Sebastian Wild

University of Liverpool
School of Electrical Engineering, Electronics & Computer Science
Department of Computer Science
Ashton Building, Ashton Street
Liverpool L69 3BX, United Kingdom

wild@liverpool.ac.uk

November 28, 2023

Employment

since 2023 **Senior Lecturer** (Associate Professor)
2019–2023 **Lecturer** (Assistant Professor)
Department of Computer Science · University of Liverpool

2017–2019 **Postdoctoral Fellow and Sessional Instructor**
David R. Cheriton School of Computer Science · University of Waterloo

2012–2017 *Wissenschaftlicher Mitarbeiter* (research assistant)
Department of Computer Science · University of Kaiserslautern

Education

Dr. rer. nat.
(equiv. to **Ph. D.**)
Department of Computer Science · University of Kaiserslautern · 2016

Dissertation

Title: *Dual-Pivot Quicksort and Beyond: Analysis of Multiway Partitioning and Its Practical Potential*

Supervisor: Prof. Dr. Markus Nebel
2nd Reviewer: Prof. Robert Sedgewick (Princeton University)
3rd Reviewer: Univ.-Prof. Dr. Martin Dietzfelbinger (TU Ilmenau)

M. Sc. Department of Computer Science · University of Kaiserslautern · 2012

B. Sc. Department of Computer Science · University of Kaiserslautern · 2010

Abitur
(equiv. to **A-levels**)
Kurfürst-Ruprecht-Gymnasium · Neustadt a. d. Weinstraße · 2006

Publications

Peer-Reviewed Conference Proceedings

[c20] *Finding the saddlepoint faster than sorting*
Justin Dallant, Frederik Haagensen, Riko Jacob, László Kozma, and Sebastian Wild
Symposium on Simplicity in Algorithms (SOSA) 2024
to be presented

[c19] *Funnelselect: Cache-oblivious multiple selection*
Gerth Stølting Brodal and Sebastian Wild
European Symposium on Algorithms (ESA) 2023
I. L. Gørtz, M. Farach-Colton, S. Puglisi, G. Herman (eds): ESA 2023, LIPIcs 274, pp 25:1–25:17

[c18] *RNA secondary structures: from ab initio prediction to better compression, and back*
Evarista Onokpasa, Sebastian Wild, and Prudence W. H. Wong
Data Compression Conference (DCC) 2023
DCC 2023, IEEE, pp 278–287

[c17] *Multiway Powersort*
William Cawley Gelling, Markus Nebel, Benjamin Smith, and Sebastian Wild
Symposium on Algorithm Engineering and Experiments (ALENEX) 2023
ALENEX 2023, ACM, pp 190–200

[c16] *Randomized Communication and Implicit Graph Representations*
Nathaniel Harms, Sebastian Wild, and Viktor Zamaraev
Symposium on Theory of Computing (STOC) 2022
STOC 2022, ACM, pp 1220–1233

[c15] *Towards the 5/6-Density Conjecture of Pinwheel Scheduling*
Leszek Gąsieniec, Benjamin Smith, and Sebastian Wild
Symposium on Algorithm Engineering and Experiments (ALENEX) 2022
C. A. Phillips and B. Speckmann (eds.): ALENEX 2022, pp 91–103

[c14] *Succinct Euler-Tour Trees*
Travis Gagie and Sebastian Wild
Canadian Conference on Computational Geometry (CCCG) 2021
M. He and D. Sheehy (eds.): CCCG 2021, pp 368–376

[c13] *Hypersuccinct Trees – New universal tree source codes for optimal compressed tree data
structures and range minima*
J. Ian Munro, Patrick K. Nicholson, Louisa Seelbach Benkner, and Sebastian Wild
European Symposium on Algorithms (ESA) 2021
P. Mutzel, R. Pagh, G. Herman (eds.): ESA 2021, LIPIcs 204, pp 70:1–70:18

[c12] *Lazy Search Trees*
Bryce Sandlund and Sebastian Wild
Foundations of Computer Science (FOCS) 2020
S. Irani (ed.): FOCS 2020, IEEE, pp 704–715

[c11] *Distance Oracles for Interval Graphs via Breadth-First Rank/Select in Succinct Trees*
Meng He, J. Ian Munro, Yakov Nekrich, Sebastian Wild, and Kaiyu Wu
International Symposium on Algorithms and Computation (ISAAC) 2020
Y. Cao, SW. Cheng, M. Li (eds.): ISAAC 2020, LIPIcs 181, pp 25:1–25:18

[c10] *Efficient Second-Order Shape-Constrained Function Fitting*
David Durfee, Yu Gao, Anup B. Rao, and Sebastian Wild
Algorithms and Data Structures Symposium (WADS) 2019
Z. Friggstad, JR. Sack, M. Salavatipour (eds.): WADS 2019, LNCS 11646, Springer, pp 395–408

[c9] *Sesquickselect: One and a half pivots for cache-efficient selection*
Conrado Martínez, Markus E. Nebel, and Sebastian Wild
Meeting on Analytic Algorithmics and Combinatorics (ANALCO) 2019
M. Mishna and J.I. Munro (eds.): ANALCO 2019, SIAM, pp 54–66

[c8] *Median-of-k Jumplists and Dangling-Min BSTs*
Markus E. Nebel, Elisabeth Neumann, and Sebastian Wild
Meeting on Analytic Algorithmics and Combinatorics (ANALCO) 2019
M. Mishna and J.I. Munro (eds.): ANALCO 2019, SIAM, pp 74–86

[c7] *Nearly-Optimal Mergesorts: Fast, Practical Sorting Methods That Optimally Adapt to Existing Runs*
J. Ian Munro and Sebastian Wild
European Symposium on Algorithms (ESA) 2018
Y. Azar, H. Bast, G. Herman (eds.): ESA 2018, LIPIcs 112, pp 63:1–63:16

[c6] *Average Cost of QuickXsort with Pivot Sampling*
Sebastian Wild
International Conference on Probabilistic, Combinatorial and Asymptotic Methods for the Analysis of Algorithms (AofA) 2018
MD. Ward, JA. Fill (eds.): AofA 2018, LIPIcs 110, pp 36:1–36:19

[c5] *Quicksort Is Optimal for Many Equal Keys*
Sebastian Wild
Meeting on Analytic Algorithmics and Combinatorics (ANALCO) 2018
M. Nebel, S. Wagner (eds.): ANALCO 2018, SIAM, pp 8–22

[c4] *Analysis of Branch Misses in Quicksort*
Conrado Martínez, Markus E. Nebel, and Sebastian Wild
Meeting on Analytic Algorithmics and Combinatorics (ANALCO) 2015
R. Sedgewick, MD. Ward (eds.): ANALCO 2015, SIAM, pp 114–128

[c3] *Pivot Sampling in Dual-Pivot Quicksort*
Markus E. Nebel and Sebastian Wild
***International Conference on Probabilistic, Combinatorial and
Asymptotic Methods for the Analysis of Algorithms (AofA) 2014***
M. Bousquet-Mélou, M. Soria (eds.): DMTCS-HAL Proceedings Series, vol. BA, pp 325–338

[c2] *Engineering Java 7's Dual Pivot Quicksort Using MaLiJAn*
Sebastian Wild, Markus E. Nebel, Raphael Reitzig, and Ulrich Laube
Meeting on Algorithm Engineering and Experiments (ALENEX) 2013
P. Sanders, N. Zeh (eds.): ALENEX 2013, SIAM, pp 55–69

[c1] *Average Case Analysis of Java 7's Dual Pivot Quicksort*
Sebastian Wild and Markus E. Nebel
European Symposium on Algorithms (ESA) 2012
L. Epstein and P. Ferragina (eds.): ESA 2012, LNCS 7501, Springer, pp 825–836.

Peer-Reviewed Journal Articles

[J9] *A Simple and Fast Linear-Time Algorithm for Divisor Methods of Apportionment*
Raphael Reitzig and Sebastian Wild
Mathematical Programming B**, **2023

[J8] *Succinct Permutation Graphs*
Konstantinos Tsakalidis, Sebastian Wild, and Viktor Zamaraev
Algorithmica** 85, 2, pp 509–543, **2022

[J7] *QuickXsort – A Fast Sorting Scheme in Theory and Practice*
Stefan Edelkamp, Armin Weiß, and Sebastian Wild
Algorithmica** 82, 3, pp 509–588, **2020

[J6] *Dual-pivot and beyond: The potential of multiway partitioning in quicksort*
Sebastian Wild
Distinguished Dissertations in ***it – Information Technology,*** 60, 3, pp 173–177, **2018**

[J5] *Building Fences Straight and High: An Optimal Algorithm for Finding the Maximum
Length You Can Cut k Times from Given Sticks*
Raphael Reitzig and Sebastian Wild
Algorithmica** 80, 11, pp 3365–3396, **2018

[J4] *Analysis of Pivot Sampling in Dual-Pivot Quicksort*
Markus E. Nebel, Sebastian Wild, and Conrado Martínez
Algorithmica** 75, 4, pp 632–683, **2016

[J3] *Analysis of Quickselect under Yaroslavskiy's Dual-Pivoting Algorithm*
Sebastian Wild, Markus E. Nebel, and Hosam Mahmoud
Algorithmica** 74, 1, pp 485–506, **2016

[J2] *Average Case and Distributional Analysis of Dual Pivot Quicksort*
Sebastian Wild, Markus E. Nebel, and Ralph Neininger
ACM Transactions on Algorithms** 11, 3, article 22, **2015

[J1]   *JAguc – A Software Package for Environmental Diversity Analyses*
Markus E. Nebel, Sebastian Wild, Michael Holzhauser, Lars Hüttenberger,
Raphael Reitzig, Matthias Sperber, and Thorsten Stoeck
Journal of Bioinformatics and Computational Biology 9, 6, pp 749–773, **2011**

Textbooks

[B1]   *Entwurf und Analyse von Algorithmen*
(Design and Analysis of Algorithms)
Markus Nebel and Sebastian Wild · *Springer Vieweg* · **2018**

Theses

[T3]   *Dual-Pivot Quicksort and Beyond: Analysis of Multiway Partitioning and Its Practical Potential*
Dissertation · University of Kaiserslautern · **2016**

[T2]   *Java 7's Dual Pivot Quicksort*
Master's Thesis · University of Kaiserslautern · **2012**

[T1]   *An Earley-style Parser for Solving the RNA-RNA Interaction Problem*
Bachelor's Thesis · University of Kaiserslautern · **2010**

Working Papers & Technical Reports

[M4]   *A House Divided: Cooperation, Polarization, and the Power of Reputation*
Sebastian Wild, Phillip Keldenich, Jann Spiess, Maximilian Schlund, Jano Costard,
Jonas Radbruch, Paul Stursberg, and Sándor Fekete · Research Square, *In Review*

[M3]   *Dynamic Optimality Refuted – For Tournament Heaps*
J. Ian Munro, Richard Peng, Sebastian Wild, and Lingyi Zhang

[M2]   *Entropy Trees and Range-Minimum Queries In Optimal Average-Case Space*
J. Ian Munro, and Sebastian Wild

[M1]   *A Practical and Worst-Case Efficient Algorithm for Divisor Methods of Apportionment*
Raphael Reitzig and Sebastian Wild

Other Publications

[O2]   *Quicksort mit zwei Pivots und mehr* · Sebastian Wild
GI LNI Dissertations Band 17 – Ausgezeichnete Informatikdissertationen 2016

[O1]   *Why is Dual-Pivot Quicksort Fast?* · Sebastian Wild
extended abstract for *Theorietage 2015* (GI Workshop on Algorithms)

Awards and Honors

2023   *Guild Awards 2023 – Teacher of the Year (Science & Engineering)*
Prize awarded by the *Guild of Students* of *University of Liverpool* by nomination
awarded to one academic in each of the three Faculties

2017 *GI Dissertationspreis 2016* · [T3]
Prize for **best dissertation** in computer science 2016 in Germany, Austria,
and Switzerland, jointly awarded by *GI*, *SI*, and *OCG*

2017 Nominated for *Distinguished Teaching Award 2017* of *University of Kaiserslautern*
for the design of the interactive course *Training für Programmierwettbewerbe*

2013 *Preis des Freundeskreises der TU Kaiserslautern* · [T2]
Best Master's Thesis in the Department of Computer Science 2012

2012 **Best Paper Award** at the *European Symposium on Algorithms 2012* · [C1]

2009–2012 **Scholarship** of the German National Academic Foundation

Grants and Funding

Principal Investigator

2023–2026 **New Investigator Award** · Engineering and Physical Sciences Research Council (EPSRC)
Computing over Compressed Graph-Structured Data
volume £ 519 180 (full economic cost)

2022–2023 **Impact Accelerator Fund** for developing impact case
Improved Sorting Algorithms for programming libraries
funded by School of Electrical Engineering, Electronics, and Computer Science,
University of Liverpool · volume £ 16 000

2022 **Visiting Fellowship** for hosting Gerth Stølting Brodal
funded by Department of Computer Science, University of Liverpool
1 of 4 funded Visiting Fellows · volume £ 700

2021–2022 **International Exchanges Program** · The Royal Society
Lazy Finger Search Trees
travel grant for research visit to Kostas Tsichlas (Patras, Greece) · volume £ 2 900

2020–2023 **PhD studentship** for Benjamin Smith
funded by School of Electrical Engineering, Electronics, and Computer Science,
University of Liverpool · 1 of 2 studentships in the department · volume £ 59 076

2021 **Workshop** *Algorithmic and probabilistic aspects of space efficiency*
funded by London Mathematical Society, Department of Computer Science, and the
EEECS School NeST Initiative of University of Liverpool · volume £ 940

2020 **Travel Grant** for research visit to Markus Lohrey
EEECS School NeST Initiative of University of Liverpool · volume £ 940

Co-Investigator

2021–2022 **International Exchanges Program** · The Royal Society
Decomposition techniques for graphs classes of bounded width parameters and their applications
PI Viktor Zamaraev; part of project team · volume £ 12 000

Talks

Slides available at www.wild-inter.net/publications.

Invited Talks

2023 *"Quicksort, Timsort, Powersort"* · [c7], [c17]
Warwick CS Colloquium · University of Warwick · 15 Nov. 2023

2023 *"Quicksort, Timsort, Powersort"*
CS Lectures · IT University of Copenhagen · 9 Nov. 2023

2023 *"Quicksort, Timsort, Powersort: Algorithmic ideas, engineering tricks, and trivia behind CPython's new sorting algorithm"* · [c7], [c17]
PyCon US 2023 · 22 Apr. 2023

2021 *"Hypersuccinct Trees"*
International Conference on Probabilistic, Combinatorial and Asymptotic Methods for the Analysis of Algorithms (AofA) 2021 · 14 Jun. 2021

2021 *"Quicksorts of the 21st Century"*
Workshop Verified software: tools and experiments · Special event celebrating quicksort's 60th birthday · Isaac Newton Institute · 7 Jun. 2021

2019 *"Dual-Pivot Quicksort and Beyond: An Analysis-of-Algorithms Perspective on Multiway Quicksort"*
Computability in Europe 2019 · Special Session *Smoothed and Probabilistic Analysis of Algorithms*
Durham University · 17 Jul. 2019

2018 *"Succinct Data Structures For Range Minimum Problems"*
NSF Center for Science of Information · Purdue University · 24 Oct. 2018

2017 *"Dual-Pivot Quicksort and Beyond"*
Annual SPP Meeting of the *DFG Schwerpunktprogramm Algorithms for Big Data*
19 Oct. 2017

2016 *"Dual-Pivot Quicksort and Beyond"*
Research Seminar · *Hasso-Plattner-Institut Potsdam* · 6 Sep. 2016

Conference & Workshop Presentations

2023 *"Funnelselect: Cache-Oblivious Multiple Selection'* · [c19]
ESA 2023 · 6 Sept. 2023

2023 *"Quicksort, Timsort, Powersort"*
Dagstuhl Seminar 23 211 (Scalable Data Structures) · 22 May 2023

2022 *"On the combinatorics of space-efficient data structures"*
Banff International Research Station Workshop 22w5004
(Analytic and Probabilistic Combinatorics) · 15 Nov. 2022

2022 *"Demystifying Neural Networks (and outreach during lockdown)"* · tiny.cc/ai-course
Creative Mathematical Science Communication 2022 · 20 Apr. 2022

2021 *"Lazy Search Trees"* · [c12]
Dagstuhl Seminar 21 071 (Scalable Data Structures) · 16 Feb. 2021

2019 *"Second-Order Shape-Constrained Function Fitting"* · [c10]
WADS 2019 · 6 Aug. 2019

2019   *"Compressed Range-Minimum Queries: Average-Case Analysis of Search Trees Meets Space-Efficient Data Structures"* · [m2]
AofA Meeting · 24 Jun. 2019

2019   *"Entropy Trees & Range-Minimum Queries In Optimal Average-Case Space"* · [m2]
Dagstuhl Seminar 19 051 (Data Structures for the Cloud and External Memory Data)
28 Jan. 2019

2019   *"Sesquickselect: One and a half pivots for cache-efficient selection"* · [c9]
ANALCO Conference · 06 Jan. 2019

2018   *"Nearly-optimal Mergesorts"* · [c7]
ESA Conference · 20 Aug. 2018

2018   *"Average Cost of QuickXsort with Pivot Sampling"* · [c6]
AofA Conference · 28 June 2018

2018   *"Quicksort Is Optimal for Many Equal Keys"* · [c5]
ANALCO Conference · 8 Jan. 2018

2017   *"Median-of-k Quicksort is optimal for many equal keys"*
AofA Meeting · 19 June 2017

2016   *"Quicksort with Equal Keys"*
Dagstuhl Seminar 16 101 (Data Structures and Advanced Models of Computation on Big Data)
7 March 2016

2015   *"Why is Dual-Pivot Quicksort Fast?"* · [O1]
GI Theorietage (Workshop) · 29 Sept. 2015

2015   *"Analysis of Branch Misses in Quicksort"* · [c4]
ANALCO Conference · 4 Jan. 2015

2014   *"Pivot Sampling in Dual-Pivot Quicksort"* · [c3]
AofA Conference · 16 June 2014

2014   *"Dual-Pivot Quicksort – Asymmetries in Sorting"*
Dagstuhl Seminar 14 091 (Data Structures and Advanced Models of Computation on Big Data)
25 March 2014

2013   *"Engineering Java 7's Dual Pivot Quicksort Using MaLiJAn"* · [c2]
ALENEX Conference · 7 Jan. 2013

2013   *"Quickselect Under Yaroslavskiy's Dual-Pivoting Algorithm"*
AofA Meeting · 28 May 2013

2013   *"Java 7's Dual Pivot Quicksort"*
FORMAT Workshop · 9 April 2013

2012   *"Average Case Analysis of Java 7's Dual Pivot Quicksort"* · [c1]
ESA Conference · 11 Sept. 2012

Departmental & Seminar Talks

2023   *"Quicksort, Timsort, Powersort"*
SSLC Distinguished Lecture Series · University of Liverpool · 17 Apr. 2023

2022	*"Putting your graphs on a diet"* Durham-Liverpool Synergy Networks Seminar · 27 Oct. 2022
2019	*"Dual-Pivot Quicksort and Beyond"* · University of Liverpool · 10 Dec. 2019
2017	*"Dual-Pivot Quicksort and Beyond"* · University of Waterloo · 1 Nov. 2017
2015	*"Dual-Pivot Quicksort"* · University of Kaiserslautern · 24 Mar. 2015

Teaching Experience

Details on courses and teaching evaluations at www.wild-inter.net/teaching.
(Titles are clickable links).

Instructor of Record
Sole responsibility for module (give lectures, design assignments, take/design exams).

2024	*Advances in Theoretical Computer Science (COMP 555)* · postgraduate level
2023	*Efficient Algorithmics (COMP 526)* · postgraduate level
2023	*Advances in Theoretical Computer Science (COMP 555)* · postgraduate level
2022	*Efficient Algorithmics (COMP 526)* · postgraduate level
2022/23	*Communicating Computer Science (COMP 335)* · third-year undergraduate
2022	*Applied Algorithmics (COMP 526)* · postgraduate level
2021/22	*Communicating Computer Science (COMP 335)* · third-year undergraduate
2021	*Applied Algorithmics (COMP 526)* · postgraduate level
2020	*Applied Algorithmics (COMP 526)* · postgraduate level
2018	*Data Structures and Data Management (CS 240)* · undergraduate level
2017	*Advanced Algorithmics: Strategies for Hard Problems* · advanced postgraduate level
2017	*Competitive Programming* · undergraduate level
2016/17	*Algorithms and Data Structures* · undergraduate level, non-CS majors

Teaching Assistance
Responsible for tutorials (recruit student tutors, design assignments and exams, give exercise classes).

2015/16 **2014**	*Introduction to the Mathematical Analysis of Algorithms* (original title: *Algorithm Engineering*) · advanced postgraduate level
2013/14	*Computational Biology I: Alignments and Sequencing* advanced undergraduate level
2015/16 **2014** **2012/13**	*Computational Biology II: Signals, Phylogenetics and Structure Prediction* postgraduate level
2014/15	*Design and Analysis of Algorithms* · intermediate undergraduate level

2013   *Combinatorial Algorithms: String Search, Compression, Networks,*
        and Random Generation · advanced undergraduate level

2013/14 *Proof Techniques* · tutorial at introductory undergraduate level
2012/13

Student Tutor
(grade assignments, give exercise class).

Formal Foundations of Programming · *Software Development I: Introduction to Programming* ·
Software Development III: Concurrency and Parallel Programming

Supervised Students

PhD Students

2020–2024   Benjamin Smith

2021–2025   Eva Onokpasa

Selected Master's Theses

2021   William Cawley Gelling · Title: *4-way Peeksort & 4-way Powersort* · [c17]

2020   Benjamin Smith · Title: *Exact Solutions for the Bamboo Garden Trimming Problem* · [c15]

Selected Bachelor's Theses

2016   Marvin Peterson · Title: *Experimental View on Cache Behavior of Search Trees*

2015   Elisabeth Neumann · Title: *Randomized Jumplists With Several Jump Pointers* · [c8]

Service

To Profession

Program committees   AofA 2024 (Co-Chair)
SOFSEM 2023 · LATIN 2022 · AofA 2022 · ESA 2019 · ANALCO 2019 ·
ANALCO 2018

Reviews (journals)   *ACM Journal of Experimental Algorithmics* · *ACM Transactions on Algorithms* ·
Algorithmica · *Bulletin of Mathematical Biology* ·
Combinatorics, Probability & Computing · *Discrete Applied Mathematics* ·
IEEE Transactions on Computers · *Information Processing Letters* ·
International Journal of Computer Mathematics · *Journal of Experimental Algorithmics* ·
Mathematical Programming · *Mathematics in Computer Science* ·
Software: Practice and Experience · *The Computer Journal* ·
Theoretical Computer Science ·
Stochastics (Intern. J. of Probability and Stochastic Processes)

Reviews STOC 2023 · ESA 2023 · MFCS 2023 · IWOCA 2023 · WABI 2022 · ICALP 2022 · (conferences) SODA 2022 · SOSA 2022 · ISAAC 2021 · STACS 2021 · ESA 2021 · SoCG 2020 · SODA 2020 · SOFSEM 2020 · SPAA 2019 · SEA 2018 · WADS 2017 · SEA 2017 · ANALCO 2017 · AofA 2016 · SWAT 2014 · ANALCO 2014 · ESA 2013

To Department

since 2022 **Lead** of the **Recruitment, Outreach, and Public Relations** group
of the School of Electrical Engineering, Electronics, and Computer Science
University of Liverpool

since 2020 **Coordinator** of **Outreach Activities** of the Department of Computer Science
University of Liverpool

2012 – 2017 Representative of Scientific Employees in **Board of Examiners**
(*Prüfungsausschuss*) · TU Kaiserslautern

Additional Training

2023 *Knowledge Transfer Training Programme*
Skillfluence & The Academy, University of Liverpool

2020 *Fellow of the Higher Education Academy*
Recognition of teaching experience through the ULTRA program
Advance HE & The Academy, University of Liverpool

2017 *Teaching Development Seminar Series for Postdocs*
Centre for Teaching Excellence, University of Waterloo · 6 – 10 Nov. 2017

2016 *Lehre 2.0 – Lehren mit dem Internet*
Workshop on including social media in teaching · 13 June 2016

2015 *Meetings und Projektbesprechungen effizient und zielgerichtet leiten*
Workshop on how to effectively chair a group meeting · 9 – 10 April 2015

Nonacademic Work Experience

Java Developer *marketmaker Software AG* (since 2012 part of *vwd Vereinigte Wirtschaftsdienste GmbH*)
Jul 2010 – Apr 2012 in term breaks

Developed server components for a web-based financial market-data solution.

Languages

German	native
English	fluent
French	elementary
Spanish	elementary