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From benchmarking optimization heuristics to dynamic algorithm configuration

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Bibliography

- [1] Theodore W. Anderson and Donald A. Darling. Asymptotic theory of certain “goodness of fit” criteria based on stochastic processes. *The annals of mathematical statistics*, pages 193–212, 1952.
- [2] Warren Armstrong, Peter Christen, Eric McCreath, and Alistair P Rendell. Dynamic algorithm selection using reinforcement learning. In *2006 international workshop on integrating ai and data mining*, pages 18–25. IEEE, 2006.
- [3] Anne Auger, Dimo Brockhoff, and Nikolaus Hansen. Mirrored sampling in evolution strategies with weighted recombination. In Natalio Krasnogor and Pier Luca Lanzi, editors, *13th Annual Genetic and Evolutionary Computation Conference, GECCO 2011, Proceedings, Dublin, Ireland, July 12-16, 2011*, pages 861–868. ACM, 2011.
- [4] Anne Auger, Dimo Brockhoff, Nikolaus Hansen, Tea Tušar, and Konstantinos Varelas. Data from BBOB-workshops on 24 noiseless functions, 2020. <https://numbbbo.github.io/data-archive/bbob/>.
- [5] Anne Auger and Nikolaus Hansen. A restart CMA evolution strategy with increasing population size. In *Proceedings of the IEEE Congress on Evolutionary Computation, CEC 2005, 2-4 September 2005, Edinburgh, UK*, pages 1769–1776. IEEE, 2005.
- [6] Anne Auger, Mohamed Jebalia, and Olivier Teytaud. Algorithms (x, sigma, eta): Quasi-random mutations for evolution strategies. In El-Ghazali Talbi, Pierre Liardet, Pierre Collet, Evelyne Lutton, and Marc Schoenauer, editors, *Artificial Evolution, 7th International Conference, Evolution Artificielle, EA 2005, Lille, France, October 26-28, 2005, Revised Selected Papers*, volume 3871 of *Lecture Notes in Computer Science*, pages 296–307. Springer, 2005.
- [7] Amine Aziz-Alaoui, Carola Doerr, and Johann Dréo. Towards large scale automated algorithm design by integrating modular benchmarking frameworks. In Krzysztof Krawiec, editor, *GECCO ’21: Genetic and Evolutionary Computation Conference, Companion Volume, Lille, France, July 10-14, 2021*, pages 1365–1374. ACM, 2021.

Bibliography

- [8] Thomas Bartz-Beielstein, Carola Doerr, Jakob Bossek, Sowmya Chandrasekaran, Tome Eftimov, Andreas Fischbach, Pascal Kerschke, Manuel López-Ibáñez, Katherine M. Malan, Jason H. Moore, Boris Naujoks, Patryk Orzechowski, Vanessa Volz, Markus Wagner, and Thomas Weise. Benchmarking in optimization: Best practice and open issues. *CoRR*, abs/2007.03488, 2020.
- [9] Nacim Belkhir. *Per Instance Algorithm Configuration for Continuous Black Box Optimization*. PhD thesis, University of Paris-Saclay, France, 2017.
- [10] Nacim Belkhir, Johann Dréo, Pierre Savéant, and Marc Schoenauer. Per instance algorithm configuration of CMA-ES with limited budget. In Peter A. N. Bosman, editor, *Proceedings of Genetic and Evolutionary Computation (GECCO'17)*, pages 681–688. ACM, 2017.
- [11] Yoav Benjamini. Discovering the false discovery rate. *Journal of the Royal Statistical Society: Series B (Statistical Methodology)*, 72(4):405–416, 2010.
- [12] Yoav Benjamini and Yosef Hochberg. Controlling the false discovery rate: a practical and powerful approach to multiple testing. *Journal of the Royal statistical society: series B (Methodological)*, 57(1):289–300, 1995.
- [13] Yoav Benjamini and Daniel Yekutieli. The Control of the False Discovery Rate in Multiple Testing under Dependency. *The Annals of Statistics*, 29(4):1165–1188, 2001.
- [14] Przemysław Biecek and Teresa Ledwina. ddst: Data driven smooth tests. R package version 1.0.2.
- [15] André Biedenkapp, H. Furkan Bozkurt, Frank Hutter, and Marius Lindauer. Towards white-box benchmarks for algorithm control. *CoRR*, abs/1906.07644, 2019.
- [16] Rafał Biedrzycki. Comparison with state-of-the-art: Traps and pitfalls. In *IEEE Congress on Evolutionary Computation, CEC 2021, Kraków, Poland, June 28 - July 1, 2021*, pages 863–870. IEEE, 2021.
- [17] Rafał Biedrzycki, Jarosław Arabas, and Dariusz Jagodziński. Bound constraints handling in differential evolution: An experimental study. *Swarm and Evolutionary Computation*, 50:100453, 2019.
- [18] Bernd Bischl, Olaf Mersmann, Heike Trautmann, and Mike Preuß. Algorithm selection based on exploratory landscape analysis and cost-sensitive learning. In Terence Soule and Jason H. Moore, editors, *Genetic and Evolutionary Computation Conference, GECCO '12, Philadelphia, PA, USA, July 7-11, 2012*, pages 313–320. ACM, 2012.
- [19] Carlo Bonferroni. Teoria statistica delle classi e calcolo delle probabilita. *Pubblicazioni del R Istituto Superiore di Scienze Economiche e Commericiali di Firenze*, 8:3–62, 1936.

- [20] Jakob Bossek, Carola Doerr, Pascal Kerschke, Aneta Neumann, and Frank Neumann. Evolving sampling strategies for one-shot optimization tasks. In Thomas Bäck, Mike Preuss, André H. Deutz, Hao Wang, Carola Doerr, Michael T. M. Emmerich, and Heike Trautmann, editors, *Parallel Problem Solving from Nature - PPSN XVI - 16th International Conference, PPSN 2020, Leiden, The Netherlands, September 5-9, 2020, Proceedings, Part I*, volume 12269 of *Lecture Notes in Computer Science*, pages 111–124. Springer, 2020.
- [21] Olivier Bousquet, Sylvain Gelly, Karol Kurach, Olivier Teytaud, and Damien Vincent. Critical hyper-parameters: No random, no cry. *CoRR*, abs/1706.03200, 2017.
- [22] Ilhem Boussaïd, Julien Lepagnot, and Patrick Siarry. A survey on optimization metaheuristics. *Information Sciences*, 237:82–117, 2013.
- [23] Janez Brest, Saso Greiner, Borko Boskovic, Marjan Mernik, and Viljem Zumer. Self-adapting control parameters in differential evolution: A comparative study on numerical benchmark problems. *IEEE Transactions on Evolutionary Computation*, 10(6):646–657, 2006.
- [24] Janez Brest and Mirjam Sepesy Maučec. Population size reduction for the differential evolution algorithm. *Applied Intelligence*, 29(3):228–247, 2008.
- [25] Janez Brest, Mirjam Sepesy Maučec, and Borko Boskovic. Single objective real-parameter optimization: Algorithm jso. In *2017 IEEE Congress on Evolutionary Computation, CEC 2017, Donostia, San Sebastián, Spain, June 5-8, 2017*, pages 1311–1318. IEEE, 2017.
- [26] Dimo Brockhoff. A bug in the multiobjective optimizer IBEA: salutary lessons for code release and a performance re-assessment. In António Gaspar-Cunha, Carlos Henggeler Antunes, and Carlos A. Coello Coello, editors, *Evolutionary Multi-Criterion Optimization - 8th International Conference, EMO 2015, Guimarães, Portugal, March 29 -April 1, 2015. Proceedings, Part I*, volume 9018 of *Lecture Notes in Computer Science*, pages 187–201. Springer, 2015.
- [27] Dimo Brockhoff. Comparing boundary handling techniques of CMA-ES on the bbob and sbob-cost test suites. In Sara Silva and Luís Paquete, editors, *Companion Proceedings of the Conference on Genetic and Evolutionary Computation, GECCO 2023, Companion Volume, Lisbon, Portugal, July 15-19, 2023*, pages 2318–2325. ACM, 2023.
- [28] Dimo Brockhoff, Anne Auger, Nikolaus Hansen, Dirk V. Arnold, and Tim Hohm. Mirrored sampling and sequential selection for evolution strategies. In Robert Schaefer, Carlos Cotta, Joanna Kolodziej, and Günter Rudolph, editors, *Parallel Problem Solving from Nature - PPSN XI, 11th International Conference, Kraków, Poland, September 11-15, 2010, Proceedings, Part I*, volume 6238 of *Lecture Notes in Computer Science*, pages 11–21. Springer, 2010.

Bibliography

- [29] Charles G. Broyden. The Convergence of a Class of Double-rank Minimization Algorithms: 2. The New Algorithm. *IMA Journal of Applied Mathematics*, 6(3):222–231, 09 1970.
- [30] H. D. Brunk. On the Range of the Difference between Hypothetical Distribution Function and Pyke’s Modified Empirical Distribution Function. *The Annals of Mathematical Statistics*, 33(2):525 – 532, 1962.
- [31] Edmund K. Burke, Michel Gendreau, Matthew R. Hyde, Graham Kendall, Gabriela Ochoa, Ender Özcan, and Rong Qu. Hyper-heuristics: a survey of the state of the art. *Journal of the Operational Research Society*, 64(12):1695–1724, 2013.
- [32] Sébastien Cahon, Nordine Melab, and El-Ghazali Talbi. ParadisEO: A framework for the reusable design of parallel and distributed metaheuristics. *Journal of Heuristics*, 10(3):357–380, 2004.
- [33] Borja Calvo, Josu Ceberio, and José Antonio Lozano. Bayesian inference for algorithm ranking analysis. In Hernán E. Aguirre and Keiki Takadama, editors, *Proceedings of the Genetic and Evolutionary Computation Conference Companion, GECCO 2018, Kyoto, Japan, July 15-19, 2018*, pages 324–325. ACM, 2018.
- [34] Christian Leonardo Camacho-Villalón, Marco Dorigo, and Thomas Stützle. PSO-X: A component-based framework for the automatic design of particle swarm optimization algorithms. *IEEE Transactions on Evolutionary Computation*, 26(3):402–416, 2022.
- [35] Christian Leonardo Camacho-Villalón, Thomas Stützle, and Marco Dorigo. Grey wolf, firefly and bat algorithms: Three widespread algorithms that do not contain any novelty. In Marco Dorigo, Thomas Stützle, Maria J. Blesa, Christian Blum, Heiko Hamann, Mary Katherine Heinrich, and Volker Strobelt, editors, *Swarm Intelligence - 12th International Conference, ANTS 2020, Barcelona, Spain, October 26-28, 2020, Proceedings*, volume 12421 of *Lecture Notes in Computer Science*, pages 121–133. Springer, 2020.
- [36] Felipe Campelo and Moisés Botelho. Experimental investigation of recombination operators for differential evolution. In Tobias Friedrich, Frank Neumann, and Andrew M. Sutton, editors, *Proceedings of the 2016 on Genetic and Evolutionary Computation Conference, Denver, CO, USA, July 20 - 24, 2016*, pages 221–228. ACM, 2016.
- [37] Guogang Cao, Cong Cao, Qing Zhang, and Wenju Li. Differential evolution improved with intelligent mutation operator based on proximity and ranking. In *11th International Symposium on Computational Intelligence and Design, ISCID 2018, Hangzhou, China, December 8-9, 2018, Volume 2*, pages 196–201. IEEE, 2018.

- [38] Fabio Caraffini and Giovanni Iacca. The SOS Platform: Designing, Tuning and Statistically Benchmarking Optimisation Algorithms. *Mathematics*, 8(5):785, May 2020.
- [39] Fabio Caraffini and Anna V. Kononova. Structural bias in differential evolution: A preliminary study. *AIP Conference Proceedings*, 2070(1):020005, 2019.
- [40] Fabio Caraffini, Anna V. Kononova, and David Corne. Infeasibility and structural bias in differential evolution. *Information Sciences*, 496:161–179, 2019.
- [41] Javier Castro, Daniel Gómez, and Juan Tejada. Polynomial calculation of the shapley value based on sampling. *Computers & Operations Research*, 36(5):1726–1730, 2009.
- [42] Maximilian Christ, Nils Braun, Julius Neuffer, and Andreas W. Kempa-Liehr. Time series feature extraction on basis of scalable hypothesis tests (tsfresh - A python package). *Neurocomputing*, 307:72–77, 2018.
- [43] François Clément, Diederick Vermetten, Jacob de Nobel, Alexandre D. Jesus, Luís Paquete, and Carola Doerr. Computing star discrepancies with numerical black-box optimization algorithms. In Sara Silva and Luís Paquete, editors, *Proceedings of the Genetic and Evolutionary Computation Conference, GECCO 2023, Lisbon, Portugal, July 15-19, 2023*, pages 1330–1338. ACM, 2023.
- [44] Harald Cramér. On the composition of elementary errors: First paper: Mathematical deductions. *Scandinavian Actuarial Journal*, 1928(1):13–74, 1928.
- [45] Noel Cressie. An optimal statistic based on higher order gaps. *Biometrika*, 66(3):619–627, 12 1979.
- [46] Noel Cressie and Timothy R. C. Read. Multinomial goodness-of-fit tests. *Journal of the Royal Statistical Society. Series B (Methodological)*, 46(3):440–464, 1984.
- [47] Sandor Csorgo and Julian J. Faraway. The Exact and Asymptotic Distributions of Cramer-von Mises Statistics. *Journal of the Royal Statistical Society. Series B (Methodological)*, 58(1):221–234, 1996.
- [48] Swagatam Das, Ajith Abraham, Uday K. Chakraborty, and Amit Konar. Differential evolution using a neighborhood-based mutation operator. *IEEE Transactions on Evolutionary Computation*, 13(3):526–553, 2009.
- [49] Swagatam Das, Sankha Subhra Mullick, and Ponnuthurai N. Suganthan. Recent advances in differential evolution - an updated survey. *Swarm and Evolutionary Computation*, 27:1–30, 2016.
- [50] Pierre Lafaye de Micheaux and Viet Anh Tran. PowerR: A reproducible research tool to ease monte carlo power simulation studies for goodness-of-fit tests in r. *Journal of Statistical Software, Articles*, 69(3):1–44, 2016.

- [51] Jacob de Nobel, Diederick Vermetten, Hao Wang, Carola Doerr, and Thomas Bäck. Tuning as a means of assessing the benefits of new ideas in interplay with existing algorithmic modules. In Krzysztof Krawiec, editor, *GECCO '21: Genetic and Evolutionary Computation Conference, Companion Volume, Lille, France, July 10-14, 2021*, pages 1375–1384. ACM, 2021.
- [52] Jacob de Nobel, Hao Wang, and Thomas Bäck. Explorative data analysis of time series based algorithm features of CMA-ES variants. In Francisco Chicano and Krzysztof Krawiec, editors, *GECCO '21: Genetic and Evolutionary Computation Conference, Lille, France, July 10-14, 2021*, pages 510–518. ACM, 2021.
- [53] Jacob de Nobel, Furong Ye, Diederick Vermetten, Hao Wang, Carola Doerr, and Thomas Bäck. Iohexperimenter: Benchmarking platform for iterative optimization heuristics. *Evolutionary Computation*, pages 1–6, 2024.
- [54] James Demmel and Krešimir Veselić. Jacobi’s method is more accurate than qr. *SIAM Journal on Matrix Analysis and Applications*, 13(4):1204–1245, 1992.
- [55] Janez Demsar. Statistical comparisons of classifiers over multiple data sets. *Journal of Machine Learning Research*, 7:1–30, 2006.
- [56] Luc Devroye. *The compound random search*. Ph.D. dissertation, Purdue Univ., West Lafayette, IN, 1972.
- [57] Konstantin Dietrich and Pascal Kerschke. Evaluation of algorithms from the nevergrad toolbox on the strictly box-constrained SBOX-COST benchmarking suite. In Sara Silva and Luís Paquete, editors, *Companion Proceedings of the Conference on Genetic and Evolutionary Computation, GECCO 2023, Companion Volume, Lisbon, Portugal, July 15-19, 2023*, pages 2326–2329. ACM, 2023.
- [58] Konstantin Dietrich and Olaf Mersmann. Increasing the diversity of benchmark function sets through affine recombination. In Günter Rudolph, Anna V. Kononova, Hernán E. Aguirre, Pascal Kerschke, Gabriela Ochoa, and Tea Tusar, editors, *Proceedings of Parallel Problem Solving from Nature (PPSN'22)*, volume 13398 of *LNCS*, pages 590–602. Springer, 2022.
- [59] David P. Dobkin, David Eppstein, and Don P. Mitchell. Computing the discrepancy with applications to supersampling patterns. *ACM Trans. Graph.*, 15(4):354–376, 1996.
- [60] Benjamin Doerr and Carola Doerr. Theory of parameter control for discrete black-box optimization: Provable performance gains through dynamic parameter choices. In *Theory of Evolutionary Computation: Recent Developments in Discrete Optimization*, pages 271–321. Springer, 2020.
- [61] Benjamin Doerr, Mahmoud Fouz, Martin Schmidt, and Magnus Wahlström. BBOB: nelder-mead with resize and halfruns. In Franz Rothlauf, editor, *Proceedings of Genetic and Evolutionary Computation (GECCO'09)*, pages 2239–2246. ACM, 2009.

-
- [62] Carola Doerr, Hao Wang, Furong Ye, Sander van Rijn, and Thomas Bäck. IOHprofiler: A Benchmarking and Profiling Tool for Iterative Optimization Heuristics. *arXiv e-prints:1810.05281*, abs/1810.05281, 2018.
- [63] Carola Doerr, Furong Ye, Naama Horesh, Hao Wang, Ofer M. Shir, and Thomas Bäck. Benchmarking discrete optimization heuristics with IOHprofiler. In *Proceedings of Genetic and Evolutionary Computation Conference (GECCO'19, Companion Material)*, volume 88, pages 1798–1806. ACM, 2019. Full version to appear with *Applied Soft Computing*.
- [64] Marco Dorigo and Thomas Stützle. *Ant colony optimization*. MIT Press, 2004.
- [65] Johann Dréo, Arnaud Liefooghe, Sébastien Vérel, Marc Schoenauer, Juan Julián Merelo Guervós, Alexandre Quemy, Benjamin Bouvier, and Jan Gmys. Paradiseo: from a modular framework for evolutionary computation to the automated design of metaheuristics: 22 years of paradiseo. In Krzysztof Krawiec, editor, *GECCO '21: Genetic and Evolutionary Computation Conference, Companion Volume, Lille, France, July 10-14, 2021*, pages 1522–1530. ACM, 2021.
- [66] Gunter Dueck and Tobias Scheuer. Threshold accepting: a general purpose optimization algorithm appearing superior to simulated annealing. *Journal of Computational Physics*, 90:161–175, 1990.
- [67] James Durbin and R Brown. Tests of serial independence based on the cumulated periodogram. *Bulletin of the International Statistical Institute*, 42:1039–1048, 1967.
- [68] Tome Eftimov, Peter Korosec, and Barbara Korousic-Seljak. A novel approach to statistical comparison of meta-heuristic stochastic optimization algorithms using deep statistics. *Information Sciences*, 417:186–215, 2017.
- [69] Tome Eftimov, Gasper Petelin, and Peter Korosec. DSCTool: A web-service-based framework for statistical comparison of stochastic optimization algorithms. *Applied Soft Computing*, 87:105977, 2020.
- [70] Agoston Endre Eiben, Robert Hinterding, and Zbigniew Michalewicz. Parameter control in evolutionary algorithms. *IEEE Transactions on Evolutionary Computation*, 3(2):124–141, 1999.
- [71] Agoston Endre Eiben and James E. Smith. *Introduction to Evolutionary Computing, Second Edition*. Natural Computing Series. Springer, 2015.
- [72] Ouassim Ait ElHara, Anne Auger, and Nikolaus Hansen. A median success rule for non-elitist evolution strategies: study of feasibility. In Christian Blum and Enrique Alba, editors, *Genetic and Evolutionary Computation Conference, GECCO '13, Amsterdam, The Netherlands, July 6-10, 2013*, pages 415–422. ACM, 2013.

Bibliography

- [73] Michael G. Epitropakis, Dimitris K. Tasoulis, Nicos G. Pavlidis, Vassilis P. Plagianakos, and Michael N. Vrahatis. Enhancing differential evolution utilizing proximity-based mutation operators. *IEEE Transactions on Evolutionary Computation*, 15(1):99–119, 2011.
- [74] Nick Erickson, Jonas Mueller, Alexander Shirkov, Hang Zhang, Pedro Larroy, Mu Li, and Alexander J. Smola. Autogluon-tabular: Robust and accurate automl for structured data. *CoRR*, abs/2003.06505, 2020.
- [75] Julian Faraway, George Marsaglia, John Marsaglia, and Adrian Baddeley. goftest: Classical goodness-of-fit tests for univariate distributions. R package version 1.2.3.
- [76] Matthias Feurer, Katharina Eggensperger, Stefan Falkner, Marius Lindauer, and Frank Hutter. Auto-sklearn 2.0: Hands-free automl via meta-learning. *J. Mach. Learn. Res.*, 23:261:1–261:61, 2022.
- [77] Roger Fletcher. A new approach to variable metric algorithms. *The Computer Journal*, 13(3):317–322, 01 1970.
- [78] Carlos M. Fonseca, Andreia P. Guerreiro, Manuel López-Ibáñez, and Luís Paquete. On the computation of the empirical attainment function. In Ricardo H. C. Takahashi, Kalyanmoy Deb, Elizabeth F. Wanner, and Salvatore Greco, editors, *Evolutionary Multi-Criterion Optimization - 6th International Conference, EMO 2011, Ouro Preto, Brazil, April 5-8, 2011. Proceedings*, volume 6576 of *Lecture Notes in Computer Science*, pages 106–120. Springer, 2011.
- [79] Alexandre Fréchette, Lars Kotthoff, Tomasz P. Michalak, Talal Rahwan, Holger H. Hoos, and Kevin Leyton-Brown. Using the shapley value to analyze algorithm portfolios. In Dale Schuurmans and Michael P. Wellman, editors, *Proceedings of the Thirtieth AAAI Conference on Artificial Intelligence, February 12-17, 2016, Phoenix, Arizona, USA*, pages 3397–3403. AAAI Press, 2016.
- [80] Tobias Friedrich and Frank Neumann. Maximizing submodular functions under matroid constraints by multi-objective evolutionary algorithms. In Thomas Bartz-Beielstein, Jürgen Branke, Bogdan Filipic, and Jim Smith, editors, *Parallel Problem Solving from Nature - PPSN XIII - 13th International Conference, Ljubljana, Slovenia, September 13-17, 2014. Proceedings*, volume 8672 of *Lecture Notes in Computer Science*, pages 922–931. Springer, 2014.
- [81] Matteo Gagliolo and Jürgen Schmidhuber. Learning dynamic algorithm portfolios. *Ann. Math. Artif. Intell.*, 47(3-4):295–328, 2006.
- [82] Roger Gämperle, Sibylle D Müller, and Petros Koumoutsakos. A parameter study for differential evolution. *Advances in intelligent systems, fuzzy systems, evolutionary computation*, 10(10):293–298, 2002.

- [83] Tobias Glasmachers, Tom Schaul, Yi Sun, Daan Wierstra, and Jürgen Schmidhuber. Exponential natural evolution strategies. In Martin Pelikan and Jürgen Branke, editors, *Genetic and Evolutionary Computation Conference, GECCO 2010, Proceedings, Portland, Oregon, USA, July 7-11, 2010*, pages 393–400. ACM, 2010.
- [84] Michael Gnewuch, Magnus Wahlström, and Carola Winzen. A new randomized algorithm to approximate the star discrepancy based on threshold accepting. *SIAM J. Numer. Anal.*, 50(2):781–807, 2012.
- [85] Donald Goldfarb. A family of variable-metric methods derived by variational means. *Mathematics of Computation*, 24(109):23–26, 1970.
- [86] Major Greenwood. The statistical study of infectious diseases. *Journal of the Royal Statistical Society*, 109(2):85–110, 1946.
- [87] Shu-Mei Guo and Chin-Chang Yang. Enhancing differential evolution utilizing eigenvector-based crossover operator. *IEEE Transactions on Evolutionary Computation*, 19(1):31–49, 2015.
- [88] Nikolaus Hansen. CMA-ES with two-point step-size adaptation. *CoRR*, abs/0805.0231, 2008.
- [89] Nikolaus Hansen. Benchmarking a bi-population CMA-ES on the BBOB-2009 function testbed. In Franz Rothlauf, editor, *Genetic and Evolutionary Computation Conference, GECCO 2009, Proceedings, Montreal, Québec, Canada, July 8-12, 2009, Companion Material*, pages 2389–2396. ACM, 2009.
- [90] Nikolaus Hansen. The CMA evolution strategy: A tutorial. *CoRR*, abs/1604.00772, 2016.
- [91] Nikolaus Hansen and Anne Auger. Principled design of continuous stochastic search: From theory to practice. In Yossi Borenstein and Alberto Moraglio, editors, *Theory and Principled Methods for the Design of Metaheuristics*, Natural Computing Series, pages 145–180. Springer, 2014.
- [92] Nikolaus Hansen, Anne Auger, Dimo Brockhoff, Dejan Tutar, and Tea Tutar. COCO: performance assessment. *CoRR*, abs/1605.03560, 2016.
- [93] Nikolaus Hansen, Anne Auger, Dimo Brockhoff, and Tea Tutar. Anytime performance assessment in blackbox optimization benchmarking. *IEEE Transactions on Evolutionary Computation*, 26(6):1293–1305, 2022.
- [94] Nikolaus Hansen, Anne Auger, Raymond Ros, Steffen Finck, and Petr Posik. Comparing results of 31 algorithms from the black-box optimization benchmarking BBOB-2009. In Martin Pelikan and Jürgen Branke, editors, *Genetic and Evolutionary Computation Conference, GECCO 2010, Proceedings, Portland, Oregon, USA, July 7-11, 2010, Companion Material*, pages 1689–1696. ACM, 2010.

Bibliography

- [95] Nikolaus Hansen, Anne Auger, Raymond Ros, Olaf Mersmann, Tea Tusar, and Dimo Brockhoff. COCO: a platform for comparing continuous optimizers in a black-box setting. *Optimization Methods and Software*, 36(1):114–144, 2021.
- [96] Nikolaus Hansen, Steffen Finck, Raymond Ros, and Anne Auger. Real-Parameter Black-Box Optimization Benchmarking 2009: Noiseless Functions Definitions. Research Report RR-6829, INRIA, 2009.
- [97] Nikolaus Hansen and Andreas Ostermeier. Adapting arbitrary normal mutation distributions in evolution strategies: The covariance matrix adaptation. In Toshio Fukuda and Takeshi Furuhashi, editors, *Proceedings of 1996 IEEE International Conference on Evolutionary Computation, Nayoya University, Japan, May 20-22, 1996*, pages 312–317. IEEE, 1996.
- [98] Nikolaus Hansen and Andreas Ostermeier. Completely derandomized self-adaptation in evolution strategies. *Evolutionary Computation*, 9(2):159–195, 2001.
- [99] William E. Hart, Carl D. Laird, Jean-Paul Watson, David L. Woodruff, Gabriel A. Hackebeit, Bethany L. Nicholson, and John D. Siirola. *Pyomo-optimization modeling in python*, volume 67. Springer, 2017.
- [100] Trevor Hastie, Robert Tibshirani, and Jerome H. Friedman. *The Elements of Statistical Learning: Data Mining, Inference, and Prediction, 2nd Edition*. Springer Series in Statistics. Springer, 2009.
- [101] Y. A. S. Hegazy and J. R. Green. Some new goodness-of-fit tests using order statistics. *Journal of the Royal Statistical Society: Series C (Applied Statistics)*, 24(3):299–308, 1975.
- [102] Edmund Hlawka. Funktionen von beschränkter Variation in der Theorie der Gleichverteilung. *Annali di Matematica Pura ed Applicata*, 54:325–333, 1961.
- [103] Myles Hollander, Douglas A Wolfe, and Eric Chicken. *Nonparametric statistical methods*, volume 751. John Wiley & Sons, 2013.
- [104] Holger H. Hoos, Frank Hutter, and Kevin Leyton-Brown. Automated configuration and selection of SAT solvers. In Armin Biere, Marijn Heule, Hans van Maaren, and Toby Walsh, editors, *Handbook of Satisfiability - Second Edition*, volume 336 of *Frontiers in Artificial Intelligence and Applications*, pages 481–507. IOS Press, 2021.
- [105] Alfred Inselberg. The plane with parallel coordinates. *The visual computer*, 1(2):69–91, 1985.
- [106] Sk. Minhazul Islam, Swagatam Das, Saurav Ghosh, Subhrajit Roy, and Pon-nuthurai Nagarathnam Suganthan. An adaptive differential evolution algorithm with novel mutation and crossover strategies for global numerical optimization. *IEEE Transactions on Systems, Man, and Cybernetics, Part B (Cybernetics)*, 42(2):482–500, 2012.

-
- [107] Anja Jankovic and Carola Doerr. Landscape-aware fixed-budget performance regression and algorithm selection for modular CMA-ES variants. In Carlos Artemio Coello Coello, editor, *GECCO '20: Genetic and Evolutionary Computation Conference, Cancún Mexico, July 8-12, 2020*, pages 841–849. ACM, 2020.
- [108] Anja Jankovic, Tome Eftimov, and Carola Doerr. Towards feature-based performance regression using trajectory data. In Pedro A. Castillo and Juan Luis Jiménez Laredo, editors, *Applications of Evolutionary Computation - 24th International Conference, EvoApplications 2021, Held as Part of EvoStar 2021, Virtual Event, April 7-9, 2021, Proceedings*, volume 12694 of *Lecture Notes in Computer Science*, pages 601–617. Springer, 2021.
- [109] Anja Jankovic, Gorjan Popovski, Tome Eftimov, and Carola Doerr. The impact of hyper-parameter tuning for landscape-aware performance regression and algorithm selection. In Francisco Chicano and Krzysztof Krawiec, editors, *GECCO '21: Genetic and Evolutionary Computation Conference, Lille, France, July 10-14, 2021*, pages 687–696. ACM, 2021.
- [110] Anja Jankovic, Diederick Vermetten, Ana Kostovska, Jacob de Nobel, Tome Eftimov, and Carola Doerr. Trajectory-based algorithm selection with warm-starting. In *IEEE Congress on Evolutionary Computation, CEC 2022, Padua, Italy, July 18-23, 2022*, pages 1–8. IEEE, 2022.
- [111] Carlos M. Jarque and Anil K. Bera. A test for normality of observations and regression residuals. *International Statistical Review/Revue Internationale de Statistique*, 55(2):163–172, 1987.
- [112] Grahame A. Jastrebski and Dirk V. Arnold. Improving evolution strategies through active covariance matrix adaptation. In *IEEE International Conference on Evolutionary Computation, CEC 2006, part of WCCI 2006, Vancouver, BC, Canada, 16-21 July 2006*, pages 2814–2821. IEEE, 2006.
- [113] Donald R. Jones. A taxonomy of global optimization methods based on response surfaces. *Journal of Global Optimization*, 21(4):345–383, 2001.
- [114] Tomas Kadavy, Adam Viktorin, Anezka Kazikova, Michal Pluhacek, and Roman Senkerik. Impact of boundary control methods on bound-constrained optimization benchmarking. *IEEE Transactions of Evolutionary Computation*, 26(6):1271–1280, 2022.
- [115] Alexander H. G. Rinnooy Kan and G. T. Timmer. Stochastic global optimization methods part I: clustering methods. *Math. Program.*, 39(1):27–56, 1987.
- [116] Alexander H. G. Rinnooy Kan and G. T. Timmer. Stochastic global optimization methods part II: multi level methods. *Mathematical Programming*, 39(1):57–78, 1987.

Bibliography

- [117] Leonid Kantorovitch. On the translocation of masses. *Management Science*, 5(1):1–4, 1958.
- [118] Sitanshu S. Kar and Archana Ramalingam. Is 30 the magic number? issues in sample size estimation. *National Journal of Community Medicine*, 4(1):175–179, 2013.
- [119] Giorgos Karafotias, Mark Hoogendoorn, and Ágoston E. Eiben. Parameter control in evolutionary algorithms: Trends and challenges. *IEEE Transactions on Evolutionary Computation*, 19(2):167–187, 2015.
- [120] Zohar Shay Karnin, Tomer Koren, and Oren Somekh. Almost optimal exploration in multi-armed bandits. In *Proceedings of the 30th International Conference on Machine Learning, ICML 2013, Atlanta, GA, USA, 16-21 June 2013*, volume 28 of *JMLR Workshop and Conference Proceedings*, pages 1238–1246. JMLR.org, 2013.
- [121] Maarten Keijzer, Juan Julián Merelo Guervós, Gustavo Romero, and Marc Schoenauer. Evolving objects: A general purpose evolutionary computation library. In Pierre Collet, Cyril Fonlupt, Jin-Kao Hao, Evelyne Lutton, and Marc Schoenauer, editors, *Artificial Evolution, 5th International Conference, Evolution Artificielle, EA 2001, Le Creusot, France, October 29-31, 2001, Selected Papers*, volume 2310 of *Lecture Notes in Computer Science*, pages 231–244. Springer, 2001.
- [122] Maurice G. Kendall. A new measure of rank correlation. *Biometrika*, 30(1/2):81–93, 1938.
- [123] James Kennedy and Russell Eberhart. Particle swarm optimization. In *Proceedings of International Conference on Neural Networks (ICNN’95), Perth, WA, Australia, November 27 - December 1, 1995*, pages 1942–1948. IEEE, 1995.
- [124] Pascal Kerschke, Holger H. Hoos, Frank Neumann, and Heike Trautmann. Automated algorithm selection: Survey and perspectives. *Evolutionary Computation*, 27(1):3–45, 2019.
- [125] Pascal Kerschke and Heike Trautmann. The r-package flacco for exploratory landscape analysis with applications to multi-objective optimization problems. In *2016 IEEE Congress on Evolutionary Computation (CEC)*, pages 5262–5269. IEEE, IEEE, July 2016.
- [126] Pascal Kerschke and Heike Trautmann. Automated algorithm selection on continuous black-box problems by combining exploratory landscape analysis and machine learning. *Evolutionary Computation*, 27(1):99–127, 2019.
- [127] Pascal Kerschke and Heike Trautmann. *Comprehensive Feature-Based Landscape Analysis of Continuous and Constrained Optimization Problems Using the R-Package Flacco*, pages 93–123. Studies in Classification, Data Analysis, and Knowledge Organization. Springer International Publishing, Cham, 2019.

- [128] Scott Kirkpatrick, C. D. Gelatt, and Mario P. Vecchi. Optimization by simulated annealing. *Science*, 220:671–680, 1983.
- [129] Jurjen F. Koksma. Een algemeene stelling uit de theorie der gelijkmatige verdeling modulo 1. *Mathematica (Zutphen)*, 11:7–11, 1942.
- [130] Andrey Nikolaevich Kolmogorov. Sulla determinazione empirica di una legge di distribuzione. *Giornale dell'Istituto Italiano degli Attuari*, 4:83–91, 1933.
- [131] Anna V. Kononova, Fabio Caraffini, and Thomas Bäck. Differential evolution outside the box. *Information Sciences*, 581:587–604, 2021.
- [132] Anna V. Kononova, Fabio Caraffini, Hao Wang, and Thomas Bäck. Can compact optimisation algorithms be structurally biased? In Thomas Bäck, Mike Preuss, André H. Deutz, Hao Wang, Carola Doerr, Michael T. M. Emmerich, and Heike Trautmann, editors, *Parallel Problem Solving from Nature - PPSN XVI - 16th International Conference, PPSN 2020, Leiden, The Netherlands, September 5-9, 2020, Proceedings, Part I*, volume 12269 of *LNCS*, pages 229–242, Cham, 2020. Springer.
- [133] Anna V. Kononova, David W. Corne, Philippe De Wilde, Vsevolod Shneer, and Fabio Caraffini. Structural bias in population-based algorithms. *Information Sciences*, 298:468–490, 2015.
- [134] Anna V. Kononova, Diederick Vermetten, Fabio Caraffini, Madalina-Andreea Mitran, and Daniela Zaharie. The importance of being constrained: Dealing with infeasible solutions in differential evolution and beyond. *Evolutionary Computation*, 32(1):3–48, 2024.
- [135] Ana Kostovska, Anja Jankovic, Diederick Vermetten, Jacob de Nobel, Hao Wang, Tome Eftimov, and Carola Doerr. Per-run algorithm selection with warm-starting using trajectory-based features. In Günter Rudolph, Anna V. Kononova, Hernán E. Aguirre, Pascal Kerschke, Gabriela Ochoa, and Tea Tusar, editors, *Parallel Problem Solving from Nature - PPSN XVII - 17th International Conference, PPSN 2022, Dortmund, Germany, September 10-14, 2022, Proceedings, Part I*, volume 13398 of *Lecture Notes in Computer Science*, pages 46–60. Springer, 2022.
- [136] Ana Kostovska, Diederick Vermetten, Carola Doerr, Sašo Džeroski, Panče Panov, and Tome Eftimov. OPTION: OPTImization Algorithm Benchmarking ONtology. *IEEE Transactions on Evolutionary Computation*, 27(6):1618–1632, 2023.
- [137] Oswin Krause, Tobias Glasmachers, and Christian Igel. Qualitative and quantitative assessment of step size adaptation rules. In *Proceedings of the 14th ACM/SIGEVO Conference on Foundations of Genetic Algorithms*, FOGA '17, page 139–148, New York, NY, USA, 2017. Association for Computing Machinery.

Bibliography

- [138] Benjamin Lacroix and John McCall. Limitations of benchmark sets and landscape features for algorithm selection and performance prediction. In *Proceedings of Genetic and Evolutionary Computation (GECCO'19)*, page 261–262, New York, NY, USA, 2019. Association for Computing Machinery.
- [139] Pedro Larrañaga and José Antonio Lozano, editors. *Estimation of Distribution Algorithms*. Genetic Algorithms and Evolutionary Computation. Springer, 2002.
- [140] Pedro Larrañaga and José Antonio Lozano. *Estimation of Distribution Algorithms: A New Tool for Evolutionary Computation*. Kluwer Academic Publishers, 2002.
- [141] Rui Li, Michael T. M. Emmerich, Jeroen Eggermont, Thomas Bäck, Martin Schütz, Jouke Dijkstra, and Johan H. C. Reiber. Mixed integer evolution strategies for parameter optimization. *Evolutionary Computation*, 21(1):29–64, 2013.
- [142] Shutao Li, Mingkui Tan, Ivor W. Tsang, and James Tin-Yau Kwok. A hybrid PSO-BFGS strategy for global optimization of multimodal functions. *IEEE Transactions on Systems, Man, and Cybernetics Part B*, 41(4):1003–1014, 2011.
- [143] Xiaodong Li, Ke Tang, Mohammad N Omidvar, Zhenyu Yang, Kai Qin, and Hefei China. Benchmark functions for the cec 2013 special session and competition on large-scale global optimization. *gene*, 7(33):8, 2013.
- [144] Jing J Liang, Bo Y Qu, and Ponnuthurai N Suganthan. Problem definitions and evaluation criteria for the cec 2014 special session and competition on single objective real-parameter numerical optimization. *Computational Intelligence Laboratory, Zhengzhou University, Zhengzhou China and Technical Report, Nanyang Technological University, Singapore*, 635:490, 2013.
- [145] Jialin Liu, Antoine Moreau, Mike Preuss, Jérémy Rapin, Baptiste Rozière, Fabien Teytaud, and Olivier Teytaud. Versatile black-box optimization. In Carlos Artemio Coello Coello, editor, *GECCO '20: Genetic and Evolutionary Computation Conference, Cancún Mexico, July 8-12, 2020*, pages 620–628. ACM, 2020.
- [146] Junhong Liu and Jouni Lampinen. A fuzzy adaptive differential evolution algorithm. *Soft Comput.*, 9(6):448–462, 2005.
- [147] Marco Locatelli and Fabio Schoen. Random linkage: a family of acceptance/rejection algorithms for global optimisation. *Mathematical Programming*, 85(2), 1999.
- [148] Fu Xing Long, Bas van Stein, Moritz Frenzel, Peter Krause, Markus Gitterle, and Thomas Bäck. Learning the characteristics of engineering optimization problems with applications in automotive crash. In Jonathan E. Fieldsend and Markus Wagner, editors, *Proceedings of the Genetic and Evolutionary Computation Conference*, GECCO '22, page 1227–1236, New York, NY, USA, 2022. Association for Computing Machinery.

-
- [149] Fu Xing Long, Diederick Vermetten, Anna V. Kononova, Roman Kalkreuth, Kaifeng Yang, Thomas Bäck, and Niki van Stein. Challenges of ela-guided function evolution using genetic programming. In Niki van Stein, Francesco Marcelloni, H. K. Lam, Marie Cottrell, and Joaquim Filipe, editors, *Proceedings of the 15th International Joint Conference on Computational Intelligence, IJCCI 2023, Rome, Italy, November 13-15, 2023*, pages 119–130. SCITEPRESS, 2023.
- [150] Fu Xing Long, Diederick Vermetten, Bas van Stein, and Anna V. Kononova. BBOB instance analysis: Landscape properties and algorithm performance across problem instances. In João Correia, Stephen L. Smith, and Raneem Qaddoura, editors, *Applications of Evolutionary Computation - 26th European Conference, EvoApplications 2023, Held as Part of EvoStar 2023, Brno, Czech Republic, April 12-14, 2023, Proceedings*, volume 13989 of *Lecture Notes in Computer Science*, pages 380–395. Springer, 2023.
- [151] Manuel López-Ibáñez, Jürgen Branke, and Luís Paquete. Reproducibility in evolutionary computation. *ACM Transactions on Evolutionary Learning and Optimization*, 1(4):14:1–14:21, 2021.
- [152] Manuel López-Ibáñez, Jérémie Dubois-Lacoste, Leslie Pérez Cáceres, Mauro Bittaratti, and Thomas Stützle. The irace package: Iterated racing for automatic algorithm configuration. *Operations Research Perspectives*, 3:43–58, 2016.
- [153] Manuel López-Ibáñez and Thomas Stützle. The automatic design of multiobjective ant colony optimization algorithms. *IEEE Transactions on Evolutionary Computation*, 16(6):861–875, 2012.
- [154] Ilya Loshchilov. A computationally efficient limited memory CMA-ES for large scale optimization. In Dirk V. Arnold, editor, *Genetic and Evolutionary Computation Conference, GECCO '14, Vancouver, BC, Canada, July 12-16, 2014*, pages 397–404. ACM, 2014.
- [155] Ilya Loshchilov, Marc Schoenauer, and Michèle Sebag. Bi-population CMA-ES algorithms with surrogate models and line searches. In Christian Blum and Enrique Alba, editors, *Genetic and Evolutionary Computation Conference, GECCO '13, Amsterdam, The Netherlands, July 6-10, 2013, Companion Material Proceedings*, pages 1177–1184. ACM, 2013.
- [156] Martin Lukasiewicz, Michael Glaß, Felix Reimann, and Jürgen Teich. Opt4J: a modular framework for meta-heuristic optimization. In Natalio Krasnogor and Pier Luca Lanzi, editors, *13th Annual Genetic and Evolutionary Computation Conference, GECCO 2011, Proceedings, Dublin, Ireland, July 12-16, 2011*, pages 1723–1730. ACM, 2011.
- [157] Scott M. Lundberg and Su-In Lee. A unified approach to interpreting model predictions. In Isabelle Guyon, Ulrike von Luxburg, Samy Bengio, Hanna M. Wallach, Rob Fergus, S. V. N. Vishwanathan, and Roman Garnett, editors, *Advances in Neural Information Processing Systems 30: Annual Conference on*

Bibliography

- Neural Information Processing Systems 2017, December 4-9, 2017, Long Beach, CA, USA*, pages 4765–4774, 2017.
- [158] Henry B Mann and Donald R Whitney. On a test of whether one of two random variables is stochastically larger than the other. *The annals of mathematical statistics*, pages 50–60, 1947.
- [159] M. A. Marhuenda, Y. Marhuenda, and D. Morales. Uniformity tests under quantile categorization. *Kybernetes*, 34(6):888–901, 2005.
- [160] Oded Maron and Andrew W. Moore. The racing algorithm: Model selection for lazy learners. *Artificial Intelligence Review*, 11(1-5):193–225, 1997.
- [161] Frank J. Massey Jr. The Kolmogorov-Smirnov test for goodness of fit. *Journal of the American statistical Association*, 46(253):68–78, 1951.
- [162] Jorge Maturana, Álvaro Fialho, Frédéric Saubion, Marc Schoenauer, Frédéric Lardeux, and Michèle Sebag. Adaptive operator selection and management in evolutionary algorithms. In Youssef Hamadi, Eric Monfroy, and Frédéric Saubion, editors, *Autonomous Search*, pages 161–189. Springer, 2012.
- [163] Leland McInnes, John Healy, Nathaniel Saul, and Lukas Großberger. UMAP: uniform manifold approximation and projection. *Journal of Open Source Software*, 3(29):861, 2018.
- [164] Olaf Mersmann, Bernd Bischl, Heike Trautmann, Mike Preuss, Claus Weihs, and Günter Rudolph. Exploratory landscape analysis. In Natalio Krasnogor and Pier Luca Lanzi, editors, *13th Annual Genetic and Evolutionary Computation Conference, GECCO 2011, Proceedings, Dublin, Ireland, July 12-16, 2011*, pages 829–836. ACM, 2011.
- [165] Olaf Mersmann, Mike Preuss, and Heike Trautmann. Benchmarking evolutionary algorithms: Towards exploratory landscape analysis. In Robert Schaefer, Carlos Cotta, Joanna Kolodziej, and Günter Rudolph, editors, *Parallel Problem Solving from Nature - PPSN XI, 11th International Conference, Kraków, Poland, September 11-15, 2010, Proceedings, Part I*, volume 6238 of *Lecture Notes in Computer Science*, pages 73–82. Springer, 2010.
- [166] Laurent Meunier, Herilalaina Rakotoarison, Pak-Kan Wong, Baptiste Rozière, Jérémy Rapin, Olivier Teytaud, Antoine Moreau, and Carola Doerr. Black-box optimization revisited: Improving algorithm selection wizards through massive benchmarking. *IEEE Transactions on Evolutionary Computation*, 26(3):490–500, 2022.
- [167] Madalina-Andreea Mitran, Anna V. Kononova, Fabio Caraffini, and Daniela Zaharie. Patterns of convergence and bound constraint violation in differential evolution on SBOX-COST benchmarking suite. In Sara Silva and Luís Paquete, editors, *Companion Proceedings of the Conference on Genetic and Evolutionary*

- Computation, GECCO 2023, Companion Volume, Lisbon, Portugal, July 15-19, 2023*, pages 2337–2345. ACM, 2023.
- [168] Domingo Morales, Leandro Pardo, María C. Pardo, and Igor Vajda. Limit laws for disparities of spacings. *Journal of Nonparametric Statistics*, 15(3):325–342, 2003.
 - [169] Patrick A. P. Moran. The random division of an interval—part ii. *Journal of the Royal Statistical Society. Series B (Methodological)*, 13(1):147–150, 1951.
 - [170] Mario A. Muñoz, Michael Kirley, and Saman K. Halgamuge. Exploratory landscape analysis of continuous space optimization problems using information content. *IEEE Transactions on Evolutionary Computation*, 19(1):74–87, 2015.
 - [171] Mario A. Muñoz and Kate Smith-Miles. Effects of function translation and dimensionality reduction on landscape analysis. In *IEEE Congress on Evolutionary Computation, CEC 2015, Sendai, Japan, May 25-28, 2015*, pages 1336–1342. IEEE, 2015.
 - [172] Mario A. Muñoz and Kate Smith-Miles. Generating new space-filling test instances for continuous black-box optimization. *Evol. Comput.*, 28(3):379–404, 2020.
 - [173] Mario A. Muñoz and Kate Amanda Smith-Miles. Performance analysis of continuous black-box optimization algorithms via footprints in instance space. *Evolutionary computation*, 25(4), 2017.
 - [174] Mario A. Muñoz, Yuan Sun, Michael Kirley, and Saman K. Halgamuge. Algorithm selection for black-box continuous optimization problems: A survey on methods and challenges. *Information Sciences*, 317:224–245, 2015.
 - [175] Mario Andrés Muñoz, Michael Kirley, and Kate Smith-Miles. Analyzing randomness effects on the reliability of exploratory landscape analysis. *Natural Computing*, 21(2):131–154, 2022.
 - [176] Aneta Neumann, Frank Neumann, and Chao Qian. Evolutionary submodular optimisation. In Krzysztof Krawiec, editor, *GECCO '21: Genetic and Evolutionary Computation Conference, Companion Volume, Lille, France, July 10-14, 2021*, pages 918–940. ACM, 2021.
 - [177] Frank Neumann, Aneta Neumann, Chao Qian, Anh Viet Do, Jacob de Nobel, Diederick Vermetten, Saba Sadeghi Ahouei, Furong Ye, Hao Wang, and Thomas Bäck. Benchmarking algorithms for submodular optimization problems using IOHProfiler. In *IEEE Congress on Evolutionary Computation, CEC 2023, Chicago, IL, USA, July 1-5, 2023*, pages 1–9. IEEE, 2023.
 - [178] Jerzy Neyman. Smooth test for goodness of fit. *Scandinavian Actuarial Journal*, 1937(3-4):149–199, 1937.

Bibliography

- [179] Harald Niederreiter. Discrepancy and convex programming. *Annali di matematica pura ed applicata*, 93:89–97, 1972.
- [180] Ana Nikolikj, Carola Doerr, and Tome Eftimov. RF+clust for leave-one-problem-out performance prediction. In João Correia, Stephen L. Smith, and Raneem Qaddoura, editors, *Applications of Evolutionary Computation - 26th European Conference, EvoApplications 2023, Held as Part of EvoStar 2023, Brno, Czech Republic, April 12-14, 2023, Proceedings*, volume 13989 of *Lecture Notes in Computer Science*, pages 285–301. Springer, 2023.
- [181] Eric W. Noreen. *Computer-Intensive Methods for Testing Hypotheses: An Introduction*. Wiley, 1989.
- [182] Tom Packebusch and Stephan Mertens. Low autocorrelation binary sequences. *Journal of Physics A: Mathematical and Theoretical*, 49(16):165001, 2016.
- [183] László Pál. Benchmarking a hybrid multi level single linkage algorithm on the bbob noiseless testbed. In Christian Blum and Enrique Alba, editors, *Genetic and Evolutionary Computation Conference, GECCO '13, Amsterdam, The Netherlands, July 6-10, 2013, Companion Material Proceedings*, pages 1145–1152. ACM, 2013.
- [184] Maria C. Pardo. A test for uniformity based on informational energy. *Statistical Papers*, 44:521–534, 2003.
- [185] Karl Pearson. Das Fehlergesetz und Seine Verallgemeinerungen Durch Fechner und Pearson. A Rejoinder. *Biometrika*, 4(1-2):169–212, 06 1905.
- [186] Fabian Pedregosa, Gaël Varoquaux, Alexandre Gramfort, Vincent Michel, Bertrand Thirion, Olivier Grisel, Mathieu Blondel, Peter Prettenhofer, Ron Weiss, Vincent Dubourg, Jake VanderPlas, Alexandre Passos, David Cournapeau, Matthieu Brucher, Matthieu Perrot, and Edouard Duchesnay. Scikit-learn: Machine learning in python. *Journal of Machine Learning Research*, 12:2825–2830, 2011.
- [187] Alejandro Piad-Morffis, Suilan Estevez-Velarde, Antonio Bolufé Röhrler, James Montgomery, and Stephen Chen. Evolution strategies with threshold convergence. In *IEEE Congress on Evolutionary Computation, CEC 2015, Sendai, Japan, May 25-28, 2015*, pages 2097–2104. IEEE, 2015.
- [188] Maxim Pikalov and Vladimir Mironovich. Parameter tuning for the $(1 + (\lambda, \lambda))$ genetic algorithm using landscape analysis and machine learning. In Juan Luis Jiménez Laredo, José Ignacio Hidalgo, and Kehinde O. Babaagba, editors, *Applications of Evolutionary Computation - 25th European Conference, EvoApplications 2022, Held as Part of EvoStar 2022, Madrid, Spain, April 20-22, 2022, Proceedings*, volume 13224 of *Lecture Notes in Computer Science*, pages 704–720. Springer, 2022.

-
- [189] Petr Posik. Bbob-benchmarking the DIRECT global optimization algorithm. In Franz Rothlauf, editor, *Genetic and Evolutionary Computation Conference, GECCO 2009, Proceedings, Montreal, Québec, Canada, July 8-12, 2009, Companion Material*, pages 2315–2320. ACM, 2009.
- [190] Michael J. D. Powell. An efficient method for finding the minimum of a function of several variables without calculating derivatives. *The Computer Journal*, 7(2):155–162, 01 1964.
- [191] Michael J. D. Powell. *A direct search optimization method that models the objective and constraint functions by linear interpolation*. Springer, 1994.
- [192] Raphael Patrick Prager and Heike Trautmann. Pflacco: Feature-based landscape analysis of continuous and constrained optimization problems in python. *Evolutionary Computation*, pages 1–25, 2023.
- [193] Kenneth Price, Rainer M Storn, and Jouni A Lampinen. *Differential evolution: a practical approach to global optimization*. Springer Science & Business Media, 2006.
- [194] Ronald Pyke. Spacings. *Journal of the Royal Statistical Society: Series B (Methodological)*, 27(3):395–436, 1965.
- [195] A. Kai Qin, Vicky Ling Huang, and Ponnuthurai N. Suganthan. Differential evolution algorithm with strategy adaptation for global numerical optimization. *IEEE Transactions on Evolutionary Computation*, 13(2):398–417, 2009.
- [196] Charles P. Quesenberry and F.L. Miller Jr. Power studies of some tests for uniformity. *Journal of Statistical Computation and Simulation*, 5(3):169–191, 1977.
- [197] Shahryar Rahnamayan, Hamid R. Tizhoosh, and Magdy M. A. Salama. Opposition-based differential evolution algorithms. In *IEEE International Conference on Evolutionary Computation, CEC 2006, part of WCCI 2006, Vancouver, BC, Canada, 16-21 July 2006*, pages 2010–2017. IEEE, 2006.
- [198] David Criado Ramón. Python advanced differential evolution (pyade). <https://github.com/xKuZz/pyade>, 2019. Accessed on 31/12/2021.
- [199] Jérémy Rapin, Marcus Gallagher, Pascal Kerschke, Mike Preuss, and Olivier Teytaud. Exploring the MLDA benchmark on the nevergrad platform. In Manuel López-Ibáñez, Anne Auger, and Thomas Stützle, editors, *Proceedings of the Genetic and Evolutionary Computation Conference Companion, GECCO 2019, Prague, Czech Republic, July 13-17, 2019*, pages 1888–1896. ACM, 2019.
- [200] Jeremy Rapin and Olivier Teytaud. Nevergrad - A gradient-free optimization platform. <https://GitHub.com/FacebookResearch/Nevergrad>, 2018.
- [201] Ingo Rechenberg. *Evolutionssstrategie*. Friedrich Fromman Verlag (Günther Holzboog KG), Stuttgart, 1973.

Bibliography

- [202] Quentin Renau, Carola Doerr, Johann Dréo, and Benjamin Doerr. Exploratory landscape analysis is strongly sensitive to the sampling strategy. In Thomas Bäck, Mike Preuss, André H. Deutz, Hao Wang, Carola Doerr, Michael T. M. Emmerich, and Heike Trautmann, editors, *Parallel Problem Solving from Nature - PPSN XVI - 16th International Conference, PPSN 2020, Leiden, The Netherlands, September 5-9, 2020, Proceedings, Part II*, volume 12270 of *Lecture Notes in Computer Science*, pages 139–153. Springer, 2020.
- [203] Quentin Renau, Johann Dréo, Carola Doerr, and Benjamin Doerr. Expressiveness and robustness of landscape features. In Manuel López-Ibáñez, Anne Auger, and Thomas Stützle, editors, *Proceedings of the Genetic and Evolutionary Computation Conference Companion, GECCO 2019, Prague, Czech Republic, July 13-17, 2019*, pages 2048–2051. ACM, 2019.
- [204] Quentin Renau, Johann Dréo, Carola Doerr, and Benjamin Doerr. Towards explainable exploratory landscape analysis: Extreme feature selection for classifying BBOB functions. In Pedro A. Castillo and Juan Luis Jiménez Laredo, editors, *Applications of Evolutionary Computation - 24th International Conference, EvoApplications 2021, Held as Part of EvoStar 2021, Virtual Event, April 7-9, 2021, Proceedings*, volume 12694 of *Lecture Notes in Computer Science*, pages 17–33. Springer, 2021.
- [205] John R. Rice. The algorithm selection problem. *Advances in Computers*, 15:65–118, 1976.
- [206] André Luis Debiasio Rossi, André Carlos Ponce de Leon Ferreira de Carvalho, Carlos Soares, and Bruno Feres de Souza. Metastream: A meta-learning based method for periodic algorithm selection in time-changing data. *Neurocomputing*, 127:52–64, 2014.
- [207] Thomas J. Santner, Brian J. Williams, and William I. Notz. *The Design and Analysis of Computer Experiments*. Springer Series in Statistics. Springer, Springer, 2003.
- [208] Maria Laura Santoni, Elena Raponi, Renato De Leone, and Carola Doerr. Comparison of high-dimensional bayesian optimization algorithms on BBOB. *CoRR*, abs/2303.00890, 2023.
- [209] Lennart Schäpermeier, Christian Grimme, and Pascal Kerschke. To boldly show what no one has seen before: A dashboard for visualizing multi-objective landscapes. In Hisao Ishibuchi, Qingfu Zhang, Ran Cheng, Ke Li, Hui Li, Handing Wang, and Aimin Zhou, editors, *Evolutionary Multi-Criterion Optimization - 11th International Conference, EMO 2021, Shenzhen, China, March 28-31, 2021, Proceedings*, volume 12654 of *Lecture Notes in Computer Science*, pages 632–644. Springer, 2021.
- [210] Dominik Schröder, Diederick Vermetten, Hao Wang, Carola Doerr, and Thomas Bäck. Chaining of numerical black-box algorithms: Warm-starting and switching points. *CoRR*, abs/2204.06539, 2022.

-
- [211] Michael A. Schumer and Kenneth Steiglitz. Adaptive step size random search. *IEEE Transactions on Automatic Control*, 13:270–276, 1968.
- [212] David F. Shanno. Conditioning of quasi-newton methods for function minimization. *Mathematics of Computation*, 24(111):647–656, 1970.
- [213] Claude Elwood Shannon. A mathematical theory of communication. *The Bell system technical journal*, 27(3):379–423, 1948.
- [214] Samuel Sanford Shapiro and Martin B Wilk. An analysis of variance test for normality (complete samples). *Biometrika*, 52(3/4):591–611, 1965.
- [215] Lloyd S. Shapley. A value for n-person games. In H. Kuhn and A. Tucker, editors, *Contributions to the Theory of Games II*, pages 307–317. Princeton University Press, 1953.
- [216] Urban Škvorc, Tome Eftimov, and Peter Korošec. Understanding the problem space in single-objective numerical optimization using exploratory landscape analysis. *Applied Soft Computing*, 90:106138, 2020.
- [217] Kate A Smith-Miles. Cross-disciplinary perspectives on meta-learning for algorithm selection. *ACM Computing Surveys (CSUR)*, 41(1):1–25, 2009.
- [218] Kenneth Sörensen. Metaheuristics - the metaphor exposed. *International Transactions in Operational Research*, 22(1):3–18, 2015.
- [219] Rainer Storn and Kenneth Price. Differential evolution – a simple and efficient heuristic for global optimization over continuous spaces. *Journal of Global Optimization*, 11(4):341–359, 1997.
- [220] Genaro Sucarrat. AutoSEARCH: General-to-Specific (GETS) Modelling. R package version 1.5.
- [221] Ponnuthurai Nagaratnam Suganthan, Mostafa Ali, J. J. Liang, B. Y. Qu, Cai Tong Yue, and Kenneth Price. Competition on single objective bound constrained numerical optimization. <https://github.com/P-N-Suganthan/2020-Bound-Constrained-Opt-Benchmark>, 2020.
- [222] T. Swartz. Goodness-of-fit tests using kullback-leibler information. *Communications in Statistics: Theory and Methods*, 21:711–729, 1992.
- [223] Ryoji Tanabe and Alex Fukunaga. Success-history based parameter adaptation for differential evolution. In *Proceedings of the IEEE Congress on Evolutionary Computation, CEC 2013, Cancun, Mexico, June 20-23, 2013*, pages 71–78. IEEE, 2013.
- [224] Ryoji Tanabe and Alex S. Fukunaga. Improving the search performance of SHADE using linear population size reduction. In *Proceedings of the IEEE Congress on Evolutionary Computation, CEC 2014, Beijing, China, July 6-11, 2014*, pages 1658–1665. IEEE, 2014.

Bibliography

- [225] Dirk Thierens and Tobias van Driessel. A benchmark generator of tree decomposition mk landscapes. In Krzysztof Krawiec, editor, *GECCO '21: Genetic and Evolutionary Computation Conference, Companion Volume, Lille, France, July 10-14, 2021*, pages 229–230. ACM, 2021.
- [226] Emanuel Todorov, Tom Erez, and Yuval Tassa. MuJoCo: A physics engine for model-based control. In *2012 IEEE/RSJ International Conference on Intelligent Robots and Systems, IROS 2012, Vilamoura, Algarve, Portugal, October 7-12, 2012*, pages 5026–5033. IEEE, 2012.
- [227] Tea Tusar, Dima Brockhoff, and Nikolaus Hansen. Mixed-integer benchmark problems for single- and bi-objective optimization. In Anne Auger and Thomas Stützle, editors, *Proceedings of the Genetic and Evolutionary Computation Conference, GECCO 2019, Prague, Czech Republic, July 13-17, 2019*, pages 718–726. ACM, 2019.
- [228] Tea Tusar, Dima Brockhoff, Nikolaus Hansen, and Anne Auger. COCO: the bi-objective black box optimization benchmarking (bbob-biobj) test suite. *CoRR*, abs/1604.00359, 2016.
- [229] Tjeerd van Campen, Herbert Hamers, Bart Husslage, and Roy Lindelauf. A new approximation method for the shapley value applied to the WTC 9/11 terrorist attack. *Social Network Analysis and Mining*, 8(1):3:1–3:12, 2018.
- [230] Laurens van der Maaten and Geoffrey Hinton. Visualizing data using t-SNE. *Journal of Machine Learning Research*, 9(86):2579–2605, 2008.
- [231] Jan N. van Rijn, Geoffrey Holmes, Bernhard Pfahringer, and Joaquin Vanschoren. Having a blast: Meta-learning and heterogeneous ensembles for data streams. In Charu C. Aggarwal, Zhi-Hua Zhou, Alexander Tuzhilin, Hui Xiong, and Xindong Wu, editors, *2015 IEEE International Conference on Data Mining, ICDM 2015, Atlantic City, NJ, USA, November 14-17, 2015*, pages 1003–1008. IEEE Computer Society, 2015.
- [232] Sander van Rijn, Carola Doerr, and Thomas Bäck. Towards an adaptive CMA-ES configurator. In Anne Auger, Carlos M. Fonseca, Nuno Lourenço, Penousal Machado, Luís Paquete, and L. Darrell Whitley, editors, *Parallel Problem Solving from Nature - PPSN XV - 15th International Conference, Coimbra, Portugal, September 8-12, 2018, Proceedings, Part I*, volume 11101 of *Lecture Notes in Computer Science*, pages 54–65. Springer, 2018.
- [233] Sander van Rijn, Hao Wang, Matthijs van Leeuwen, and Thomas Bäck. Evolving the structure of evolution strategies. In *2016 IEEE Symposium Series on Computational Intelligence, SSCI 2016, Athens, Greece, December 6-9, 2016*, pages 1–8. IEEE, 2016.
- [234] Sander van Rijn, Hao Wang, Bas van Stein, and Thomas Bäck. Algorithm configuration data mining for CMA evolution strategies. In Peter A. N. Bosman,

- editor, *Proceedings of the Genetic and Evolutionary Computation Conference, GECCO 2017, Berlin, Germany, July 15-19, 2017*, pages 737–744. ACM, 2017.
- [235] Bas van Stein, Fabio Caraffini, and Anna V. Kononova. Emergence of structural bias in differential evolution. In Krzysztof Krawiec, editor, *GECCO '21: Genetic and Evolutionary Computation Conference, Companion Volume, Lille, France, July 10-14, 2021*, pages 1234–1242. ACM, 2021.
- [236] Bas van Stein, Diederick Vermetten, Fabio Caraffini, and Anna V. Kononova. Deep BIAS: detecting structural bias using explainable AI. In Sara Silva and Luís Paquete, editors, *Companion Proceedings of the Conference on Genetic and Evolutionary Computation, GECCO 2023, Companion Volume, Lisbon, Portugal, July 15-19, 2023*, pages 455–458. ACM, 2023.
- [237] Joaquin Vanschoren, Jan N. van Rijn, Bernd Bischl, and Luís Torgo. Openml: networked science in machine learning. *SIGKDD Explor.*, 15(2):49–60, 2013.
- [238] Konstantinos Varelas, Ouassim Ait ElHara, Dimo Brockhoff, Nikolaus Hansen, Duc Manh Nguyen, Tea Tusar, and Anne Auger. Benchmarking large-scale continuous optimizers: The bbob-largescale testbed, a COCO software guide and beyond. *Applied Soft Computing*, 97(Part):106737, 2020.
- [239] Oldrich Vasicek. A test for normality based on sample entropy. *Journal of the Royal Statistical Society. Series B (Methodological)*, 38(1):54–59, 1976.
- [240] Diederick Vermetten, Fabio Caraffini, Anna V. Kononova, and Thomas Bäck. Modular differential evolution. In Sara Silva and Luís Paquete, editors, *Proceedings of the Genetic and Evolutionary Computation Conference, GECCO 2023, Lisbon, Portugal, July 15-19, 2023*, pages 864–872. ACM, 2023.
- [241] Diederick Vermetten, Anna V. Kononova, Fabio Caraffini, Hao Wang, and Thomas Bäck. Is there anisotropy in structural bias? In Krzysztof Krawiec, editor, *GECCO '21: Genetic and Evolutionary Computation Conference, Companion Volume, Lille, France, July 10-14, 2021*, pages 1243–1250. ACM, 2021.
- [242] Diederick Vermetten, Manuel López-Ibáñez, Olaf Mersmann, Richard Allmendinger, and Anna V. Kononova. Analysis of modular CMA-ES on strict box-constrained problems in the SBOX-COST benchmarking suite. In Sara Silva and Luís Paquete, editors, *Companion Proceedings of the Conference on Genetic and Evolutionary Computation, GECCO 2023, Companion Volume, Lisbon, Portugal, July 15-19, 2023*, pages 2346–2353. ACM, 2023.
- [243] Diederick Vermetten, Sander van Rijn, Thomas Bäck, and Carola Doerr. Online selection of CMA-ES variants. In Anne Auger and Thomas Stützle, editors, *Proceedings of the Genetic and Evolutionary Computation Conference, GECCO 2019, Prague, Czech Republic, July 13-17, 2019*, pages 951–959. ACM, 2019.

Bibliography

- [244] Diederick Vermetten, Bas van Stein, Fabio Caraffini, Leandro L. Minku, and Anna V. Kononova. BIAS: A toolbox for benchmarking structural bias in the continuous domain. *IEEE Transactions on Evolutionary Computation*, 26(6):1380–1393, 2022.
- [245] Diederick Vermetten, Hao Wang, Thomas Bäck, and Carola Doerr. Towards dynamic algorithm selection for numerical black-box optimization: investigating BBOB as a use case. In Carlos Artemio Coello Coello, editor, *GECCO '20: Genetic and Evolutionary Computation Conference, Cancún Mexico, July 8-12, 2020*, pages 654–662. ACM, 2020.
- [246] Diederick Vermetten, Hao Wang, Carola Doerr, and Thomas Bäck. Integrated vs. sequential approaches for selecting and tuning CMA-ES variants. In Carlos Artemio Coello Coello, editor, *GECCO '20: Genetic and Evolutionary Computation Conference, Cancún Mexico, July 8-12, 2020*, pages 903–912. ACM, 2020.
- [247] Diederick Vermetten, Hao Wang, Manuel López-Ibáñez, Carola Doerr, and Thomas Bäck. Analyzing the impact of undersampling on the benchmarking and configuration of evolutionary algorithms. In Jonathan E. Fieldsend and Markus Wagner, editors, *GECCO '22: Genetic and Evolutionary Computation Conference, Boston, Massachusetts, USA, July 9 - 13, 2022*, pages 867–875. ACM, 2022.
- [248] Diederick Vermetten, Hao Wang, Kevin Sim, and Emma Hart. To switch or not to switch: Predicting the benefit of switching between algorithms based on trajectory features. In João Correia, Stephen L. Smith, and Raneem Qaddoura, editors, *Applications of Evolutionary Computation - 26th European Conference, EvoApplications 2023, Held as Part of EvoStar 2023, Brno, Czech Republic, April 12-14, 2023, Proceedings*, volume 13989 of *Lecture Notes in Computer Science*, pages 335–350. Springer, 2023.
- [249] Diederick Vermetten, Furong Ye, Thomas Bäck, and Carola Doerr. MA-BBOB: A problem generator for black-box optimization using affine combinations and shifts. *CoRR*, abs/2312.11083, 2023.
- [250] Diederick Vermetten, Furong Ye, Thomas Bäck, and Carola Doerr. MA-BBOB: many-affine combinations of BBOB functions for evaluating automl approaches in noiseless numerical black-box optimization contexts. In Aleksandra Faust, Roman Garnett, Colin White, Frank Hutter, and Jacob R. Gardner, editors, *International Conference on Automated Machine Learning, 12-15 November 2023, Hasso Plattner Institute, Potsdam, Germany*, volume 224 of *Proceedings of Machine Learning Research*, pages 7/1–14. PMLR, 2023.
- [251] Diederick Vermetten, Furong Ye, and Carola Doerr. Using affine combinations of BBOB problems for performance assessment. In Sara Silva and Luís Paquete, editors, *Proceedings of the Genetic and Evolutionary Computation Conference, GECCO 2023, Lisbon, Portugal, July 15-19, 2023*, pages 873–881. ACM, 2023.

-
- [252] Costas Voglis, Grigoris S. Piperagkas, Konstantinos E. Parsopoulos, Dimitris G. Papageorgiou, and Isaac E. Lagaris. MEMPSODE: an empirical assessment of local search algorithm impact on a memetic algorithm using noiseless testbed. In Terence Soule and Jason H. Moore, editors, *Genetic and Evolutionary Computation Conference, GECCO '12, Philadelphia, PA, USA, July 7-11, 2012, Companion Material Proceedings*, pages 245–252. ACM, 2012.
- [253] Urban Škvorc, Tome Eftimov, and Peter Korošec. The effect of sampling methods on the invariance to function transformations when using exploratory landscape analysis. In *IEEE Congress on Evolutionary Computation, CEC 2021, Kraków, Poland, June 28 - July 1, 2021*, pages 1139–1146. IEEE, 2021.
- [254] Hao Wang, Michael Emmerich, and Thomas Bäck. Mirrored orthogonal sampling for covariance matrix adaptation evolution strategies. *Evolutionary Computation*, 27(4):699–725, 2019.
- [255] Hao Wang, Diederick Vermetten, Furong Ye, Carola Doerr, and Thomas Bäck. IOAnalyzer: Detailed performance analyses for iterative optimization heuristics. *ACM Transactions on Evolutionary Learning and Optimization*, 2(1):3:1–3:29, 2022.
- [256] Thomas Weise, Yan Chen, Xinlu Li, and Zhize Wu. Selecting a diverse set of benchmark instances from a tunable model problem for black-box discrete optimization algorithms. *Applied Soft Computing*, 92:106269, 2020.
- [257] Thomas Weise, Stefan Niemczyk, Hendrik Skubch, Roland Reichle, and Kurt Geihs. A tunable model for multi-objective, epistatic, rugged, and neutral fitness landscapes. In Conor Ryan and Maarten Keijzer, editors, *Genetic and Evolutionary Computation Conference, GECCO 2008, Proceedings, Atlanta, GA, USA, July 12-16, 2008*, pages 795–802. ACM, 2008.
- [258] Thomas Weise and Zijun Wu. Difficult features of combinatorial optimization problems and the tunable w-model benchmark problem for simulating them. In Hernán E. Aguirre and Keiki Takadama, editors, *Proceedings of the Genetic and Evolutionary Computation Conference Companion, GECCO 2018, Kyoto, Japan, July 15-19, 2018*, pages 1769–1776. ACM, 2018.
- [259] L. Darrell Whitley, Francisco Chicano, and Brian W. Goldman. Gray box optimization for mk landscapes (NK landscapes and MAX-kSAT). *Evolutionary Computation*, 24(3):491–519, 2016.
- [260] Daan Wierstra, Tom Schaul, Jan Peters, and Jürgen Schmidhuber. Natural evolution strategies. In *Proceedings of the IEEE Congress on Evolutionary Computation, CEC 2008, June 1-6, 2008, Hong Kong, China*, pages 3381–3387. IEEE, 2008.
- [261] Lin Xu, Frank Hutter, Holger H. Hoos, and Kevin Leyton-Brown. Satzilla: Portfolio-based algorithm selection for SAT. *J. Artif. Intell. Res.*, 32:565–606, 2008.

Bibliography

- [262] Lin Xu, Frank Hutter, Holger H. Hoos, and Kevin Leyton-Brown. Evaluating component solver contributions to portfolio-based algorithm selectors. In *Proceedings of Theory and Applications of Satisfiability Testing (SAT'12)*, volume 7317 of *LNCS*, pages 228–241. Springer, 2012.
- [263] Danial Yazdani, Mohammad Nabi Omidvar, Delaram Yazdani, Kalyanmoy Deb, and Amir H. Gandomi. GNBG: A generalized and configurable benchmark generator for continuous numerical optimization. *CoRR*, abs/2312.07083, 2023.
- [264] Furong Ye, Carola Doerr, Hao Wang, and Thomas Bäck. Automated configuration of genetic algorithms by tuning for anytime performance. *IEEE Transactions on Evolutionary Computation*, 26(6):1526–1538, 2022.
- [265] Jin Zhang. Powerful goodness-of-fit tests based on the likelihood ratio. *Journal of the Royal Statistical Society, Series B*, 64:281–294, 2002.
- [266] Jingqiao Zhang and Arthur C. Sanderson. JADE: adaptive differential evolution with optional external archive. *IEEE Transactions on Evolutionary Computation*, 13(5):945–958, 2009.

Acronyms

AOCC	Area Over the Convergence Curve
AOC	Area Over the (ECDF) Curve
AUC	Area Under the (ECDF) Curve
BBOB	Black-Box Optimization Benchmarking
CMA-ES	Covariance-Matrix Adaptation Evolution Strategy
COCO	COmparing Continuous Optimizers
DE	Differential Evolution
DynAS	Dynamic Algorithm Selection
ECDF	Empirical Cumulative Distribution Function
ERT	Expected Running time
ELA	Exploratory Landscape Analysis
IOH	Iterative Optimization Heuristic
KS	Kolmogorov-Smirnov
MA-BBOB	Many-Affine BBOB
MIP-EGO	Mixed-Integer Parallel Efficient Global Optimization
PAR	Penalized Average Running time
PCA	Principal Component Analysis
SB	Structural Bias
SMAC	Sequential Model-based Algorithm Configuration
TSNE	T-distributed Stochastic Neighbor Embedding
UMAP	Uniform Manifold Approximation Projection
VBS	Virtual Best Solver

