

Christian J. Darken

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Summary

Expertise in Machine Learning, and more broadly, in Artificial Intelligence technologies, with a wide range of applications under typical industrial constraints such as high quality, strict computational constraints, and real time performance. Project management experience in the building and leadership of small diverse teams.

Education

Yale University

Ph.D. Electrical Engineering Awarded 1993. Advisor: John Moody. Title: Learning Rate Schedules for Stochastic Gradient Algorithms. Qualification exam in vision, control, pattern recognition, and neural networks.

M.S., M.Phil. Physics Awarded 1989. Completed all requirements for physics Ph.D. except thesis.

Andrews University

B.A. Physics August 1985. Minor in behavioral science with courses in learning theory and physiological psychology.

Employment History

Siemens Corporate Research, Senior Member of Technical Staff and Project Manager
Sept. 1999–Present.

Siemens Corporate Research, Member of Technical Staff and Project Manager Sept. 1996–
Sept. 1999.

Siemens Corporate Research, Member of Technical Staff Sept. 1994–Sept. 1996.

Siemens Corporate Research, Associate Member of Technical Staff Sept. 1992–Sept. 1994.

IBM Thomas J. Watson Research Center, Intern Summer, 1989.

Yale University, Research Assistant 1987–1992.

Yale University, Teaching Assistant 1986–87.

Argonne National Laboratory, Student research program Spring semester, 1986.

Management

Program Building Built Decision Support Systems program up from just myself to a team of four Ph.D.'s, a software engineer, and various students by project acquisition together with department head. Responsible for negotiation and writing of research contracts with Siemens operating companies. The funding required for the project was about one million dollars in the 99-00 fiscal year, half of which was from discretionary money from the divisions that is not earmarked for joint projects with central R&D, of which Siemens Corporate Research is one part. Contracts are won in stiff competition from central research in Germany, divisional research units, outside companies, and universities.

Diverse Team Team includes computer scientists, electrical engineers, and physicists. Supervised several US and German graduate students, including two diplom (European masters) theses, one of which won a "best thesis" award.

Diverse Projects Contracts on nuclear power, gas turbines, patient monitoring, telecommunication switches, electronic commerce, voice detection. Developed and applied a wide variety of machine learning and signal processing technologies.

Selected Projects

Reactor trip diagnosis by probabilistic reasoning, which allows principled comparison of the validity of multiple diagnostic hypotheses. Currently applying technology to monitoring of intensive care patients. Product, tech. lead, 1997–2000.

MIMOSA public demonstration applet (graphical machine condition information browsing across multiple enterprises in a unified session). Product, design and implementation, 2000.

Fast, portable proof checker for full first-order logic with equality (intended for use checking properties of nuclear operating procedures). Tech. lead and implementor, 1999–2000.

Sodium level estimation algorithm on the basis on spectroscopy of the turbulent flow in a gas turbine. Prototype, tech. lead, 1999–2000.

Condition-based lifetime estimation for X-ray tubes. Tech. lead, 1999–2000.

Content-based automatic document routing system. Prototype, design, 1999.

E-mail analysis agent for time-phrase spotting and parsing. Demo, design, 1998.

Speech detection algorithms for hearing aid noise suppression. Product, 1997–98, tech. lead and implementor.

Prolog-like expert system shell. Designer and implementor, 1997.

Magical physics and enemy AI for one of the first commercial immersive (first-person perspective) on-line role-playing games, Meridian 59. This was a hobby project, eventually sold to 3DO. Design and implementation, 1996–97.

COM objects for intelligent agent e-mail use. Designer and implementor, 1996.

Intelligent System Modeling Environment package for nonlinear system simulation and identification. Used to model a large wastewater processing plant in one week, a process previously outsourced for \$100,000 and requiring several months. Product, tech. lead and implementor, 1995–96.

Analysis of size selection problem in neural network design. Resulted in published advances both in engineering and pure mathematics. Team member and author, 1992–94.

- Inventor of light-weight anomaly detection algorithms applied to motor monitoring, as well as neural network and principal component techniques later implemented and patented by other team members, who also applied the techniques to helicopter gearbox monitoring under contract to the U.S. Navy. 1992–94.
- Inventor of a learning acceleration method for a broad class of machine learning algorithms (gradient-based methods) Yale, 1991–92.
- Coinventor (with thesis advisor) of the most-used learning algorithm for radial basis function neural networks. Paper has garnered about 600 citations in the 11 years since it appeared. The algorithm presented was shown to be commonly thousands of times faster than standard backpropagation. Yale, 1988–89.
- Applied neural networks to image segmentation for use in automated VLSI inspection systems. IBM, 1989.
- Applied backpropagation to classify arterial cells as atherosclerotic or healthy based on spectral data. This discrimination is vital to successful percutaneous laser angioplasty (i.e. non-invasive removal of plaque from the arterial walls by lasers). Yale, 1988.
- Replaced *ad hoc* formulae for estimating standard deviations of critical quantities in Monte Carlo reactor simulations with time series prediction techniques. Argonne, 1986.

Publications

- “Efficient Reasoning”, Russell Greiner, Christian Darken, and N. Iwan Santoso. To appear in *ACM Computing Surveys*.
- “Nuclear Plant Fault Diagnosis Using Probabilistic Reasoning”, N. Iwan Santoso, Christian Darken, Gregor Povh, and Jochen Erdmann. *Proceedings of the 1999 IEEE Power Engineering Society Summer Meeting*.
- “Accident Diagnosis with Probabilistic Reasoning”, Christian Darken, N. Iwan Santoso, and Jochen Erdmann. *Proceedings of Nuclear Technology 1999*.
- “Why Experimentation can be better than ‘Perfect Guidance’”, Tobias Scheffer, Russell Greiner, and Christian Darken. *Proceedings of the Fourteenth International Conference on Machine Learning (IMLC-97)*, Nashville, July (1997).
- “Rates of Convex Approximation in Non-Hilbert Spaces”, Michael Donahue, Leonid Gurvits, Christian Darken, and Eduardo Sontag. *Constructive Approximation*, Vol. 13, pp. 187-220 (1997).
- “A Neural Network Autoassociator for Induction Motor Failure Prediction”, Petsche T, Marcantonio A, Darken C, Hanson S, Kuhn G, and Santoso, I. *Proceedings of Neural Information Processing Systems (NIPS 1995)*.
- “Stochastic Approximation and Neural Network Learning”, Christian Darken, in *The Handbook of Brain Theory and Neural Networks*, Michael Arbib, editor, (1995).
- Comment on “Neural Networks and Related Methods for Classification” (Richard D. De Veaux with C.J. Darken and L.H. Ungar), *Journal of the Royal Statistical Society, Series B*, **56**,3,446-447. (1994) .
- “Rate of Approximation Results Motivated by Robust Neural Network Learning”, Christian Darken, Michael Donahue, Leonid Gurvits, and Eduardo Sontag, in *Proceedings of the Sixth Annual ACM Conference on Computational Learning Theory*, ACM, New York, (1993).

- “Learning Rate Schedules for Faster Stochastic Gradient Search”, Christian Darken, Joseph Chang, and John Moody, in *Neural Networks for Signal Processing II*, Kung, Fallside, Sorenson, and Kamm, eds., IEEE, Piscataway, New Jersey, (1992).
- “Towards Faster Stochastic Gradient Search”, Christian Darken and John Moody, in *Advances in Neural Information Processing Systems 4*, Moody, Hanson, and Lippmann, eds., Morgan Kaufmann, Palo Alto, (1992).
- “Neural Network and Conventional Classifiers for Fluorescence-Guided Laser Angioplasty”, Gindi G, Darken C, O’Brien K, Stetz M, Deckelbaum L. *IEEE Transactions on Biomedical Engineering*, Vol. 38, No. 3, March (1991).
- “Note on Learning Rate Schedules for Stochastic Optimization”, Christian Darken and John Moody, in *Advances in Neural Information Processing Systems 3*, Lippmann, Moody, and Touretzky, eds., Morgan Kaufmann, Palo Alto, (1991).
- “Fast, Adaptive K-Means Clustering: Some Empirical Results”, Christian Darken and John Moody, *Proceedings of the IEEE IJCNN Conference*, Vol. 2, pp. 233-238, San Diego, IEEE Press, Piscataway, NJ (1990).
- “Pixel Classification By Networks of Locally-Tuned Processing Units”, Christian Darken and Ehud Karnin, IBM Technical Report, August (1989).
- “Fast Learning in Networks of Locally-Tuned Processing Units”, John Moody and Christian Darken, *Neural Computation* 1 p. 289 (1989).
- “Learning with Localized Receptive Fields”, John Moody and Christian Darken, *Proceedings of the 1988 Connectionist Models Summer School*, Hinton, Sejnowski, and Touretzky, eds. Morgan Kaufmann (1988).

Professional Activities

Was for several years a regular reviewer for *Neural Computation*, *IEEE Transactions on Neural Networks* and the NIPS conference.

Occasional reviewer for AAAI conference.

Computational Learning Theory (COLT) 1993 (poster presentation)

NATO ASI “From Statistics to Neural Networks” (participant)

Neural Networks for Signal Processing 1992 (oral presentation)

Neural Information Processing Systems 1991 (poster presentation)

Symposium on the Interface Between Computing Science and Statistics 1991 (oral presentation)

Neural Information Processing Systems 1990 (oral presentation)

Fellowship to DIMACS Workshop on Theoretical Neural Networks 1991.

Scholarship to CMU Connectionist Models Summer School 1989.

References

Available on request.