of the 1976 NASA Symposium on Flight Mechanics/Estimation Theory*, Goddard Space Flight Center, Greenbelt, MD, Oct. 1976.
111. **James Ting-Ho Lo** and Linda R. Eshleman, Exponential Fourier Densities on  $SO(3)$  and Optimal Estimation and Detection for Rotational Processes, *SIAM Journal on Applied Mathematics*, Vol 36, No. 1, pp. 73–82, Feb. 1979.
112. **James Ting-Ho Lo** and Linda R. Eshleman, Exponential Fourier Densities on  $S^2$  and Optimal Estimation and Detection for Directional Processes, *IEEE Transactions on Information Theory*, Vol. IT-23, No. 3, pp. 321–336, May 1977.
113. **James Ting-Ho Lo**, Estimation Problems with Lie Group Structure, Invited paper, *Proc. of the 1977 IEEE Conference on Decision and Control*, pp. 634–638, December 1977.
114. **James Ting-Ho Lo** and Linda R. Eshleman, Exponential Fourier Densities and Optimal Estimation for Axial Processes, *IEEE Transactions on Information Theory*, Vol. IT-25, No. 5, 463–470, 1979.
115. **James Ting-Ho Lo** and Linda R. Eshleman, Estimation for Discrete–Time Directional Processes, *Proc. of the Sixth symposium on Nonlinear Estimation and its Applications*, pp. 171–180, 1975.

116. **James Ting-Ho Lo**, Exponential Fourier Densities and Estimation and Detection on a Circle, *IEEE Transactions on Information Theory*, IT-23, 110–116, January 1977.
117. **James Ting-Ho Lo**, Global Bilinearization of Systems with Control Appearing Linearly, *SIAM Journal on Control* 13–4, 879–885, July 1975.
118. **James Ting-Ho Lo**, Representation of Continuous Curves on the 3–dimensional Rotation Group, *Mathematical Systems Theory* 8–4, 368–375, 1975.
119. **James Ting-Ho Lo**, Signal Detection for Bilinear Systems, *Information Sciences*, 9, 249–278, 1975.
120. **James Ting-Ho Lo** and Alan S. Willsky, Stochastic Control of Rotational Processes with One Degree of Freedom, *SIAM Journal on Control*, 13–4, 886–898, July 1975.
121. **James Ting-Ho Lo**, Bilinear Stochastic Systems and Finite Dimensional Sensor Orbits, *Proc. of the 8th Annual Princeton Conference on Information Sciences and Systems*, 289–294, March 1974.
122. **James Ting-Ho Lo** and Alan S. Willsky, Estimation for Rotational Processes with One Degree of Freedom III: Applications and Implementation, *IEEE Transactions on Automatic Control*, AC-20–1, 31–33, February 1975.
123. **James Ting-Ho Lo** and Alan S. Willsky, Estimation for Rotational Processes with One Degree of Freedom II: Discrete Time Processes, *IEEE Transactions on Automatic Control*, AC-20–1, 22–30, February 1975.
124. **James Ting-Ho Lo** and Alan S. Willsky, Estimation for Rotational Processes with One Degree of Freedom I: Introduction and Continuous Time Processes, *IEEE Transactions on Automatic Control*, AC-20–1, 10–21, February 1975.
125. **James Ting-Ho Lo**, Signal Detection of Rotational Processes and Frequency Demodulation, *Information and Control* 26–2, 99–115, October 1974.
126. **James Ting-Ho Lo**, Signal Detection on Lie Groups, *Geometric Methods in System Theory*, 295–304, edited by D. Q. Mayne and R. W. Brockett, D. Reidel Publishing Company, Dordrecht, Holland, 1973.
127. **James Ting-Ho Lo**, A General Bayes Rule and Its Application to Nonlinear Estimation, *Information Sciences* 8, 189–198, October 1974.
128. **James Ting-Ho Lo**, Nonlinear Filtering for Random Signals in Statistically Unknown Noise, *AIAA Journal* 10–4, 520–522, April, 1972.
129. **James Ting-Ho Lo**, On Optimal Nonlinear Estimation, Part II: Discrete Observation, *Information Sciences* 7, 1–10, January 1974.
130. **James Ting-Ho Lo**, On Optimal Nonlinear Estimation, Part I: Continuous Observation, *Information Sciences* 6, 19–32, January 1973.
131. **James Ting-Ho Lo**, Invariant Imbedding and Nonlinear Filtering with White Noise in the Plant, *Proc. of the 4th Annual Princeton Conference on Information Sciences and Systems*, 202–206, March, 1970.
132. **James Ting-Ho Lo**, Finite Dimensional Sensor Orbits and Optimal Nonlinear Filtering, *IEEE Transactions on Information Theory*, IT-18–5, 583–588, September 1972.

#### TECHNICAL REPORTS FOR INDUSTRY:

1. Target Location from TOA and Topography Data, *UTL Technical Report*, UTL Corporation, Dallas, TX, July 1982.
2. Choosing the Right Weights for the Poirot–Gray Location Estimator, *UTL Technical Report*, UTL Corporation, Dallas, TX, September 1982.
3. EEP Algorithm for the Weighted Least–Squares Estimation, *UTL Technical Report*, UTL Corporation, Dallas, TX, November 1982.
4. Running Fix of the Aircraft Position from INS, DOA and/or TACAN Data, *UTL Technical Report*, UTL Corporation, Dallas, TX, February 1982.
5. Emitter Location Using the Change Rate of the Electrical Phase Difference, *UTL Technical Report*, UTL Corporation, Dallas TX, January 1983.
6. Recursive Estimation and EEP Analysis for Emitter Location from DOA Data, *UTL Technical Report*, UTL Corporation, Dallas, TX, December 1982.
7. Combining Estimates, *UTL Technical Report*, UTL Corporation, Dallas, TX, February 1983.
8. Locating Emitters from DOA/TOA Measurements by Stationary Receivers, *UTL Technical Report*, UTL Corporation, Dallas, TX, April 1983.
9. Eliminating the Degradation of Phase Measurements through ROM Table Look–up, *UTL Technical Report*, UTL Corporation, Dallas, TX, May 1983.
10. Determination of DOAs from a Radar Pulse Histogram, *UTL Technical Report*, UTL Corporation, Dallas, TX, October 1982.
11. Running Fix of Aircraft Positions and In–Flight Clock Calibration using TDOA Measurements, *UTL Technical Report*, UTL Corporation, Dallas, TX, March 1983.
12. Geometric Meaning of the Optimal Weights for the Poirot–Gray Algorithm, UTL Technical Report, UTL Corporation, Dallas, TX, August 1982.
13. Comparison of DOA and TDOA Location Errors, *UTL Technical Report*, UTL Corporation, Dallas, TX, August 1983.
14. Calculating the “Average” Error RMS of the DOA Measurements, *UTL Technical Report*, UTL Corporation, Dallas, TX, June 1983.
15. Describing the Topography by Pseudo–Potential Functions, *UTL Technical Report*, UTL Corporation, Dallas, TX, September 1982.
16. Simultaneous Ambiguity Resolution and Emitter Location for Two–element Interferometers, *Technical Report* for Westinghouse Electric Company, June 1984.
17. Straight Line Resolution/Location Algorithm, *Technical Report* for Westinghouse Electric Company, July 1984.
18. New Methods of Frequency/Bearing Tracking and Line/Source Association from Sonar Array Measurements, *Technical Report* for the Defense Electronic Division, Gould, Inc., September 1984.
19. Computer Algorithm for the Limited Memory Filtering of Bearing/Frequency Data, *Technical Report* for the Defense Electronic Division, Gould, Inc., May 1985.
20. Neural Network Approach to Optimal Filtering, *Technical Report* for Maryland Technology Corporation, 1994.

21. Neural Filtering for INS and GPS Integration, *Technical Report* for Maryland Technology Corporation, 1993.
22. Monitoring a Welding Process with a Recurrent Neural Network, *Technical Report* for Maryland Technology Corporation, 1994.
23. Neural Filtering for Fusing TV and Thermal Images, *Technical Report* for Maryland Technology Corporation, 1994.
24. Neural Network Approach to Active Engine Noise Cancellation, *Technical Report* for Maryland Technology Corporation, 1995.
25. Satellite Attitude Estimation and Sensor Calibration by Neural Filtering, *Technical Report* for Maryland Technology Corporation, 1995.