Dirk V. Arnold

Faculty of Computer Science
Dalhousie University
Halifax, NS, Canada B3H 4R2

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Employment

Professor — since 2013
Dalhousie University, Faculty of Computer Science

Associate Professor — 2008-2013
Dalhousie University, Faculty of Computer Science

Assistant Professor — 2003-2008
Dalhousie University, Faculty of Computer Science

Research Associate — 1999-2003
Universität Dortmund, Informatik XI

Education

Dr. rer. nat., Computer Science — 2001
with distinction
Universität Dortmund, Germany

M.Sc., Computing Science — 1997
Simon Fraser University, Canada

Diplom, Computer Science — 1995
with distinction
Universität Dortmund, Germany

Fellowships and Awards

Best Paper Award, International Conference on Parallel Problem Solving from Nature — 2012

Best Paper Award, ES/EP Track, Genetic and Evolutionary Computation Conference — 2010

Best Paper Award, International Conference on Parallel Problem Solving from Nature — 2006

Best Paper Award, ES/EP Track, Genetic and Evolutionary Computation Conference — 2003

Doctoral Prize in Computer Science, Universität Dortmund — 2002

Simon Fraser University Graduate Fellowship — 1998

Simon Fraser University Faculty of Applied Sciences Graduate Fellowship — 1996

Courses Taught

At Dalhousie University:

CSCI 2132: Software Development

CSCI 3161: Computer Animation

CSCI 3162: Digital Media

CSCI 4113: Design and Analysis of Algorithms II

CSCI 4167/6608: Advanced Computer Animation

CSCI 6514: Strategies for Search and Optimization

CSCI 6604: Advanced Computer Graphics

At Simon Fraser University:

CMPT 361: Introduction to Computer Graphics

Publications

Book:

[1] D. V. Arnold, *Noisy Optimization with Evolution Strategies*, Genetic Algorithms and Evolutionary Computation Series, (Kluwer Academic Publishers, 2002).

Journal Papers:

[2] D. V. Arnold, "Resampling versus repair in evolution strategies applied to a constrained linear problem", *Evolutionary Computation*, 21(3), to appear, (2013).

[3] G. LeBlanc, A. Shouldice, D. V. Arnold, and S. Brooks, "Multi-band Fourier synthesis of ocean waves", *Journal of Graphics Tools*, 16(2):57-70, (2012).

[4] D. V. Arnold and H.-G. Beyer, "On the behaviour of evolution strategies optimising cigar functions", *Evolutionary Computation*, 18(4):661-682, (2010).

[5] T. Burrell, D. Arnold, and S. Brooks, "Advected river textures", *Computer Animation and Virtual Worlds*, 20(2-3):163-173, (2009).

[6] D. V. Arnold and H.-G. Beyer, "Evolution strategies with cumulative step length adaptation on the noisy parabolic ridge", *Natural Computing*, 7(4):555-587, (2008).

[7] D. V. Arnold and A. MacLeod, "Step length adaptation on ridge functions", *Evolutionary Computation*, 16(2):151-184, (2008).

[8] D. V. Arnold and R. Salomon, "Evolutionary gradient search revisited", *IEEE Transactions on Evolutionary Computation*, 11(4):480-495, (2007).

[9] D. V. Arnold, "Weighted multirecombination evolution strategies", *Theoretical Computer Science*, 361(1):18-37, (2006).

[10] D. V. Arnold and H.-G. Beyer, "Optimum tracking with evolution strategies", *Evolutionary Computation*, 14(3):291-308, (2006).

[11] D. V. Arnold and H.-G. Beyer, "A general noise model and its effects on evolution strategy performance", *IEEE Transactions on Evolutionary Computation*, 10(4):380-391, (2006).

[12] D. V. Arnold and H.-G. Beyer, "Expected sample moments of concomitants of selected order statistics", *Statistics and Computing*, 15(3):241-250, (2005).

[13] H.-G. Beyer, D. V. Arnold, and S. Meyer-Nieberg, "A new approach for predicting the final outcome of evolution strategy optimization under noise", *Genetic Programming and Evolvable Machines*, 6(1):7-24, (2005).

[14] D. V. Arnold and H.-G. Beyer, "Performance analysis of evolutionary optimization with cumulative step length adaptation", *IEEE Transactions on Automatic Control*, 49(4):617-622, (2004).

[15] D. V. Arnold and H.-G. Beyer, "On the benefits of populations for noisy optimization", *Evolutionary Computation*, 11(2):111-127, (2003).

[16] D. V. Arnold and H.-G. Beyer, "A comparison of evolution strategies with other direct search methods in the presence of noise", *Computational Optimization and Applications*, 24(1):135-159, (2003).

[17] H.-G. Beyer and D. V. Arnold, "Qualms regarding the optimality of cumulative path length control in CSA/CMA-evolution strategies", *Evolutionary Computation*, 11(1):19-28, (2003).

[18] D. V. Arnold and H.-G. Beyer, "Performance analysis of evolution strategies with multi-recombination in high-dimensional $\mathbb{R}^N$-search spaces disturbed by noise", *Theoretical Computer Science*, 289(1): 629-647, (2002).

[19] D. V. Arnold and H.-G. Beyer, "Local performance of the $(1 + 1)$-ES in a noisy environment", *IEEE Transactions on Evolutionary Computation*, 6(1):30-41, (2002).

[20] R. F. Hadley, A. Rotaru-Varga, D. V. Arnold, and V. C. Cardei, "Syntactic systematicity arising from semantic predictions in a Hebbian-competitive network", *Connection Science*, 13(1):73-94, (2001).

[21] D. V. Arnold, "Information-theoretic analysis of phase transitions", *Complex Systems*, 10(2):143-155, (1996).

Book Chapters:

[22] N. Hansen, D. V. Arnold, and A. Auger, "Evolution Strategies", in J. Kacprzyk and W. Pedrycz (eds.), *Handbook of Computational Intelligence*, to appear, (Springer Verlag, 2013).

[23] R. Salomon and D. V. Arnold, "The evolutionary-gradient-search procedure in theory and practice", in R. Chiong (ed.), *Nature-Inspired Algorithms for Optimisation*, pp. 77-101, (Springer Verlag, 2009).

[24] D. V. Arnold, "Evolution strategies in noisy environments — A survey of existing work", in L. Kallel et al. (eds.), *Theoretical Aspects of Evolutionary Computing*, pp. 239-249, (Springer Verlag, 2001).

[25] H.-G. Beyer and D. V. Arnold, "Theory of evolution strategies — A tutorial", in L. Kallel et al. (eds.), *Theoretical Aspects of Evolutionary Computing*, pp. 109-133, (Springer Verlag, 2001).

Refereed Conference and Workshop Papers:

[26] S. Nourashrafeddin, E. Milios and D. V. Arnold, "Interactive text document clustering using feature labeling", *Proceedings of the 13th ACM Symposium on Document Engineering — DocEng 2013*, to appear, (ACM Press, 2013).

[27] X. Gao, S. Brooks, and D. V. Arnold, "Virtual photograph based saliency analysis of high dynamic range images", *Proceedings of the 9th International Symposium on Computational Aesthetics in Graphics, Visualization, and Imaging*, to appear, (ACM Press, 2013).

[28] D. V. Arnold, "On the behaviour of the $(1, \lambda)$-ES for a conically constrained problem", *Proceedings of the 2013 Genetic and Evolutionary Computation Conference — GECCO 2013*, pp. 423-430, (ACM Press, 2013).

[29] S. Nourashrafeddin, E. Milios and D. V. Arnold, "An evolutionary algorithm for feature selective double clustering of text documents", *Proceedings of the 2013 IEEE Congress on Evolutionary Computation*, to appear, (IEEE Press, 2013).

[30] J. Porter and D. V. Arnold, "An evolutionary spline fitting algorithm for identifying filamentous cyanobacteria", *ACM Symposium on Applied Computing — SAC 2013*, pp. 40-45, (ACM Press, 2013).

[31] D. V. Arnold, "On the behaviour of the $(1, \lambda)$-σSA-ES for a constrained linear problem", in C. A. Coello Coello et al. (eds.), *Parallel Problem Solving from Nature — PPSN XII*, pp. 82-91, (Springer Verlag, 2012).

[32] D. V. Arnold and N. Hansen, "A $(1 + 1)$-CMA-ES for constrained optimisation", in T. Soule et al. (eds.), *Proceedings of the 2012 Genetic and Evolutionary Computation Conference — GECCO 2012*, pp. 297-304, (ACM Press, 2012).

[33] D. V. Arnold, "Analysis of a repair mechanism for the $(1, \lambda)$-ES applied to a simple constrained problem", in N. Krasnogor et al. (eds.), *Proceedings of the 2011 Genetic and Evolutionary Computation Conference — GECCO 2011*, pp. 853-860, (ACM Press, 2011).

[34] D. V. Arnold, "On the behaviour of the $(1, \lambda)$-ES for a simple constrained problem", *Foundations of Genetic Algorithms — FOGA 2011*, pp. 15-24, (ACM Press, 2011).

[35] D. Brockhoff, A. Auger, N. Hansen, D. V. Arnold, and T. Hohm, "Mirrored sampling and sequential selection for evolution strategies", in R. Schaefer et al. (eds.), *Parallel Problem Solving from Nature — PPSN XI*, pp. 11-21, (Springer Verlag, 2010).

[36] D. V. Arnold and N. Hansen, "Active covariance matrix adaptation for the $(1 + 1)$-CMA-ES", in J. Branke et al. (eds.), *Proceedings of the 2010 Genetic and Evolutionary Computation Conference — GECCO 2010*, pp. 385-392, (ACM Press, 2010).

[37] D. V. Arnold, H.-G. Beyer, and A. Melkozerov, "On the behaviour of weighted multi-recombination evolution strategies optimising noisy cigar functions", in G. Raidl et al. (eds.), *Proceedings of the 2009 Genetic and Evolutionary Computation Conference — GECCO 2009*, pp. 483-490, (ACM Press, 2009).

[38] D. V. Arnold and A. S. Castellarin, "A novel approach to adaptive isolation in evolution strategies", in G. Raidl et al. (eds.), *Proceedings of the 2009 Genetic and Evolutionary Computation Conference — GECCO 2009*, pp. 491-498, (ACM Press, 2009).

[39] S. B. Chisholm, D. V. Arnold, and S. Brooks, "Tone mapping by interactive evolution", in G. Raidl et al. (eds.), *Proceedings of the 2009 Genetic and Evolutionary Computation Conference — GECCO 2009*, pp. 515-522, (ACM Press, 2009).

[40] D. V. Arnold and D. Brauer, "On the behaviour of the $(1 + 1)$-ES for a simple constrained problem", in G. Rudolph et al. (eds.), *Parallel Problem Solving from Nature — PPSN X*, pp. 1-10, (Springer Verlag, 2008).

[41] D. V. Arnold and D. C. S. Van Wart, "Cumulative step length adaptation for evolution strategies using negative recombination weights", in M. Giacobini et al. (eds.), *EvoWorkshops 2008*, pp. 545-554, (Springer Verlag, 2008).

[42] D. V. Arnold, "On the use of evolution strategies for optimising certain positive definite quadratic forms", in D. Thierens et al. (eds.), *Proceedings of the 2007 Genetic and Evolutionary Computation Conference — GECCO 2007*, pp. 634-641, (ACM Press, 2007).

[43] D. V. Arnold, "Cumulative step length adaptation on ridge functions", in T. P. Runarsson et al. (eds.), *Parallel Problem Solving from Nature — PPSN IX*, pp. 11-20, (Springer Verlag, 2006).

[44] D. V. Arnold and A. MacLeod, "Hierarchically organised evolution strategies on the parabolic ridge", in M. Keijzer et al. (eds.), *Proceedings of the 2006 Genetic and Evolutionary Computation Conference — GECCO 2006*, pp. 437-444, (ACM Press, 2006).

[45] D. V. Arnold and D. MacDonald, "Weighted recombination evolution strategies on the parabolic ridge", in *Proceedings of the 2006 IEEE World Congress on Computational Intelligence*, pp. 411-418, (IEEE Press, 2006).

[46] G. A. Jastrebski and D. V. Arnold, "Improving evolution strategies through active covariance matrix adaptation", in *Proceedings of the 2006 IEEE World Congress on Computational Intelligence*, pp. 9719-9726, (IEEE Press, 2006).

[47] D. V. Arnold, "Evolution strategies with adaptively rescaled mutation vectors", in *Proceedings of the 2005 IEEE Congress on Evolutionary Computation*, pp. 2592-2599, (IEEE Press, 2005).

[48] D. V. Arnold, "Optimal weighted recombination", in A. H. Wright et al. (eds.), *Foundations of Genetic Algorithms* 8, pp. 215-237, (Springer Verlag, 2005).

[49] D. V. Arnold, "An analysis of evolutionary gradient search", in *Proceedings of the 2004 IEEE Congress on Evolutionary Computation*, pp. 47-54, (IEEE Press, 2004).

[50] H.-G. Beyer and D. V. Arnold, "The steady state behavior of $(\mu/\mu_I, \lambda)$-ES on ellipsoidal fitness models disturbed by noise", in E. Cantú-Paz et al. (eds.), *Proceedings of the 2003 Genetic and Evolutionary Computation Conference — GECCO 2003*, pp. 525-536, (Springer Verlag, 2003).

[51] D. V. Arnold and H.-G. Beyer, "On the effects of outliers on evolutionary optimization", in J. Liu et al. (eds.), *Intelligent Data Engineering and Automated Learning — IDEAL 2003*, pp. 151-160, (Springer Verlag, 2003).

[52] D. V. Arnold and H.-G. Beyer, "Random dynamics optimum tracking with evolution strategies", in J. J. Merelo et al. (eds.), *Parallel Problem Solving from Nature — PPSN VII*, pp. 3-12, (Springer Verlag, 2002).

[53] D. V. Arnold and H.-G. Beyer, "Investigation of the (μ, λ)-ES in the presence of noise", in *Proceedings of the 2001 IEEE Congress on Evolutionary Computation*, pp. 332-339, (IEEE Press, 2001).

[54] S. Markon, D. V. Arnold, T. Bäck, T. Beielstein, and H.-G. Beyer, "Thresholding — A selection operator for noisy ES", in *Proceedings of the 2001 IEEE Congress on Evolutionary Computation*, pp. 465-472, (IEEE Press, 2001).

[55] D. V. Arnold and H.-G. Beyer, "Local performance of the $(\mu/\mu_I, \lambda)$-ES in a noisy environment", in W. N. Martin and W. M. Spears (eds.), *Foundations of Genetic Algorithms* 6, pp. 127-141, (Morgan Kaufmann Publishers, 2001).

[56] D. V. Arnold and H.-G. Beyer, "Efficiency and self-adaptation of the $(\mu/\mu_I, \lambda)$-ES in a noisy environment", in M. Schoenauer et al. (eds.), *Parallel Problem Solving from Nature — PPSN VI*, pp. 39-48, (Springer Verlag, 2000).

[57] H.-G. Beyer and D. V. Arnold, "Fitness noise and localization errors of the optimum in general quadratic fitness models", in W. Banzhaf et al. (eds.), *Proceedings of the 1999 Genetic and Evolutionary Computation Conference — GECCO 1999*, pp. 817-824, (Morgan Kaufmann Publishers, 1999).

[58] R. F. Hadley, D. Arnold, and V. Cardei, "Syntactic systematicity arising from semantic predictions in a Hebbian-competitive network", in M. A. Gernsbacher and S. J. Derry (eds.), *Proceedings of the Twentieth Annual Conference of the Cognitive Science Society*, (Lawrence Erlbaum Publishers, 1998).

Professional Activities

Editorship:

Associate Editor — since 2010
Evolutionary Computation (MIT Press)

Associate Editor — since 2007
IEEE Transactions on Evolutionary Computation (IEEE Press)

Member of the Editorial Board — since 2007
Journal of Memetic Computing (Springer Verlag)

Action Editor 2010-2013
Computational Intelligence (Wiley)

Conference, Workshop, and Competition Organisation:

General Chair 2014
Genetic and Evolutionary Computation Conference — GECCO 2014
Vancouver, BC

Technical Co-Chair 2013
IEEE Congress on Evolutionary Computation — CEC 2013
Cancún, Mexico

ES/EP Track Chair 2010
Genetic and Evolutionary Computation Conference — GECCO 2010
Portland, OR

Coorganiser 2009
CAIAC/Precarn Intelligent Systems Challenge

Coorganiser 2008
Dagstuhl Seminar on the Theory of Evolutionary Algorithms
Schloss Dagstuhl, Germany

ES/EP Track Chair 2006
Genetic and Evolutionary Computation Conference — GECCO 2006
Seattle, WA

Coorganiser 2006
Dagstuhl Seminar on the Theory of Evolutionary Algorithms
Schloss Dagstuhl, Germany

ES/EP Track Chair 2005
Genetic and Evolutionary Computation Conference — GECCO 2005
Washington, DC

Tutorials, Invited Talks, and Participation:

International Conference on Continuous Optimization 2013
Coimbra, Portugal

Dagstuhl Seminar on the Theory of Evolutionary Algorithms 2013
Schloss Dagstuhl, Germany

World Congress on Computational Intelligence (tutorial) 2010
Barcelona, Spain

Acadia University, Jodrey School of Computer Science 2008
Wolfville, Nova Scotia

IEEE Symposium on Foundations of Computational Intelligence (invited tutorial) 2007
Honolulu, Hawaii

Dagstuhl Seminar on the Theory of Evolutionary Algorithms 2004
Schloss Dagstuhl, Germany

Ruhr-Universität Bochum, Institut für Neuroinformatik 2003
Bochum, Germany

Helsinki University of Technology, Lab for Theoretical Computer Science 2002
Helsinki, Finland

University of Turku, Workshop on "Evolution, Computation, and Landscapes" 2002
Turku, Finland

Dagstuhl Seminar on the Theory of Evolutionary Algorithms 2002
Schloss Dagstuhl, Germany

Seoul National University, Biointelligence Lab 2001
Seoul, South Korea

Dagstuhl Seminar on the Theory of Evolutionary Algorithms 2000
Schloss Dagstuhl, Germany

EvoNet Summer School on Theoretical Aspects of Evolutionary Computing 1999
Antwerp, Belgium

Reviewing:

Algorithmica (Springer Verlag)

Applied Mathematics and Computer Science

Applied Soft Computing (Elsevier)

Artificial Intelligence (Elsevier)

Computational Optimization and Applications (Kluwer Academic Publishers)

European Journal of Operational Research (Elsevier)

Evolutionary Computation (MIT Press)

Genetic Programming and Evolvable Machines (Kluwer Academic Publishers)

IEEE Computational Intelligence Magazine (IEEE Press)

IEEE Transactions on Cybernetics (IEEE Press)

IEEE Transactions on Evolutionary Computation (IEEE Press)

IEEE Transactions on Systems, Man and Cybernetics (IEEE Press)

Information Sciences (Elsevier)

Journal of Global Optimization (Springer Verlag)

Journal of Mathematical Modelling and Algorithms (Kluwer Academic Publishers)

Journal of System Architecture (Elsevier)

Machine Learning (Springer Verlag)

Memetic Computing (Springer Verlag)

Optimization and Engineering (Springer Verlag)

Pattern Recognition (Elsevier)

Soft Computing (Springer Verlag)

Statistics and Computing (Springer Verlag)

Theoretical Computer Science (Elsevier)

ASME Computers and Information in Engineering Conference — CIE (2005)

Asia-Pacific Conference on Knowledge Discovery and Data Mining — PAKDD (2006)

Canadian Conference on Artificial Intelligence — AI (2010, 2011, 2012)

European Conference on Artificial Life — ECAL (2013)

European Workshop on EAs in Stochastic and Dynamic Environments — EvoSTOC (2005, 2006, 2007, 2008, 2009, 2010, 2011)

Foundations of Genetic Algorithms Workshop — FOGA (2002, 2009, 2011, 2013)

Genetic and Evolutionary Computation Conference — GECCO (2000, 2002, 2003, 2007, 2008, 2009, 2011, 2012, 2013)

IEEE Congress on Evolutionary Computation — CEC (2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013)

IEEE Symposium on Foundations of Computational Intelligence — IEEE FOCI (2007)

International Conference on Evolutionary Computation — ICEC (2009)

International Workshop on Hybrid Metaheuristics — HM (2007)

Learning and Intelligent Optimization Conference — LION (2013)

Parallel Problem Solving from Nature — PPSN (2002, 2008, 2010, 2012)