

DAVID WOLPERT

Santa Fe Institute, 1399 Hyde Park Rd., Santa Fe, NM 87501,
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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 2015 to present MIT Astronautics and Aeronautics Dept., *Visiting Professor*

March 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. Doyné 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.

January 1985
to August 1985

Princeton Telecom Inc. *Programmer-Analyst*. Worked on telecommunications and home banking software for person computers.

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/

Wolpert D., and Bono, J., “Distribution-valued solution concepts”, *Reviews of Behavioral Economics*, in press.

Wolpert, D., “The gaping holes in social science”, *Reviews of Behavioral Economics*, in press.

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*, in press.

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 equipage dynamics of Nextgen technologies”, *2013 Aviation, Technology, Integration and Operations Conference*, in press.

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.

Lee, R. and Wolpert, D.H., “Game-Theoretic Modeling of Human Behavior in Mid-Air Collisions”, *Decision-Making with Imperfect Decision Makers 2011*, T. Guy, M. Karny and D.H.Wolpert (Ed.’s), Springer.

Wolpert, D. H. and Jamison, J. “Schelling Formalized: Strategic Choices of Non-Rational Behavior”, *Evolution and Rationality: Decisions, Cooperation, and Strategic Behavior*, K. Binmore and S. Okasha (Ed.’s), Cambridge University Press, in press.

Wolpert, David H. and Bono, J. W. “PGT: A Statistical Approach to Prediction and Mechanism Design”, *Proc. of SBP 2010*, Sun-Ki Chai, John Salerno, and Patricia Mabry (Eds.), Springer 2010.

Wolpert, D.H., “Why Income Comparison is Rational”, *Games and Economic Behavior*, **69**, issue 2, 458-474, 2010.

Wolpert, D.H., “Trembling Hand Perfection for mixed Quantal / Best Response Equilibria”, *International Journal of Game Theory*, **8**, Issue 4, Page 539, 2009.

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

Wolpert, D.H., Strauss, C.E.M., Rajnarayan, D., “Advances in Distributed Optimization using Probability Collectives”, *Advances in Complex Systems*, **9**, 2006.

Lawson, J and Wolpert, D.H., “Adaptive Programming of Unconventional Nano-Architectures”, *Journal of Computational and Theoretical Nanoscience*, **3**, 272-279, 2006.

Bieniawski, S., Kroo, I., and Wolpert, D.H. “Flight Control with Distributed Effectors,” AIAA Paper 2005-6074, Proceedings of the 2005 *AIAA Guidance, Navigation, and Control Conference*, San Francisco, CA, August 15-18, 2005.

Wolpert, D.H., Bieniawski, S.R., “Distributed Control by Lagrangian Steepest Descent”, in *Proceedings of IEEE Conference on Decision and Control*, 2004.

Wolpert, D.H., Huang, C.F, Bieniawski, S. and Strauss, C.E.M., “A comparative study of Probability Collectives-based Multi-agent Systems and Genetic Algorithms”, *Proceedings of 2005 GECCO conference*.

Bieniawski, S., Kroo, I., and Wolpert, D. H., “Discrete, Continuous, and Constrained Optimization Using Collectives,” AIAA Paper 2004-4580, 10th *AIAA/ISSMO Multi-disciplinary Analysis and Optimization Conference*, Albany, NY, August 30-September 1, 2004.

Wolpert, D.H., Bieniawski, S., “Distributed Adaptive Control: Beyond Single-Instant, Discrete Variables”, in *MSRAS 04*, Springer-Verlag, 2004.

Wolpert, D.H., “What Information Theory says about Bounded Rational Best Response”, in *WEHIA 04*, A. Namatame (Ed.), Springer-Verlag, 2004.

Bieniawski, S.R., Wolpert, D.H., “Adaptive, distributed control of constrained multi-agent systems”, in *Autonomous Agents and Multi-Agent Systems 2004*, 2004.

Lee, C.F., Wolpert, D.H., “Product distribution theory for control of multi-agent systems”, in *Autonomous Agents and Multi-Agent Systems 2004*, 2004.

Wolpert, D.H., Lee, C.F., “Adaptive Metropolis Sampling with Product Distributions”, in *International Conference on Complex Systems 2004*, Y. Bar-Yam (Ed.), Perseus books, 2004.

Bieniawski, S.R., Wolpert, D.H., “Product Distributions for Distributed Optimization”, in *International Conference on Complex Systems 2004*, Y. Bar-Yam (Ed.), Perseus books, 2004.

Macready, W., Wolpert, D.H., “Distributed Constrained Optimization”, in *International Conference on Complex Systems 2004*, Y. Bar-Yam (Ed.), Perseus books, 2004.

Wolpert, D.H., “Information theory - the bridge connecting bounded rational game theory and statistical physics”, in *Complex Engineering Systems*, D. Braha and Y. Bar-Yam (Ed.'s), Perseus books, 2004.

Tumer, K., Wolpert, D.H., “Coordination in Large Collectives”, in *International Conference on Complex Systems 2004*, Y. Bar-Yam (Ed.), Perseus books, 2004.

Antoine, N.E., Bieniawski, S.R., Kroo, I.M., Wolpert, D.H., “Fleet Assignment using collective intelligence”, AIAA-2004-0622, Presented at the 42nd Aerospace Sciences Meeting, 2004.

Wolpert, D.H., Tumer, K., Bandari, E. “Improving search algorithms by using intelligent coordinates”, *Physical Review E (Brief Communications)*, **69**, 017701, 2004.

Tumer, K., Wolpert, D.H., “A Survey of Collective Intelligence”, in Tumer, K., and Wolpert, D.H. (Ed.'s) *Collectives and the Design of Complex Systems*, Springer-Verlag, 2004.

Wolpert, D.H., “The Theory of Collectives”, in Tumer, K., and Wolpert, D.H. (Ed.'s) *Collectives and the Design of Complex Systems*, Springer-Verlag, 2004.

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.

Wolpert, D.H., and Tumer, K., “Beyond Mechanism Design”, *International Congress of Mathematicians 2002 Proceedings*, H. Gao et al. (Ed.s), Qingdao Publishing, 2002.

Lawson, J., and Wolpert D. H., “The Design of Collectives of Agents to Control Non-Markovian Systems”, *Proceedings of American Association of Artificial Intelligence Conference 2002*, 2002.

Wolpert, D.H, and Lawson, J., “Designing Agent Collectives For Systems With Markovian Dynamics”, in *Proceedings of First International Joint Conference on Autonomous Agents and Multi-Agent Systems*, 2002.

Tumer, K., Agogino, A, and Wolpert, D.H., “Learning Sequences of Actions in Collectives of Autonomous Agents”, in *Proceedings of First International Joint Conference on Autonomous Agents and Multi-Agent Systems*, 2002.

Wolpert, D.H., and Tumer, K., “Optimal Reward Functions in Distributed Reinforcement Learning”, *Intelligent Agent Technology 2001*, 2002.

Wolpert, D.H., Tumer, K. “Collective Intelligence, Data Routing, and Braess’ Paradox”, *Journal of Artificial Intelligence Research*, 2002.

Wolpert, D.H., “Collective Intelligence”, in *Computational Intelligence Beyond 2001: Real and Imagined*, D. Fogel and D. Robinson (Ed.), Wiley, 2001.

Wolpert, D., and Tumer, K., “Optimal Payoff Functions for Members of Collectives”, *Advances in Complex Systems*, Vol. 4, pp. 265-280, 2001.

Wolpert, D.H., Sill, J., and Tumer, K., “Using Collective Intelligence to Control Data Flow Across a Constellation of Satellites”, *Proceedings International Joint Conference on AI 2001*, Morgan Kauffman, 2001.

Wolpert, D.H., and Tumer, K., “An Illustration of the COIN Approach to Design of Multi-Agent Systems”, *Proceedings of the Agents 00 and ECML 00 Workshop on Learning in Agents*, Sen. S et al. (Ed.’s), 2000.

Tumer, K., and Wolpert, D.H. “Collective Intelligence and Braess’ Paradox”, in *Proceedings of AAAI 2000*, Morgan Kauffman, 2000.

Wolpert, D.H., Tumer, K., “Collective Intelligence for Optimization”, in “Statistical Machine Learning for Large-Scale Optimization”, J. Boyan, et al. (Ed.’s), *Neural Computing Surveys*, 2000.

Wolpert, D.H., Kirshner, S., Tumer, K., Merz, C., “Adaptivity in Agent-Based Routing for Data Networks”, in *Proceedings of Agents 00*, Sierra, C., et al, (Ed.s), 2000.

Wolpert, D.H., Wheeler, K., Tumer, K., “Collective Intelligence for Control of Distributed Dynamical Systems”, *Europhysics Letters*, vol. 49 issue 6, 708-714, 2000.

Wolpert, D.H., Wheeler, K., Tumer, K., “General Principles of Learning-based Multi-Agent Systems”, *Third International Conference of Autonomous Agents*, J.E. Bradshaw (Ed.), ACM Press, 77-83, 1999.

Wolpert, D.H., Tumer, K., Frank, J. “Using collective intelligence to route internet traffic”, *Neural Information Processing Systems 11*, Kearns et al. (Eds), MIT Press, 952-958, 1999.

Statistical Inference/

Wolpert, D.H., and DeDeo, S., “Estimating Functions of Distributions Defined over Spaces of Unknown Size”, invited contribution to *Entropy*, in press.

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

Wolpert, D.H. “The Supervised Learning No-Free-Lunch Theorems”, invited contribution to World conference on Soft Computing 2001, 2001.

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.

Wolpert, D.H., Knill, E., and Grossman, T., “Some results concerning off-training-set and IID error for the Gibbs and Bayes optimal generalizers”, *Statistics and Computing*, **8**(1), March 1998, pp. 35--54.

Delwart, E.L., Pan, H., Sheppard, H.W., Wolpert, D.H., Neumann, A.U., Korber, B.T., Mullins, J.I., “Slower Evolution of HIV-1 quasispecies evolution during progression to AIDS”, *J. Virol*, October, **71**(10), 7498-7508, 1997.

Smyth, P. and Wolpert, D. H., “Anytime Exploratory Data Analysis for Massive Data Sets”, *The Third International Conference on Knowledge Discovery and Data Mining*, AAAI Press, 1997.

Wolpert, D.H., “On Bias plus Variance”, *Neural Computation*, **9**, 1997.

Wolpert, D.H., “The Lack of A Priori Distinctions between Learning Algorithms”, *Neural Computation*, **8**, 1341 - 1390, 1996.

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.

Wolpert, D., Macready, W., “Combining Stacking with Bagging to Improve a Learning Algorithm”. Santa Fe Institute Technical Report 96-03-123, 1996.

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.

Wolpert, D.H., and Wolf, D.R., “Estimating Functions of Probability Distributions from a Finite Set of Samples”, *Physical Review E*, **52**, p. 6841, 1995. (Note subsequent erratum: *Physical Review E*, **54**, p. 6973, 1996.)

Wolpert, D.H., “Horizontal Generalization”, in *Proceedings of the International Machine Learning Conference 12*, Ed. A. Prieditis and S. Russell, Morgan Kauffman, 1995.

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.

Wolpert, D.H., “The Relationship Between the Various Supervised Learning Formalisms”, in *The Mathematics of Generalization*, Ed. D. Wolpert, Addison-Wesley, 1994.

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

Wolpert, D.H., “Filter Likelihoods and Exhaustive Learning”, in *Computational Learning Theory and Natural Learning Systems II*, Ed. S. Hanson et al., MIT Press, 1994.

Wolpert, D.H., “Bayesian back-propagation over I-O functions rather than weights”, in *Advances in Neural Information Processing Systems VI*, Ed. S. Hanson et al., Morgan Kauffman, 1994.

Strauss, C.E., Wolpert, D.H., Wolf, D.R., “Alpha, Evidence, and the Entropic Prior”, in *Maximum Entropy and Bayesian Methods 1992*, Ed. A. Mohammed-Djafari, Kluwer, 1994.

Wolpert, D.H., “Combining Generalizers Using Partitions of the Learning Set”, in *1992 Lectures in Complex Systems*, Ed. L. Nadel et al., Addison-Wesley, 1994.

Wolpert, D.H., “On the Use of Evidence in Neural Networks”, in *Advances in Neural Information Processing Systems V*, Ed. S. Hanson et al., Morgan Kaufman, 1993.

Korber, B.T., Farber, R.M., Wolpert, D.H., and Lapedes, A.S., “Covariation of Mutations in the V3 Loop of HIV-1: An Information-Theoretic Analysis”, *Proceedings of the National Academy of Sciences*, **90**, 7176-7180, 1993.

Wolpert, D.H., “How to Deal with Multiple Possible Generalizers”, in *Fast Learning and Invariant Object Recognition*, Ed. B. Soucek, Wiley and Sons, 1992.

Wolpert, D.H., “Stacked Generalization”, *Neural Networks*, **5**, 241-259, 1992.

This work was the basis of both winning entries in the 2009 netflix competition. See J. Sill, G. Takacs, L. Mackey, and D. Lin, “Feature-Weighted Linear Stacking” for details.

Wolpert, D.H., “On the Connection Between In-Sample Testing and Generalization Error”, *Complex Systems*, **6**, 47-94, 1992.

Wolpert, D.H., “The Relationship Between Occam's Razor and Convergent Guessing”, *Complex Systems*, **4**, 319-368, 1990.

Wolpert, D.H., “Using a Mathematical Theory of Generalization to Construct a Generalizer Superior to NETtalk”, *Neural Networks*, **3**, 445-452, 1990.

Wolpert, D.H., “A mathematical Theory of Generalization: part I, part II”, *Complex Systems*, **4**, 151-200, 201-249, 1990.

Wolpert, D.H., “A benchmark for how well neural nets generalize”, *Biological Cybernetics*, **61** 303-313, 1989.

Physics and Computation/

Wolpert, D.H., “Information Width: a way for the second law to increase complexity”, in *The Self-Organizing Universe: Cosmology, Biology, and the Rise of Complexity*, C. Lineweaver, P. Davies, and M. Ruse (Ed.'s), Cambridge University Press, 2013.

Wolpert, D.H. and Benford, G., “The Lesson of Newcomb’s Paradox”, *Synthese*, 2011.

Wolpert, D.H., “Inference concerning physical systems”, Proc. of CiE 2010, Fernando Ferreira, Benedikt Lowe, Elvira Mayordomo, Luis Mendes Gomes (Eds.), Springer, 2010

Wolpert, D.H., “Physical limits of inference”, *Physica D*, **237** (2008) 1257-1281.

See also Binder, P., “Theories of almost everything”, Nature, 455 (2008), 884-885

Wolpert, D.H., “Computational Capabilities of Physical Systems”, *Physical Review E*, Vol. 65, 016128, Dec. 20, 2001.

Wolpert, D.H., “The Second Law, Computation, and the Temporal (A)symmetry of Memory”, in *Advances in the Physics of Computation*, Ed. D. Matzke, IEEE press, 1993.

Wolpert, D.H. “Memory Systems, Computation, and The Second Law of Thermodynamics”, *International Journal of Theoretical Physics*, **31**, 743-785, 1992.

Wolpert, D.H., “Reversible Computing and Physical Law”, *PHYSICS TODAY*, 98-99 (March 1992).

Wolpert, D.H., “Chaos of the Brussels School is not irreversible”, *Nature*, **335**, 595, 1988.

Optimization and Search/

Wolpert, D. H. and Rajnarayan, D. “Using machine learning to improve Stochastic Optimization”, *Proc. AAAI 2013*, in press (2013).

Tracey, B. Wolpert, D.H., and Alonso, J.J., “Using Supervised Learning to Improve Monte Carlo Integral Estimation”, *AIAA Journal*, in press.

Wolpert, D.H., “What the no free lunch theorems really mean; how to improve search algorithms”, *Ubiquity Symposium on Evolutionary Computation and the Processes of Life*, ACM, ubiquity.acm.org/symposia.cfm, Dec. 2013.

Nadiga, B. and Wolpert, D.H., “Exploiting models of different complexities for state and parameter estimation”, *Geophysical Research Abstracts*, Vol. 15, EGU2013-3480, 2013

Tracey, B. Wolpert, D.H., and Alonso, J.J., “Using Supervised Learning to Improve Monte Carlo Integral Estimation”, *13th AIAA Non-Deterministic Approaches Conference, Denver, CO, April 2011*, AIAA Paper 2011-1843.

Wolpert, D. H., Rajnarayan, D., and Bieniawski S., “Probability Collectives in Optimization”, *Handbook of Statistics*, C.R. Rao and V. Govindaraju (Ed.’s), in press.

Rajnarayan, D., and Wolpert, D. H. "Bias-Variance trade-offs: Novel Applications", *Encyclopedia of Machine Learning*, Claude Sammut, Geoffrey I. Webb (Ed.’s), Springer, 2011.

Rajnarayan, D. and Wolpert, D.H., “Bias-Variance Techniques for Monte Carlo Optimization: Cross-validation for the CE Method”, arXiv:0810.0877v1, 2008.

Rajnarayan, D. and Wolpert, D.H., “Exploiting Parametric Learning to Improve Black-Box Optimization”, *Proc. ECCS 2007*, J. Jost et al. (Ed.)

Rajnarayan, D., Wolpert, D.H., Kroo, I. “Optimization Under Uncertainty Using Probability Collectives”, *Proc. 11 AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference*, Portsmouth, VA, AIAA-2006-7033, 2006.

Wolpert, D.H., and Lee, C.F., “An adaptive Metropolis-Hastings scheme: sampling and optimization”, *Europhysics Letters*, **76**, 353-359, 2006.

Wolpert, D.H., and Macready, W.G., “Coevolutionary Free Lunches”, *IEEE Transactions on Evolutionary Computation*, **9**, 721-735, 2005.

Koeppen, M., Wolpert, D. H., Macready, W. G., “Remarks on a Recent Paper on the ‘No Free Lunch’ Theorems”, *IEEE Transactions on Evolutionary Computation*, **5**, pp. 295-296, June 2001.

Macready, W.G., and Wolpert, D.H., “Bandit Problems and the Exploration/Exploitation Tradeoff”, *IEEE Transactions on Evolutionary Computation*, **2**, 2-22, 1998.

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., 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, in press.

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

Wolpert, D.H., and Macready, W.G., “Self-Dissimilarity: An Empirically Observable Measure of Complexity”, *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:

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

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 Multiple 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.

GRANTS (within last five years):

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

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

FQXi, FQXi-RFP3-1349; *A Semantic Information-Theory Model of Reality*, \$50,000

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

STUDENTS:

Co-advised PhD students (graduated): Stefan Bieniawski (Stanford), Dev Rajnarayan (Stanford)

Co-advising PhD students (current): Brendan Tracey (Stanford), Justin Grana (American University)

Thesis reviewer for students at UC-Irvine, University of Waterloo, University of Pretoria.

Co-authored 24 papers with 11 students. In 14 of the papers the student was first author.

MISCELLANEOUS:

Senior member of IEEE

Member of FQXi

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

Collaborator of *Purdue Center for Sciences of Information*

Associate Editor:

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

Member of Editorial Board:

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

Member of council:

The Socio-Economic Science with Heterogeneous Interacting Agents Society

Member of Advisory Board:

Handbook of Natural Computing, Springer

Virtual Faculty:

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.)

Co-organized:

- 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

Tsinghua 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, Beilefeld, September 2010, Summer school lecturer.

Refereed for and/or on Program Committee for:

Algorithmica
Artificial General Intelligence 2010, 2011
Artificial Intelligence and Statistics 2011
ACM Transactions on Autonomous and Adaptive Systems
American Control Conference 2011, 2012
Axioms
The American Statistician
American Association for Artificial Intelligence Conference
American Association for Artificial Intelligence Symposia
Annals of Mathematics and Artificial Intelligence
Annals of Operations Research
Annals of Physics
Annals of Statistics
Arabian Journal for Science and Engineering
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
Biophysical Journal
Brain Research Bulletin
Center for Sciences of Information
Chaos
Cognitive Information Processing 2008
Complexity
Complexus
Complex Systems
Computers and Operations Research
Connection Science
Conference on Decision and Control 2001
Congress on Evolutionary Computation 2004
Congress on Evolutionary Computation 2009
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
Europhysics Letters
Evolutionary Computation
Foundations of Evolutionary Algorithms 2000
Foundations of Physics
Foundations of Science
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
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 Fusion
Information Processing Letters
Information Sciences
INFORMS Journal on Computing
Israeli Research Foundation
Intelligent Agent Technology 2001
Internat. symposium on Innovations in Intelligent Systems and Applications, 2007
Internat. Conf. Complex Systems 2011
INISTA 2007
Institute for Mathematics and its Applications
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

Israeli Science Foundation
Joint Conference on Intelligent Systems
Journal of Artificial Intelligence Research
Journal of Autonomous Agents and Multi-Agent Systems
Journal of Chemical Information and Modeling
Journal of Combinatorial Optimization
Journal of Computational and Graphical Statistics
Journal of Heuristics
Journal of History of Economic Thought
Journal of Machine Learning Research
Journal of Neural Networks
Journal of the Royal Society, Interface
Journal of the Royal Statistical Society, B
Journal of Statistical Physics
Knowledge Discovery and Data Mining Conference
Machine Learning
The Marsden Fund of The Royal Society of NZ
Mathematical Reviews
Maximum Entropy and Bayesian Methods Conference
MCS 2000
NASA Astrobiology Institute
Nature
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
Philosophy of Science
Physica A
Physica D
Physics Letters A
PLoS One
Proceedings of the National Academy of Sciences
Journal of the Royal Statistical Society B
SIAM Review
Society for Economics and Heterogeneous Interacting agents
Soft Computing
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
Arris Corporation
2009 Aladdin Project Review (**keynote speech**)
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
Cambridge University, Newton Institute of Mathematics
Center for Nonlinear Studies (Los Alamos)
2007 CNLS conference: Unconventional Computation: Quo Vadis?
Computability in Europe 2010 (**plenary speaker**)
Conferences on Computational Learning Theory and Natural Learning Systems
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
Evolution, Cooperation and Rationality workshop, 2009 (Bristol, UK)
European Conference on Complex Systems, Future of Complex Transportation
Systems workshop, 2011
IEEE Symp. on Foundations of Computational Intelligence '07 (**keynote speech**)
Workshop on High Performance Object Databases, Cardiff '00
HP Research Labs (Palo Alto)
IBM Yorktown Heights Research Center
ICML 2000 workshop on What Works Well Where
ICML 2000 workshop on multi-agent systems
Infometrics conference (multiple meetings)
Imperial College London, Statistics Department
Institute for Human and Machine Cognition
Institute for New Economic Thinking (Oxford)
Workshop on Intelligent Agent Support for Imagery & Geospatial Analysis 2000
The International Computer Science Institute
Jet Propulsion Laboratory

Likelihood and Simplicity, Bar-Ilan University, 2014
London School of Economics, Mathematics Dept.
Max Planck Institute for Mathematics in the Natural Sciences
Maximum entropy and Bayesian Analysis conference
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
NEC Corporate Research Lab
New England Complex Systems Institute
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
Oxford University, Applied Mathematics Dept.
Oxford University, Computer Science Dept.
Oxford - Man Institute
Perimeter Institute
Purdue University, Computer Science Dept
RAND
RAVE 2009, Barcelona (**keynote speech**)
Rocky Mountain Conference on Artificial Intelligence
Rome 2010 Science Festival (**plenary speaker**)
Royal Statistical Society
2002 World Conference on Soft Computing (**plenary speaker**)
San Jose State University physics department
ScienceFoo 2009
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**)
SPIE 2008 (**keynote speech**)
Stanford, Aeronautics and Aerospace Dept.
Stanford, Computer Science Dept.
Stanford, Psychology Dept.
Stanford, Statistics Dept.
"Strategies for Implementing Large Scale Emergent Systems" Workshop.
Symposium on Understanding Complex Systems 2005 (**keynote speech**)
2013 Wright-Patterson AFRL Technical Interchange Meeting on multi-fidelity optimization
Theory and practice of open computational systems 2003
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 New Mexico, Physics Dept.
University of New Mexico, Computer Science 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