Sebastian Wild

University of Liverpool
School of Electrical Engineering, Electronics & Computer Science
Department of Computer Science
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Employment

since 2019 **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

NB: The convention in algorithms for author lists is in alphabetic order by last name.

Preprints and details at www.wild-inter.net/publications.
(Titles are clickable links).

Peer-Reviewed Conference Papers

[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, to be presented

[c17] *Multiway Powersort*
William Cawley Gelling, Markus Nebel, Benjamin Smith, and Sebastian Wild
Symposium on Algorithm Engineering and Experiments (ALENEX) 2023
ALENEX 2023, to be presented

[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, Dagstuhl, 2021, 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, 2020, 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, Dagstuhl, 2020, 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, 2019, 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, Dagstuhl, 2018, 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 vol. 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 (to appear) **2023**

[J8] *Succinct Permutation Graphs*
Konstantinos Tsakalidis, Sebastian Wild, and Viktor Zamaraev
Algorithmica (first online) **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**

Manuscripts in Preparation & Working Papers

[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] *Reputation-Based Cooperation in Local Interaction: Evolution of Indirect Reciprocity with Minimal Memory* · Jano Costard, Sándor P. Fekete, Hella-Franziska Hoffmann, Alexander Koch, Dominik Leipold, Jonas Radbruch, Maximilian Schlund, Jann Spiess, Paul Stursberg, 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

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

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

2021–2022 **Travel Grant** for research visit to Kostas Tsichlas
funded by The Royal Society, International Exchanges Program · 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 NeST Initiative of University of Liverpool · volume £940

2020 **Travel Grant** for research visit to Markus Lohrey
funded by the NeST Initiative of University of Liverpool · volume £940

Talks

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

Invited Talks

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

2022 *"On the combinatorics of space-efficient data structures"*
Banff International Research Station Workshop 22w5004
(Analytic and Probabilistic Combinatorics) · 15 Nov. 2023

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

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).

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)*

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 *Computational Biology II: Signals, Phylogenetics and Structure Prediction*
2014 postgraduate level
2012/13

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 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 (conferences)
WABI 2022 · ICALP 2022 · 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*
Demonstration 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