

DAVID WOLPERT

Santa Fe Institute, 1399 Hyde Park Rd., Santa Fe, NM
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EDUCATION:

Ph.D., UNIVERSITY OF CALIFORNIA, SANTA BARBARA, Physics, 1989.

Dissertation: Neural networks and generalization theory.

SANTA FE SUMMER SCHOOL ON COMPLEX SYSTEMS, 1988.

M.A., UNIVERSITY OF CALIFORNIA, SANTA BARBARA, Physics, 1987.

B.A., PRINCETON UNIVERSITY, Physics, 1984 (Cum Laude).

Thesis: Filamentary structure of large scale galaxy distributions.

WORK EXPERIENCE:

- February 2019 to present Complexity Science Hub, Vienna, External professor
- February 2015 to June, 2018 MIT Astronautics and Aeronautics Dept., Visiting Professor
- February 2015 to present Arizona State University, Center for Bio-social complex systems, Adjunct Professor
- September 2013 to present Santa Fe Institute, Santa Fe. Professor.
- November 2011 to September 2013 Los Alamos National Laboratory, CCS-3. Scientist 5. Perform fundamental and applied research and provide leadership in game theory, machine learning, information theory, optimization, and the foundations of physics.
- July 2011 to September 2013 Santa Fe Institute, Santa Fe. External Faculty.
- October 2010 to September 2011 Center for Nonlinear Studies, Los Alamos. Stanislaw M. Ulam Distinguished Scholar. (See cnls.lanl.gov/external/ulam.php)
- 2006 to present (extended visits) Max Planck Institute, Visiting scholar
- Fall, 2007 Tsinghua University, Visiting Professor. Taught a course in complex systems.

June 2005 to 2007
(with gaps) Stanford University Aeronautics and Astronautics Dept. *Consulting Professor*. Supervise students in several departments on topics including adaptive distributed control and bounded rational game theory.

May 1997
to November 2011 NASA Ames Research Center. *Senior Computer Scientist*. Supervise and conduct academic research on probability collectives, combinatorial optimization, machine learning and statistics, complexity measures, and the physics of information. Supervise a group to implement collective intelligence systems inside distributed computational networks.

April 1996
to May 1997 IBM Almaden Research Center. *Datamining Solutions, Research Manager*. Supervise and conduct product-driven and academic research on machine learning and statistics.

July 1995
to March 1996 TXN Inc. *Director of Research*. Conducted product-driven and academic research on machine learning and statistics. In particular developed a run-time fraud system for telecommunications networks.

November 1991
to March 1996 Santa Fe Institute. *Postdoc*. Conducted research on supervised learning, Bayesian statistics, and the thermodynamics of computation.

January 1994
to June 1995 Pediatric Aids Foundation and NIH Correlates of Human Immuno-Deficiency Program. *Research Associate*. With Bette Korber of Los Alamos conducted statistical analysis and research on several HIV-related epidemiological datasets.

May 1993
to June 1995 TXN Inc. *Consultant*. Conducted product-driven research on machine learning and statistics.

March 1989
to November 1991 Theoretical Division and Center For Nonlinear Studies, Los Alamos National Laboratory. *Postdoc (Director's Fellow)*. Performed academic research on supervised learning, Bayesian Statistics, and the thermodynamics in J. Doyne Farmer's Complex Systems Group.

January 1988
to January 1989 University of California. Department of Computer Science, CA., *Research Assistant*. With Dr. Terrence Smith investigated connectionist models, especially as applied to path-finding.

September 1985
to December 1987 University of California, Department of Physics, Santa Barbara, CA., *Teaching Assistant*. Led discussion sections for graduate and undergraduate physics courses.

August 1984
to December 1984 Neurosciences Institute, Rockefeller University. *Research Associate*. Conducted Artificial Intelligence research and ran the NSI's IBM 4331, linked to IBM's research computers at Yorktown Heights.

REFEREED PUBLICATIONS:

Human Behavior and Control of Collective Systems/

J. Shin, M. Price, D.H. Wolpert, H. Shima, B. Tracey, and T. Kohler, "Scale and Information-Processing Thresholds in Holocene Social Evolution", *Nature Communications*, May, 2020

Wolpert, D.H., and Grana, J., "How Much Would You Pay to Change a Game before Playing It?", *Entropy*, number **21**, 2019.

Grana, J., Bono, J., and Wolpert, D.H. "Reasoning About 'When' Instead of 'What' : Collusive Equilibria with Stochastic Timing in Repeated Oligopoly", *Berkeley Electronic Journal of Theoretical Economics*, 20180038, 2019.

K. Mendal, Y. Chen, J. Grana, J. Bono, B. Tracey, M. Kochenderfer, D.H. Wolpert, "Deep Reinforcement Learning for Event-Driven Multi-Agent Decision Processes", *Transactions on Intelligent Transportation Systems*, Volume 20, Issue 4, April 2019.

J. Jost, N. Bertschinger, E. Olbrich, and D. Wolpert, "Information geometry and game theory", in *Information Geometry and Its Applications IV*, N. Ay, P. Gibilisco, F. Matus (eds.), Springer Proceedings in Mathematics & Statistics, 2018.

Y. Kim, M. J. Kochenderfer, J. Grana, J. Bono, and D. Wolpert, "Optimal Lost-Link Policies for Unmanned Aircraft," in *IEEE/AIAA Digital Avionics Systems Conference*, 2015.

Wolpert D., and Bono, J., "Distribution-valued solution concepts", *Reviews of Behavioral Economics*, 2015.

Wolpert, D., "The gaping holes in social science", *Reviews of Behavioral Economics*, 2015.

Bono, J., Wolpert, D., Xie, D. and Grana J., "Decision-Theoretic Prediction and Policy Design of GDP Slot Auctions", *American Institute of Aeronautics and Astronautics* 2014-2163, June 2014.

Backhaus, S., Bent, R., Bono, J., Lee, R., Tracey, B., Wolpert, D.h., Xie, D. and Yildiz, Y. "Cyber-Physical Security: A Game Theory Model of Humans Interacting over Control Systems", *IEEE Transactions on Smart Grid*, 2014.

Bono, J.W., and Wolpert, D.H., "Game Mining: How to Make Money from those about to Play a Game", in *Entangled Political Economy*, Horwitz, Steven and Roger Koppl (Eds.), *Advances in Austrian Economics*, Vol. 18, Bingley, UK: JAI Press

Bono, J.W., Alonso, J., Bonnefoy, P., Fan, A. McConnachie, B., Tracey B., Wolpert, D., Xie, D.P., "Application of game theoretic models to evaluate airline equipment dynamics of Nextgen technologies", *2013 Aviation, Technology, Integration and Operations Conference*.

Wolpert, D.H., and Bono, J.W., “A theory of unstructured bargaining using distribution-valued solution concepts”, *Journal of Artificial Intelligence Research*, **46**, 2013.

Yan, G., Lee, R., Kent, A, Wolpert, D., “Towards a Bayesian network game framework for evaluating DDoS attacks and defense”, *Proceedings of 2012 ACM Conference on Computer and Communications Security*, 2013.

Schlicht E., Lee R., Tracey B., Wolpert, D., Kochenderfer M., “Predicting the behavior of interacting humans by fusing data from multiple sources”, *Uncertainty in Artificial Intelligence 2012*, K. Murphy (Ed.), 2012.

Lee, R., Wolpert, D.H., Backhaus, S. Bent, R., Bono, J., Tracey, B., “Counter-Factual Reinforcement Learning: How to Model Decision-Makers That Anticipate the Future”, *Decision-Making with Imperfect Decision Makers 2012*, T. Guy, M. Karny and D.H.Wolpert (Ed.’s), Springer, 2012.

Wolpert, D.H., and Harre, M., and Bertschinger, N., and Olbrich, E., and Jost, J., “Hysteresis effects of changing parameters of noncooperative games”, *Physical Review E*, **85**, 036102, 2012.

Wolpert, D. H. and Leslie, D. “Information Theory and Observational Limitations in Decision Making”, *Berkeley Electronic Journal of Theoretical Economics*, 2011.

Wolpert, D. H. and Jamison, J. “The Strategic Choice of Preferences: the Persona Model”, *Berkeley Electronic Journal of Theoretical Economics*, 2011.

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Wolpert, D.H. and Kulkarni, N., “Game-theoretic Management of Interacting Adaptive Systems”, *Proc. 2008 NASA/ESA Conference on Adaptive Hardware and Systems*.

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Airiau, S., Wolpert, D.H., Sen, S., and Tumer, K., “Providing effective access to shared resources: a COIN approach”, *Proceedings of ESOA '03*, A. Karageorgos et al., 2003.

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Statistical Inference and information theory/

Wolpert, D.H., “What is important about the No Free Lunch theorems?”, to appear in *Black Box Optimization, Machine Learning and No-Free Lunch Theorems*", P. Pardalos, V. Rasskazova, M.N. Vrahatis, Ed., Springer

Kolchinsky, A., Tracey, B., and Wolpert, D.H., “Nonlinear Information Bottleneck”, *Entropy*, 2019; *selected for cover of journal*.

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Rauh, J., Banerjee, P., Olbrich, E., Jost, J., Bertschinger, N., and Wolpert, D.H., “Coarse-Graining and the Blackwell Order”, *Entropy*, 2017

Grana, J., Wolpert, D.H., Neil, J., Xie, D., Bhattachaya, T., Bent, R., “A Likelihood Ratio Anomaly Detector for Identifying Within-Perimeter Computer Network Attacks”, *Journal of Network and Computer Applications*, 2016

Wolpert, D.H., and DeDeo, S., “Estimating Functions of Distributions Defined over Spaces of Unknown Size”, invited contribution to *Entropy* 2013, 15(11), 4668-4699

Wolpert, D.H., “Supervised Learning Theory”, invited contribution to *Encyclopedia of Cognitive Science*, Robert French et al. (Ed.’s), Macmillian Press, 2013.

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Smyth, P. and Wolpert, D. H., “Linearly Combining Density Estimators via Stacking”, *Machine Learning Journal*, **36**, 59-83, 1999.

Wolpert, D.H., and Macready, W.G., “An Efficient Method to Estimate Bagging’s Generalization Error”, *Machine Learning Journal*, **35**, 41-55, 1999.

Smyth, P. and Wolpert, D. H., “Stacked Density Estimation”, *Neural Information Processing Systems 10*, MIT Press, 1998.

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Wolpert, D.H., “The Existence of A Priori Distinctions between Learning Algorithms”, *Neural Computation*, **8**, 1996.

Wolpert, D.H., “Determining Whether Two Data Sets are from the Same Distribution”, in *Maximum Entropy and Bayesian Methods 1995*, Ed. K. Hanson and R. Silver, Kluwer Academic press, 1996.

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Wolpert, D.H., “The Bootstrap is Inconsistent with Probability Theory”, in *Maximum Entropy and Bayesian Methods 1995*, Ed. K. Hanson and R. Silver, Kluwer Academic press, 1996.

Wolpert, D.H., Strauss, C.E., “What Bayes has to say about the evidence procedure”, in *Maximum Entropy and Bayesian Methods 1993*, Ed. G. Heidbreder, Kluwer Academic press, 1996.

Wolpert, D.H., “Reconciling Bayesian and non-Bayesian analysis”, in *Maximum Entropy and Bayesian Methods 1993*, Ed. G. Heidbreder, Kluwer Academic press, 1996.

Kohavi, R., and Wolpert, D.H., “Bias Plus Variance Decomposition for Zero-One Loss Functions”, *Proceedings of the International Machine Learning Conference 13*, Ed. Lorenza and Saiita, Morgan Kauffman, 1996.

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Wolpert, D.H., “On the Bayesian 'Occam Factors' Argument for Occam's Razor”, in *Computational Learning Theory and Natural Learning Systems III*, Ed. T. Petsche et al., MIT Press, 1995.

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Wolpert, D.H., and Lapedes, A.S., “A Rigorous Investigation of Exhaustive Learning”, in *The Mathematics of Generalization*, Ed. D. Wolpert, Addison-Wesley, 1994.

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Physics and Computation/

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Optimization and Search/

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Wolpert, D.H., and Macready, W.G., “No Free Lunch Theorems for Optimization”, *IEEE Transactions on Evolutionary Computation*, **1**, 1997.

Macready, W.G., and Wolpert, D.H. “What Makes an Optimization Problem Hard?”, *Complexity*, **5**, 1996.

Other topics/

Wolpert, D.H., Kinney, D., “Noisy Deductive Reasoning: How Humans Construct Math, and How Math Constructs Universes”, in *Undecidability, Uncomputability, and Unpredictability*, A. Aguirre et al. (Ed.’s), Springer, in press

Wolpert, D.H., “Theories of knowledge and theories of everything”, in *The Map and the Territory*, Shyam Wuppuluri and Francisco Antonio Doria (Ed.’s), Springer, 2019.

Kempes, C.P., Van Bodegom, P., Wolpert, D., Libby, E., Amend, J., Hoehler, “Drivers of bacterial maintenance and minimal energy requirements”, *Frontiers in Microbiology*, 2019

Wolpert, D.H., J. Grochow, E. Libby, S. DeDeo, “The many faces of state space compression” in *From Matter to Life: Information and Causality*, Walker, Ellis and Davies (Ed.’s), Cambridge University Press, 2017, 199-243.

Wolpert, D.H., Macready, W., “Using Self-dissimilarity to Quantify Complexity”, *Complexity*, **12**, 2007.

Wolpert, D.H., Macready, W., “Self-dissimilarity as a high dimensional complexity measure”, in *International Conference on Complex Systems 2004*, Y. Bar-Yam (Ed.), Perseus books, 2004.

Wolpert, D.H., “Metrics for more than two points at once”, in *International Conference on Complex Systems 2004*, Y. Bar-Yam (Ed.), Perseus books, 2004.

Wolpert, D.H., MacLennan, B. J., “A Computationally Universal Field Computer with Linear Dynamics”, *Neural Computation*.

Wolpert, D.H., and Macready, W.G., “Self-Dissimilarity: An Empirically Observable Measure of Complexity”, in *Unifying Themes in Complex Systems*”, Y. Bar-Yam (Ed.), Perseus books, 2000.

Wolpert, D.H., and MacLennan, B., “A Computationally Universal Field Computer that is Purely Linear”, in *Proceedings of the 5th Joint Conference on Information Sciences*”, (Atlantic City, NJ, Feb. 27 - Mar. 3, 2000), I, pp. 782-5, Paul P. Wang (Ed.), ACM Press, 2000.

BOOKS:

Wolpert, D., Kempes, C., Stadler, P., Grochow, J. (Ed.) , *The Energetics of Computing in Life and Machines*, Santa Fe Institute Press, 2019.

Guy, T., Karny, N. and Wolpert, D.H., (Ed.), *Proceedings of ECML 2013 workshop on “Scalable decision making: Uncertainty, Imperfection, Deliberation”*, Springer, 2015.

Guy, T., Karny, N. and Wolpert, D.H., (Ed.), *Proceedings of NIPS 2011 workshop on “Decision Making and Imperfection”*, Springer, 2013.

Guy, T., Karny, N. and Wolpert, D.H., (Ed.), *Proceedings of NIPS 2010 workshop on “Decision Making with Imperfect Decision Makers”*, Springer, 2012.

Tumer, K. and Wolpert, D.H. (Ed.), *Collectives and the Design of Complex Systems*, Springer, 2004.

Wolpert, D.H. (Ed.), *The Mathematics of Generalization*, Addison-Wesley, 1994.

POPULAR PRESS:

Wolpert, D.H., “Why do computers take so much energy?”, *Scientific American*, Oct. 4, 2018

GRANTS (within last five years, in reverse chronological order, only those for which I am PI and that are over \$50,000):

NSF IBSS, 1620462; *Information Networks and the Evolution of Social Organizations*; \$770,000, PI

NSF, CHE-1648973; INSPIRE: *Tradeoffs in the Thermodynamics of Computation: A New Paradigm for Biological Information-Processing*; \$999,947, PI

FQXi, SVCF: 2016-160137 (5561)/ FQXi-RFP-1622; *Observers as self-maintaining non-equilibrium systems*; \$128,319, PI

ARO, W911-NF-15-1-0127; *Event-driven game theory for predicting dynamics of social systems*, \$294,535, PI

AFOSR, FA9550-15-1-0038A; *Unified and Algorithmic Framework for Managing Multiple Information Sources of Multi- Physics Systems*, \$4,298,194, co-I

NASA, NNX14ZI11G; *Event-driven Game Theory for Aviation Safety*, \$900,000, PI

Templeton World Charity Foundation, TWCF0079/ AB47; *Information Theory, Ecosystems, and Schrodinger's Paradox*, \$588,061, PI

FQXi, SVCF: 2013-111422 (4661)/ FQXi-RFP-1349; *A Semantic Information-Theory Model of Reality*, \$50,000, PI

NASA, 60058457-101700-C; *Modeling of Airline Behavior Using Strategic, Agent-Based Approaches*, \$133,923, PI

STUDENTS:

Co-advised PhD students (graduated): Stefan Bieniawski (Stanford), Dev Rajnarayan (Stanford), Brendan Tracey (Stanford), Justin Grana (American University)

Thesis reviewer for students at UC-Irvine, University of Waterloo, University of Pretoria, University of Leipzig, University of Luxembourg, Imperial College London

Co-authored 25 papers with 12 students. In 15 of the papers the student was first author.

MISCELLANEOUS:

Second place in 2020 FQXi essay contest (\$5000 prize)

Fellow of IEEE. (Fewer than .1% IEEE members are elected fellows per year.)

Member of FQXi

Research Associate of *Info-metrics Institute, American University*

Collaborator of *Purdue Center for Sciences of Information*

Associate Editor (current only):

Advances in Complex Systems,
IEEE Transactions on Evolutionary Computation,
ACM Transactions on Autonomous and Adaptive Systems

Member of Editorial Board (current only):

Journal of Artificial Intelligence Research
Theory in Biosciences
Journal of Economic Interaction and Coordination
Reviews of Behavioral Economics
Entropy
Sci
Cancer Convergence

Member of council (current only):

The Socio-Economic Science with Heterogeneous Interacting Agents Society

Member of Senior Advisory Panel (current only):

Journal of Physics: Complexity

Member of Advisory Board (current only):

Handbook of Natural Computing, Springer
Sci, MDPI

Virtual Faculty (current only):

Bielefeld University Cluster on Cognitive Interaction Technology

Bios Fellow.

Member of multiple NSF panels. Member of NCI panel.

US Patent 5,535,301 on Stacked Generalization.

US patent 09/160,828 (1998) for Surfaid Predictor.
US patent (1999) for Masked Proportional Routing.

Top two winners of 2009 Netflix competition made extensive use of my patented Stacked Generalization technique. (See Sill, J. and Takacs, G. and Mackey L. and Lin D, “Feature-Weighted Linear Stacking”, at arXiv:0911.0460.)

Tsingua University, Center for Intelligent Networked Systems, Beijing, October 2005. Visiting professor. Taught an intensive graduate course on “Advances in Complex Systems”.

Max Planck Institute, Mathematics in the Physical Sciences, Leipzig, June 2006, October 2007, March 2009, January 2011, May 2013, October 2013. Visiting scholar.

Center of Excellence Cognitive Interaction Technology, Bielefeld, September 2010, Summer school lecturer.

Co-organized:

- 2020 SFI workshop on *Evolution of Collective Computational Abilities of (Pre)Historic Societies*
- 2020 CSH workshop on *Stochastic Thermodynamics in Complex Systems*
- 2020 SFI working group on *The Interplay of Large-Scale Impersonal Trends, Big Ideas, and Great Leaders in History*
- 2019 SFI workshop on *What is Biological Computation?*
- 2019 SFI working group on *Thermodynamic and Computational Efficiency in Cellular Chemical Reaction Networks*
- 2018 SFI working group on *Lookahead Optimization*
- 2017 SFI workshop on *Information Networks and the Evolution of Social Organization*
- 2017 SFI workshop on *Thermodynamics and Computation: toward a new synthesis*
- 2017 SFI workshop on *Thermodynamics of Computation in Chemical and Biological Systems*
- 2016 NIPS workshop on *Imperfect Decision Makers: Admitting Real-World Rationality*
- 2016 SFI workshop on *Statistical Physics, Information Processing and Biology*
- 2014 SFI working group on *Major Transitions in Natural, Synthetic, and Artificial Evolution*
- 2014 SFI working group on *Information Theory, Ecosystems, and Schrodinger's Paradox*
- 2013 SFI / LANL working group on *Multi-Information Source Optimization*
- 2012 SFI / LANL working group on *Multi-Information Source Optimization*
- 2012 SFI / LANL Theme week on *Combining Information Theory and Game Theory*
- 2011 NIPS workshop on *Decision Making with Multiple Imperfect Decision*

Makers

- 2010 NIPS workshop on *Decision Making with Multiple Imperfect Decision Makers*
- 2010 Santa Fe Institute / Center for Nonlinear Studies workshop and miniprogram on *Decentralized control of strategic agents*
- 2010 Perimeter Institute workshop on the *Foundations of physics*
- 2009 Oxford-Man Institute workshop, *From Game Theory to Game Engineering*
- 2008 Beyond Institute workshop on *The Nature of the Laws of Physics*
- 2005 NIPS workshop on *Game Theory, Machine Learning and Reasoning under Uncertainty*
- 2005 Center for Nonlinear Studies workshop on *Collectives*
- 2004 Special Session on *Product Distribution Theory* at The 2004 International Conference on Complex Systems (invited organizer)
- 2003 Stanford/NASA workshop on *Collective Intelligence*
- 2002 NASA workshop on *Collective Intelligence*
- 2001 Santa Fe Institute / NASA workshop on *Collective Intelligence*
- 2002 WCCI Special Track on *Distributed Learning for Optimization*
- NIPS-98 Workshop on *Turnkey Algorithms for Improving Generalizers*
- The AAI-96 Workshop on *Integrating Multiple Learning Methods*. Co-edited the associated special issue of *Machine Learning Journal*
- Spring 1996 AAI Symposium on *Computational Issues in Learning Models of Dynamical Systems*
- 1992 Center for Nonlinear Studies / Santa Fe Institute workshop on *Mathematics of Generalization*

Reviewed for:

- ACM Transactions on Autonomous and Adaptive Systems
- AIAA journal
- Air Force Office of Scientific Research
- Artificial General Intelligence 2010, 2011
- Artificial Intelligence and Statistics 2011
- American Control Conference 2011, 2012
- The American Statistician
- American Association for Artificial Intelligence Conferences
- American Association for Artificial Intelligence Symposia
- American Journal of Epidemiology
- Annals of Mathematics and Artificial Intelligence
- Annals of Operations Research
- Annals of Physics
- Annals of Statistics
- Arabian Journal for Science and Engineering
- Army Research Office
- Artificial Intelligence
- Artificial Intelligence and Mathematics
- Asia-Pacific Conference on Intelligent Agent Technology 2001

Automatica
Autonomous Agents and Multi-agent systems '03
Autonomous Agents and Multi-agent systems '04
Autonomous Agents and Multi-agent systems '05
Journal of Autonomous Agents and Multi-agent systems
Axioms
Axios
Belgium, Fund for Scientific Research – FRNS
Big Data and Society
Biophysical Journal
Brain Research Bulletin
Cambridge University Press
Cell Reports Physical Science
Center for Sciences of Information
Center for Nonlinear Studies
Chaos
Cognitive Information Processing 2008
Communication Physics Nature
Complexity
Complexus
Complexis conference 2016
Complex Systems
Computers and Operations Research
Connection Science
Conference on Decision and Control 2001
Congress on Evolutionary Computation 2004
Congress on Evolutionary Computation 2009
Czech Science Foundation
The Open Cybernetics and Systemics Journal
Decision Support Systems
Econometrica
Engineering self-organizing applications 2003
Engineering and Physical Sciences Research Council
Engineering Societies in the Agents World, 2008
Entertainment Computing
Entropy
EURASIP Journal on Applied Signal Processing
European Conference on Complex Systems 2006
European Research Council Advanced Grant Call
Europhysics Letters
Evolutionary Computation
Foundations of Evolutionary Algorithms 2000
Foundations of Physics
Foundations of Science
Fund for Scientific Research (Belgium)
FQXi

Frontiers in Evolutionary Algorithms 2000
Games and Economic Behavior
Handbook of Natural Computing
Human Movement Review
Human Movement Science
IBM Journal of Research and Development
ICML 2015
ICML 2019
ICPRAM 2011
IEEE Communications Letters
IEEE Control Systems Conference 2011
IEEE International Symposium on Cluster Computing and the Grid 2001
IEEE Intelligent Systems
IEEE Transactions on Evolutionary Computation
IEEE Transactions on Knowledge and Data Engineering
IEEE Transactions on Neural Networks
IEEE Transactions on Pattern Analysis and Machine Intelligence
IEEE Transactions on Systems, Man and Cybernetics, A and B
Infometrics Institute 2011 workshop on Philosophy of Information
Information
Information Fusion
Information Processing Letters
Information Sciences
INFORMS Journal on Computing
Israeli Research Foundation
Intelligent Agent Technology 2001
Intern. symposium on Innovations in Intelligent Systems and Applications, 2007
International Conf. Complex Systems 2011
International Journal of Business Intelligence and Data Mining
INISTA 2007
Institute for Mathematics and its Applications
Interdisciplinary Science Reviews
International Center for Theoretical Physics
International Joint Conference on Artificial Intelligence
International Conference on Complex Systems 2004
International Conference on Machine Learning and Applications
International Joint Conference on Neural Networks
International Workshop on Multiple Classifier Systems
Iranian Journal of Management Studies
Israeli Science Foundation
John Templeton Foundation
Joint Conference on Intelligent Systems
Journal of Aerospace Engineering
Journal of Artificial Intelligence Research
Journal of Autonomous Agents and Multi-Agent Systems
Journal of Biological Physics

Journal of Chemical Information and Modeling
Journal of Chemical Physics
Journal of Combinatorial Optimization
Journal of Computational and Graphical Statistics
Journal of Computer Science Applications and Information Technology
Journal of Heuristics
Journal of History of Economic Thought
Journal of Machine Learning Research
Journal of Neural Networks
Journal of Optimization
Journal of the Royal Society, Interface
Journal of the Royal Statistical Society, B
Journal of Statistical Physics
Keck Foundation
Knowledge Discovery and Data Mining Conference
Machine Learning
The Marsden Fund of The Royal Society of NZ
Mathematics
Mathematical Reviews
Max Planck Institute for Intelligent Systems, Search committee for Director
Maximum Entropy and Bayesian Methods Conference
MCS 2000
MIND
NASA Astrobiology Institute
Nature
Nature Communications
Nature Physics
Nature Scientific Reports
National Cancer Institute
National Science Foundation (more than half a dozen divisions)
Netherlands Organization for Scientific Research
Neural Computation
Neural Networks
Neural Information Processing Systems Conference
Oxford University Press
Philosophical Transactions A
Philosophy of Science
Physica A
Physica D
Physical Review Letters
Physics Essays
Physics Letters A
PLoS One
PLoS Computational Biology
Proceedings of the National Academy of Sciences
Proceedings of the Royal Society A

Progress in Biophysics and Molecular Biology
Journal of the Royal Statistical Society B
Remote Sensing
Research Foundation Flanders
Royal Society Wolfson Research Merit Award
Royal Society Leverhulme Trust Award
Science Advances
Scientific Reports
SIAM Review
Society for Economics and Heterogeneous Interacting agents
Soft Computing
Sustainability
Swiss National Science Foundation
Theoretical Computer Science
Theory in Biosciences
1999 Workshop on Economics with Heterogeneous Interacting Agents
First International Workshop on Theory and practice of open computational
systems
WCCI 2008

Invited presentations and discussion panels:

Agents '00 "Infrastructure for Scalable Multi-Agent Systems" workshop.
American Association for Advancement of Science 1995 Panel on Artificial Life
American Mathematical Society Mt. Holyoke 1996 Workshop on Statistics
Arizona State University, Mathematics and Cognition Seminar
Arizona State University, Biosocial Complexity Initiative
Arris Corporation
2009 Aladdin Project Review (**keynote speech**)
Beilstein-Bozen symposium, 2018
Beyond Institute on General Principles of Increasing Complexity
Brigham Young University, Computer Science Dept.
Bristol University, Computer Science Dept.
Cal State Fresno, Business School
Cal State Fresno, Physics Dept.
Cal State Fresno, Computer Science Dept.
Cal Tech, Center for Neuromorphic Systems Engineering
Cal Tech, Control and Dynamical Systems
Cal Tech, Physics Research Conference (**sole speaker**)
Cambridge University, Newton Institute of Mathematics
Center for Nonlinear Studies (Los Alamos)
2007 CNLS conference: Unconventional Computation: Quo Vadis?
Complexity Science Hub, Vienna
Cognitive Computing 2018 (Hanover), (**keynote speech**)

2015 Conference on Complex Systems (three talks)
 2017 Conference on Complex Systems (**invited speaker**)
 Complexity, Criticality and Computation 2017 (**keynote speech**)
 Computation in Natural Systems 2018 (**keynote speech**)
 Computability in Europe 2010 (**plenary speaker**)
 Conferences on Computational Learning Theory and Natural Learning Systems
 (several)
 Conference on Cognitive Computing - Merging Concepts with Hardware 2018
 (**plenary speaker**)
 Conference on Control and Decision Theory 2004
 Control Mechanisms for Complex Systems 1996 International Workshop
 Conference in honor of Reuven Rubinstein 2008
 Conference on Evolutionary Computation 2000 (**banquet speech**)
 Conference on Evolutionary Computation 2005 (**keynote speech**)
 Courant Institute
 Cowles Foundation 2009 workshop on simplicity and likelihood
 Dynamics of multilevel systems 2015 workshop
 Dynamics of multilevel systems 2015 (**summer school lecturer**)
 Entropy 2018 (**keynote speech**)
 Evolution, Cooperation and Rationality workshop, 2009 (Bristol, UK)
 European Conference on Complex Systems, Future of Complex Transportation
 Systems workshop, 2011
 Guided self-organization 2018 (**keynote speech**)
 IEEE Symp. on Foundations of Computational Intelligence '07 (**keynote speech**)
 IEEE Beijing Frontiers of Machine Intelligence 2016 (**keynote speech**)
 FQXi biannual conference, 2016
 Fusion Engineering and Design
 Workshop on High Performance Object Databases, Cardiff '00
 HP Research Labs (Palo Alto)
 IBM Yorktown Heights Research Center
 IBM Informational Lens Workshop
 ICML 2000 workshop on What Works Well Where
 ICML 2000 workshop on multi-agent systems
 Imperial College London, Statistics Department
 Infometrics conference (multiple meetings)
 Information Engines at the Frontiers of Nanoscale Thermodynamics, 2016
 Institute for Human and Machine Cognition
 Institute for New Economic Thinking (Oxford)
 Workshop on Intelligent Agent Support for Imagery & Geospatial Analysis 2000
 Institute of Science and Technology Austria, Physics Department, 2019
 International Center for Theoretical Physics
 The International Computer Science Institute
 Jet Propulsion Laboratory
 Keio university, Physics Dept.
 Likelihood and Simplicity, Bar-Ilan University, 2014
 London School of Economics, Mathematics Dept.

Luxembourg University, Physics Dept.
 Max Planck Institute for Mathematics in the Natural Sciences
 Maximum entropy and Bayesian Analysis conference, 2016 (**keynote speech**)
 Microsoft Corporation
 Modeling Complex Systems '02
 Monitoring, security, and rescue tasks in multi-agent systems (keynote speaker)
 MIT Artificial Intelligence Lab
 MIT Lincoln Laboratories
 2002 Brookings Inst. Workshop on Multi-Agent Comp. in Economies
 NASA Center for Computational Astrobiology kickoff panel discussion
 Nanyang Technical University, Physics Department
 NEC Corporate Research Lab
 New England Complex Systems Institute
 Neural Information Processing Systems main conference
 Neural Information Processing Systems workshop on Combining generalizers
 Neural Information Processing Systems workshop on Occam's Razor
 Neural Information Processing Systems workshop on Electronic Commerce
 NIMBioS workshop on *Information and Entropy in Biological Systems*, 2015
 NORDITA workshop on "Statistical Physics of Complex Systems", 2019
 Complexity Science Hub Vienna, "Information-theoretic Methods for Complexity Science", 2019
 Oxford University, Applied Mathematics Dept.
 Oxford University, Computer Science Dept.
 Oxford - Man Institute
 Parmenides Foundation, *Re-Thinking Matter, Life, Mind* 2018 (**plenary speech**)
 Perimeter Institute
 Purdue University, Computer Science Dept
 Pyeongchang forum, 2019, (**keynote speech**)
 RAND, Santa Monica, 2015
 RAVE 2009, Barcelona (**keynote speech**)
 Workshop on Re-conceptualizing the Origin of Life, Carnegie Institute, 2016
 Rocky Mountain Conference on Artificial Intelligence
 Rome 2010 Science Festival (**plenary speaker**)
 Royal Statistical Society
 2002 World Conference on Soft Computing (**plenary speaker**)
 Sandia Complex Systems Department (**distinguished lecturer**)
 San Jose State University physics department
 ScienceFoo 2009
 Seoul National University, Physics Dept., 2019
 Snowbird conference on neural computing
 SIAM 2013 mini-symposium on Multi-information source optimization
 SIAM 2014 mini-symposium on Multi-fidelity optimization
 Siemens Corporate Research
 Self Optimizing Systems NSF workshop (**keynote speech**)
 Solvay workshop on Noneq. and nonlinear phenomena in statistical mechanics
 SPIE 2008 (**keynote speech**)

Stanford, Aeronautics and Aerospace Dept.
Stanford, Computer Science Dept.
Stanford, Psychology Dept.
Stanford, Statistics Dept.
Statistical Mechanics Workshop, 2016
“Strategies for Implementing Large Scale Emergent Systems” Workshop.
Symposium on Understanding Complex Systems 2005 (**keynote speech**)
Symposium on Frontiers of Machine Intelligence 2016 (**keynote speech**)
2013 Wright-Patterson AFRL Technical Interchange Meeting on multi-fidelity optimization
Theory and practice of open computational systems 2003
Thermodynamic Computing workshop, 2019
Tsinghua university computer science and physics departments, 2016
UC Berkeley, Statistics Dept.
UC Davis, Computer Science Dept.
UC Irvine, Institute for Mathematical Behavioral Sciences
UCLA, Aerospace Dept.
UCLA, Statistics Dept.
UC San Diego, Politics Dept.
UC Santa Cruz, Computer Science Dept.
UC Santa Cruz, Applied Math Dept.
USC, Computer Science Dept.
University of Luxembourg, Physics Dept.
University of New Mexico, Physics Dept.
University of New Mexico, Computer Science Dept.
University of Tokyo, Physics Dept.
University of Warwick, Economics Dept.
UT Austin, Physics Dept.
2002 World Congress on Computational Intelligence (**plenary speaker**)
2004 Workshop on Econ. and Heterog. Interactive Agents (**plenary speaker**)

Peer-Reviewed Awards:

Best Paper Award for IEEE Trans. Evolutionary Computation, Vol. 1
Best Paper Award for IEEE Trans. Evolutionary Computation, Vol. 2
Superior Accomplishment Award for NASA Code IC for 1999
TXN fellow
NIH Postdoctoral Fellowship
LANL Director's Postdoctoral Fellowship
UC DuPont Fellowship
UC Regent's Fellowship
Princeton University Physics Department Kusaka Prize