

## J. David Schaffer

Binghamton University  
dschaffe@binghamton.edu

**Objective:** I believe mastery of complexity is the key to the next major advances in virtually every engineering discipline. Genetic algorithms are one of the keys to these breakthroughs. Hence, my objective is to help advance this art by directing basic and applied research in evolutionary computation and to teach the art to the next generation.

### Experience Summary

After my PhD dissertation (1984) that took genetic algorithms (GAs) into the domain of multiobjective learning, I lead a genetic algorithms project at Philips Research. Under my direction, some four dozen publications were produced, including the development of one of the world's most robust genetic algorithms and pioneering work in combinations of GAs with neural nets. We also applied GAs to real problems for Philips product divisions with considerable commercial success. I received the technical achievement of the year award in 1995 and in April 2001 was promoted to Research Fellow. Subsequently, we developed applications in molecular medicine and clinical decision support systems. I retired from Philips in October 2010 and moved to Binghamton University where I advise graduate students, and conduct research on the evolution of spiking neural networks, a speech-based diagnostic test for dementia, and other bioinformatics topics. I serve on the editorial board for the Evolutionary Computation Journal and hold forty-three US patents. I was awarded a Pioneer in Evolutionary Computation by the IEEE Computational Intelligence Society in 2012.

### Experience

Visiting Research Professor, full time, Binghamton University, Vestal, NY 2010-present.

Visiting Research Faculty, part time, Bioengineering Dept, Binghamton University, Binghamton, NY 2006-2010.

Advising graduate research into the evolution of spike neural networks for machine intelligence and bioinformatics, and the diagnosis of dementia from speech patterns.

Visiting Faculty Research Program, Air Force research Lab, Rome, NY, summers 2014 – 2018.

Conducted research on evolving spiking neural networks in the Neuromorphing Computing group.

Research Fellow (Research Fellow), Philips Laboratories, Briarcliff Manor, NY, 1985-2010.

Responsible for developing basic and applied research projects to benefit the commercial interests of the company. Initiated and directed a research project in genetic algorithms. Applications include the design multiplierless of digital filters, channel coding schemes, and the optimization of the setup for PCB assembly machines (a successful product for more than 10 years; 5 patents). We developed a general method for the evolution of neural network topologies and have applied it to visual inspection and to modeling human game-playing strategy. Our research has shown the advantages in genetic search of Gray coding, incest prevention, restarts and vigorous crossover with binary and numerical representations. We have developed novel crossover operators for real-coded chromosomes and shown when the bias of each is appropriate to use. We have developed a novel crossover operator for subset selection tasks and applied it to the compaction of computer code for use in memory-limited consumer devices. We developed a theoretical view of genetic algorithms as convergence constrained variation (CCV) algorithms. Devised schemes by which machine learning methods can be applied to personal profiling of TV viewers to help them easily locate TV shows of interest. Launched research into GAs for pattern discovery in medical molecular diagnostics and disease modeling and the modeling of disease dynamics (e.g. sepsis).

Research Assistant Professor, Dept. of Electrical and Biomedical Engineering, Vanderbilt University, Nashville, TN, 1980-1985

Responsible for database design, data coordination and statistical analysis of a multicenter clinical trial comparing the effects of different modalities of dialysis therapy. Developed prototype expert systems for: dialysis therapy recommendation, the repair of electro-mechanical equipment, and supervision of spacecraft attitude control simulations. Initiated and conducted research extending the use of genetic algorithms by introducing vector evaluations (PhD Thesis). This permitted their application to multiobjective function optimization and multiclass pattern discrimination learning by machine.

Coordinator, Biometrics Laboratory, Tennessee Neuropsychiatric Institute (Vanderbilt University), Nashville, TN, 1977-1980

Responsible for all aspects of data collection and analysis for a Psychiatric research institute, including developing the software system (TNI\_BLIIPS).

Research Scientist, Biometrics Laboratory, The George Washington University, Kensington, MD, 1974-1977

Part of a team responsible for design, implementation and testing of a research data processing system (BLIPS II) for the documentation of clinical drug trials.

Project co-director, Public Services Laboratory (PSL), Georgetown University, Washington, D.C., 1973-1974

Responsible for conducting a 1-year National Science Foundation funded project to evaluate policy-related research in the field of municipal personnel systems.

Instructor, Widener University, Chester, PA, 1971-1973

Taught computer programming, simulation gaming, and dynamics.

VISTA (Volunteers In Service To America) Volunteer, Little Rock, AR, 1969-1971

## Education

Ph.D. Electrical Engineering, Vanderbilt University, Nashville, TN, 1984

M.S. Systems Engineering, Widener College, Chester, PA, 1973

B.S. Aerospace Engineering, University of Notre Dame, Notre Dame, IN 1967

## Invited Speaker

May 2014, Keynote, SPIE workshop bio-inspired computing, Baltimore, MD.

November 2013, panel member, Complexity in Healthcare, Complex Adaptive Systems, Baltimore, MD.

September 2006, BCIG NIH, Washington, DC (<http://nihbreeze.cit.nih.gov/p73822607/>)

April 2003, EMO'03 (Evolutionary Multi-Criterion Optimization), Algarve, Portugal

November 2000, ANNIE2000 (Artificial Neural Networks in Engineering), St. Louis, MO

June 1996 Russian Academy of Sciences, Moscow (EvCA-96)

April 1995 Brunel University & Unicom, London, Advanced Decision Technologies (ADT-95)

August 1993, University of Lisbon, Portugal (1-week course on GAs, European Summer School in Logic, Language & Information)

May 1991, SIAM (Society of Industrial and Applied Mathematics), Pittsburgh, PA (AMCRP-91)

April 1988 Bolt Beranek and Newman, Cambridge, MA

## Professional Memberships

Institute of Electrical and Electronics Engineers – Life member

Association for Computing Machines -- SIGEVO

## Professional Volunteering

Editorial board for Evolutionary Computation Journal, 2006 - present  
Steering Committee for conference series Evolutionary Multiobjective Optimization (EMO), 2001- present  
Associate editor for Evolutionary Computation Journal, 1994 - 2006  
Program committee for many recent GA conferences  
Cofounder in 2000 of New York Complexity Symposia (NYCS)  
Publications chair International Conference on Genetic Algorithms (ICGA-97)  
Program committee, USA-Japan Symposium on Flexible Automation 1994  
Program co-chair, World Congress on Computational Intelligence (WCCI-94)  
Conference co-chair, ICGA-93  
Chair IEEE workshop on Combinations of Genetic Algorithms and Neural Networks (COGANN-92)  
Publications chair, ICGA-91  
Program chair, ICGA-89

## Web Presence

PBS radio, and two local TV interviews on Diagnosing Alzheimer's using speech, Sept 2013  
<http://stream.publicbroadcasting.net/production/mp3/wskg/local-wskg-1028825.mp3>  
<http://www.wbng.com/news/local/A-simple-test-to-help-Alzheimers-disease-diagnosis-227136141.html>  
<http://www.wicz.com/news2005/viewarticle.asp?a=29835>

Talk on complex systems as a possible foundation for a grand theory of everything, CoCo Dec 2012  
<http://vimeo.com/55458801>

Talk: introduction to evolutionary computation EVOS Oct 2013  
<http://evolution.binghamton.edu/evos/seminars/fall-2013/david-schaffer/>

Talk: Alzheimer's Speech Project, CoCo Feb 2014  
<http://vimeo.com/87146866>

Talk: Evolving SNNs – growth of learning machines CoCo Nov 16 2016  
<https://vimeo.com/192303000>

Google Scholar  
<http://scholar.google.com/citations?user=pRy5WdkAAAAJ&hl=en>  
Research Gate  
[https://www.researchgate.net/profile/J\\_Schaffer](https://www.researchgate.net/profile/J_Schaffer)  
Microsoft Academic Research  
<https://academic.microsoft.com/#/detail/2098556547>