STEWART W. WILSON
PREDICTION DYNAMICS®, Concord MA 01742, USA
+1 978 369-9232
Email: wilson@prediction-dynamics.com
URL: prediction-dynamics.com

SUMMARY

Scientist/inventor/consultant with particular strengths in learning classifier systems, genetic algorithms, adaptive behavior, perception, and technology-based learning systems for people. Strong conceptual and experimental R&D carried through to practical solutions.

EDUCATION

Ph.D. and S.M. (electrical engineering), and S.B. (physics), M.I.T. (Cambridge, MA).

EXPERIENCE

PREDICTION DYNAMICS® (Concord, MA).

President, 1998 to present.

Research and consulting in classifier systems, data mining, software and robotic agents, and genetic algorithms. Research included extending XCS classifier system to integer- and real-valued inputs, obtaining outstanding results on the benchmark Wisconsin Breast Cancer problem. With P. L. Lanzi, showed first optimal classifier system performance on non-Markov problems. Demonstrated function approximation with XCS, leading to concept of a generalized classifier subsuming previous classifier formats and enabling continuous actions.

Co-organizer of the International Workshops on Learning Classifier Systems (IWLCS) 1999-2005. Named Honorary Chairman, 2007.

UNIVERSITY OF ILLINOIS (Urbana-Champaign, IL).

Adjunct Professor in the Department of Industrial and Enterprise Systems Engineering, 1999 to present.

VGO Associates (Newburyport, MA).

Associate, 2007 to present.

NUTECH SOLUTIONS (Charlotte, NC).

Technical Consultant, 2000-2002..

THE ROWLAND INSTITUTE FOR SCIENCE (Cambridge, MA).

Senior Scientist, 1983-1998.

Developed XCS, a new kind of classifier system based on J. Holland's work, but departing in its definition of classifier fitness and other key aspects, with resulting major gains in performance and accurate generalization ability. Successfully applied XCS to categorization, animat, and robotics problems. Mentored Ph.D. students with XCS-based theses.

Major contributor to the field of classifier systems/genetic algorithms. Developed BOOLE, the first demonstration of learning of a complex Boolean function using a classifier system. Developed "Animat", a simulated creature that learned, without supervision, to find food in a forest-like environment, and was the first system successfully to employ "bucket-brigade" temporal credit allocation. Made first proposal of an hierarchical classifier system to support goals having different time-scales. Made first proposal applying genetic algorithms to simulated evolution of multicellular organisms. Demonstrated evolution of perceptron networks to solve nonlinear problems.

Conducted experiments indicating that the human visual system has an automatic scanning/size-normalizing mechanism. Results also suggested an explanation of the so-called stroboscopic imagery.

Co-founded and -chaired the international conference series "Simulation of Adaptive Behavior: From Animals to Animats" (Paris, 1990 through Paris, 2000), the first major meetings to bring together researchers ranging from ethology to artificial intelligence to focus on the behaviors and underlying mechanisms that allow animals and, potentially, robots to adapt and survive in uncertain environments.

Co-founded the International Society for Adaptive Behavior (ISAB) and the MIT Press (now ISAB) journal *Adaptive Behavior*. President of ISAB, 1994-1997.

Advisor to the MIT Press book series on complex adaptive systems.

Developed NetQ, a system permitting individuals on the world wide web to ask questions of authors of scientific papers.

POLAROID CORPORATION (Cambridge, MA), 1962-1983.

Reported to Edwin H. Land, founder, President, and Director of Research, from 1962-1981, and to the succeeding Director of Research from 1981-1983.

Research Associate 1976-1983

Built experimental sensory-motor learning system consisting of computer- controlled motorized TV camera which, like an eyeball, learned to turn and fixate visual patterns.

Discovered technique by which a complex robot arm can learn arbitrary reaching movements through prior training which provides only binary closer/not closer information. Application is to lower-level coordinated movements ordered by high-level executive.

Investigated and published on human visual system property that processing power per unit area falls rapidly but regularly from center to periphery. Application to robotic vision includes automatic size normalization, "grain" independence, and large processing economies over linear (uniform field) methods.

Invented and supervised development of a sound-slide system incorporating a moving dot of light (a "pointer"). When recording, the speaker moves finger or pen on a small surface to control the dot of light on the projected slide. The motion of the dot is recorded along with the speaker's voice. The effect on playback greatly increases the communicative power and liveliness of the sound-slide medium, and the system is not expensive.

Originated and participated in development of handwriting tranceiver capable of operating simultaneously with voice over the same telephone line. Unit has an easy to use pen and thermal paper. Application is to scratchpad telephone conversations between engineers, chemists, designers, etc., to personal communication, and (using recorded signals) in teaching systems.

Senior Scientist 1971-1976

Invented, developed, produced, and marketed the Interactive Lecture System (ILS), an individual learning system which approximates a personal, branching interaction with an articulate scientist or teacher on a topic of mutual interest, including answers by the speaker to questions as they arise.

Contracted with and directed the making of Interactive Lecture recordings by scientists such as Carl Sagan and Philip Morrison. Tested system with students from M.I.T., Harvard, and Boston University.

For the ILS's graphic channel, which allows formulas and sketches in the teacher's own hand to play back from the second track of the tape, invented and implemented a compensator unit which totally eliminates tape flutter effects from the writing.

Directed manufacture of the ILS, introduced as a Polaroid product at shows such as the American Physical Society's annual meeting, and marketed it nationally to schools and colleges.

Scientist 1967-1971, Associate Scientist 1962-1967

Performed basic research (partly for Ph.D. thesis) which later led to the ILS. Investigated what would happen if a young student could ask science questions of an information source which answered like an articulate and interested teacher, but was in fact a neutral machine. Result showed exceptional quality and insight in ordinary students' questions, and surprising (voluntary) concentration over long periods. This suggested the educational and commercial potential of such a machine, if it could be built.

Investigated pattern recognition and semantic problems in language understanding. Wrote a successful program which learned to recognize unconstrained hand-drawn letters; termed by one authority in the field (M. Minsky) "probably the most powerful learning program so far written" (1965).

PRINCIPAL PATENTS

3,810,188: Frequency Deviation Compensation System. Eliminates flutter effects in recorded FM signals.

3,832,045: Wideband Frequency Compensation System in a Sound Motion Picture Projector. Eliminates flutter effects from recorded broadband (voice, music) signals.

3,942,268: Methods and Apparatus for Interactive Communications. Basic Interactive Lecture System patent.

4,146,314: Audio Visual System Having Recorded Moving Light Pointer. The basic pointer patent.

JOURNAL POSITIONS

Evolutionary Computation, Editorial Board, 1993-2004, Advisory Board, 2005 to present
Evolutionary Intelligence, Editorial Board, 2008 to present
Adaptive Behavior, Associate Editor, 1994-2005, Editorial Board, 2006 to present
Artificial Life, Editorial Board, 1993 to present

MEMBER

Organizing Committee, International Conference on Simulation of Adaptive Behavior,
    1990, 1992, 1994, 1996, 1998, 2000.
Organizing Committee, International Conference on Genetic Algorithms, 1987, 1989, 1991.
M.I.T. Corporation Visiting Committee to the Dept. of Linguistics and Philosophy, 1982-1984.
Sigma Xi, Tau Beta Pi.
Massachusetts Historical Society.
St. Botolph Club, Boston.

Married, two children.

PRINCIPAL PUBLICATIONS

• Updated to July 12, 2001. Please see http://prediction-dynamics.com for current list, abstracts, and downloads.

Wilson, S. W. (2001). Function approximation with a classifier system. *Proceedings of the Genetic and Evolutionary Computation Conference (GECCO-2001)*, L. Spector et al, eds., San Francisco, CA: Morgan Kaufmann.

Wilson, S. W. (2001). Compact rulesets from XCSI. Presented at the Fourth International Workshop on Learning Classifier Systems (IWLCS-2001). To appear in Lanzi, P. L., Stolzmann, W. and S. W. Wilson, eds., *Advances in Learning Classifier Systems. Fourth International Workshop (IWLCS-2001)*. Berlin, Springer-Verlag.

Butz, M. V. and Wilson, S. W. (2001). An algorithmic description of XCS. In Lanzi, P. L., Stolzmann, W. and S. W. Wilson, eds., *Advances in Learning Classifier Systems. Third International Workshop (IWLCS-2000)*, LNAI-1996. Berlin, Springer-Verlag.

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Lanzi, P. L., Stolzmann, W. and S. W. Wilson, eds. (2001). *Advances in Learning Classifier Systems. Third International Workshop (IWLCS-2000)*, LNAI-1996. Berlin, Springer-Verlag.

Meyer, J.-A., Berthoz, A., Floreano, D., Roitblat, H., and S. W. Wilson, eds. (2000), *From Animals to Animats 6: Proceedings of the Sixth International Conference on Simulation of Adaptive Behavior*. Cambridge, MA: The MIT Press/Bradford Books.

Lanzi, P. L. and Wilson, S. W. (2000). Toward Optimal classifier system performance in non-Markov environments. *Evolutionary Computation*, **8**(4), 393-418.

Holmes, J. H., Lanzi, P. L., Stolzmann, W., and S. W. Wilson (2000). Learning Classifier Systems: New Models, Successful Applications. *Information Processing Letters*, to appear.

Wilson, S.W. (2000). Get real! XCS with continuous-valued inputs. From *Festschrift in Honor of John H. Holland, May 15-18, 1999*, L. Booker, S. Forrest, M. Mitchell, and R. Riolo (eds.). Center for the Study of Complex Systems, The University of Michigan, Ann Arbor, MI. Also published in Lanzi, P. L., Stolzmann, W., and S. W. Wilson, eds., *Learning Classifier Systems: From Foundations to Applications*, LNAI-1813. Berlin, Springer-Verlag.

Wilson, S.W. (2000). State of XCS classifier system research. In Lanzi, P. L., Stolzmann, W., and S. W. Wilson, eds., *Learning Classifier Systems: From Foundations to Applications*, LNAI-1813. Berlin, Springer-Verlag.

Lanzi, P. L., Stolzmann, W., and S. W. Wilson, eds. (2000). *Learning Classifier Systems: From Foundations to Applications*, LNAI-1813. Berlin, Springer-Verlag.

Wilson, S.W. (1998). Generalization in the XCS classifier system. In *Genetic Programming 1998: Proceedings of the Third Annual Conference*, J. Koza et al., eds., San Francisco, CA: Morgan Kaufmann.

Wilson, S.W. (1996). Explore/exploit strategies in autonomy. In *From animals to animats 4: Proceedings of the Fourth International Conference on Simulation of Adaptive Behavior* (pp. 325-332), P. Maes, M. Mataric, J. Pollack, J.-A. Meyer, S. Wilson, eds., Cambridge MA: The MIT Press/Bradford Books.

Maes, P., Mataric, M., Meyer, J.-A., Pollack, J., and Wilson, S.W., eds. (1996). *From Animals to Animats 4: Proceedings of The Fourth International Conference on Simulation of Adaptive Behavior*, Cambridge, MA: The MIT Press/Bradford Books.

Wilson, S.W. (1995). Classifier fitness based on accuracy. *Evolutionary Computation*, **3**(2), 149-175.

Todd, P.M., Wilson, S.W., Somayaji, A.B., and Yanco, H.A. (1994). The Blind Breeding the Blind: Adaptive Behavior without Looking. In *From Animals to Animats 3: Proceedings of the Third International Conference on Simulation of Adaptive Behavior* (pp. 228-237), D. Cliff, P. Husbands, J.-A. Meyer, and S.W. Wilson, eds., Cambridge, MA: The MIT Press/ Bradford Books.

Cliff, D., Husbands, P., Meyer, J.-A., and Wilson, S.W., eds. (1994). *From Animals to Animats 3: Proceedings of The Third International Conference on Simulation of Adaptive Behavior*, Cambridge, MA: The MIT Press/Bradford Books.

Wilson, S.W. (1994). ZCS: a zeroth level classifier system. *Evolutionary Computation*, **2**(1), 1-18.

Davis, L., Wilson, S.W, and Orvosh, D. (1993). Temporary Memory for Examples Can Speed Learning in a Simple Adaptive System. In *From Animals to Animats 2: Proceedings of the Second International Conference on Simulation of Adaptive Behavior* (pp. 313-320), J.-A. Meyer, H.L. Roitblat, and S.W. Wilson, eds., Cambridge, MA: The MIT Press/ Bradford Books.

Todd, P.M. and Wilson, S.W. (1993). Environment Structure and Adaptive Behavior from the Ground Up. In *From Animals to Animats 2: Proceedings of the Second International Conference on Simulation of Adaptive Behavior* (pp. 11-20), J.-A. Meyer, H.L. Roitblat, and S.W. Wilson, eds., Cambridge, MA: The MIT Press/ Bradford Books.

Meyer, J.-A., Roitblat, H.L., and Wilson, S.W., eds. (1993). *From Animals to Animats 2: Proceedings of The Second International Conference on Simulation of Adaptive Behavior*, Cambridge, MA: The MIT Press/Bradford Books.

Wilson, S.W. (1992). Toward a GA solution of the discovery problem. (extended abstract). In *Collected Abstracts for the First International Workshop on Learning Classifier Systems*, October 6-8, 1992, Houston, Texas.

Wilson, S.W. (1992). Classifier system mapping of real vectors. (extended abstract). In *Collected Abstracts for the First International Workshop on Learning Classifier Systems*, October 6-8, 1992, Houston, Texas.

Wilson, S.W. (1991). GA-Easy Does Not Imply Steepest-Ascent Optimizable. In *Proceedings of The Fourth International Conference on Genetic Algorithms* (pp. 85-89), R. K. Belew and L. B. Booker, eds., San Mateo, CA: Morgan Kaufmann Publishers.

Meyer, J.-A. and Wilson, S.W., eds. (1991). *From Animals to Animats: Proceedings of The First International Conference on Simulation of Adaptive Behavior*, Cambridge, MA: The MIT Press/Bradford Books.

Wilson, S.W. (1991). The Animat Path to AI. In *From Animals to Animats: Proceedings of The First International Conference on Simulation of Adaptive Behavior* (pp. 15-21), J.-A. Meyer and S.W. Wilson, eds., Cambridge, MA: The MIT Press/Bradford Books.

Wilson, S.W. (1990). Perceptron Redux: Emergence of Structure. *Physica D*, **42**(1-3), 249-256. Republished in *Emergent Computation*, S. Forrest (ed.), MIT Press/Bradford Books.

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Smith, S.J. and Wilson, S.W. (1989). Rosetta: Toward A Model of Learning Problems. In *Proceedings of the Third International Conference on Genetic Algorithms* (pp. 347-350), Los Altos, California: Morgan Kaufmann.

Wilson, S.W. and Goldberg, D.E. (1989). A Critical Review of Classifier Systems. In *Proceedings of the Third International Conference on Genetic Algorithms* (pp. 244-255), Los Altos, California: Morgan Kaufmann.

Wilson, S.W. (1988). Bid Competition and Specificity Reconsidered. *Complex Systems*, **2**, 6, 705-723.

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Wilson, S.W. (1987). The Genetic Algorithm and Biological Development, In *Genetic Algorithms and Their Applications: Proceedings of the Second International Conference on Genetic Algorithms* (pp. 247-251), Grefenstette, J.J., ed., Hillsdale, NJ: Lawrence Erlbaum Associates.

Wilson, S.W. (1987). Quasi-Darwinian Learning in a Classifier System, In *Proceedings of the Fourth International Workshop on Machine Learning* (pp. 59-65), Los Altos, CA: Morgan Kaufmann.

Wilson, S.W. (1985). Knowledge Growth in an Artificial Animal, In *Proceedings of an International Conference on Genetic Algorithms and Their Applications* (pp. 16-23), Grefenstette, J.J., ed., Hillsdale, NJ: Lawrence Erlbaum Associates.

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Wilson, S.W. (1983). On the Retino-Cortical Mapping. *International Journal of Man-Machine Studies*, **18**, 361-369.

Wilson, S.W. (1972). Interactive Lectures. *Technology Review*, vol. 74, no. 3, January, 1972.

Land, E.H., and Wilson, S.W. (1967). Education and the Need to Know. *Technology Review*, vol. 69, no. 3, January, 1967.