

# Pavel Veselý – Curriculum Vitae

**Current position:** Assistant Professor at Computer Science Institute of Charles University  
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**Google Scholar:** [scholar.google.cz/citations?user=65ss5RMAAAAJ](https://scholar.google.cz/citations?user=65ss5RMAAAAJ)

## RESEARCH INTERESTS

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Theoretical computer science and combinatorics, with particular focus on designing efficient algorithms and data structures, specifically:

- streaming algorithms (e.g., quantile estimation, geometric streams, packing and scheduling problems),
- online algorithms (e.g., buffer management, packing and scheduling problems), and
- approximation algorithms (e.g., shortest superstring problem).

## POSITIONS, EDUCATION, AND ACADEMIC DEGREES

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September 2020 — present: **Assistant Professor**, Computer Science Institute of Charles University, Prague, Czech Republic. On leave from 19 September 2020 – 30 April 2021.

September 2018 — April 2021: **Research Fellow**, Department of Computer Science, University of Warwick. Advisor prof. **Graham Cormode**.

**Ph.D.** — 2018, Charles University, doctoral thesis *Online Algorithms for Packet Scheduling*. Advisor prof. RNDr. **Jiří Sgall**, DrSc.

October 2014 — September 2018: PhD studies at Computer Science Institute of Charles University, Prague, Czech Republic. Advisor prof. RNDr. **Jiří Sgall**, DrSc.

**Mgr.** — 2014, Charles University, master thesis *Online algorithms for variants of bin packing*. Advisor prof. RNDr. **Jiří Sgall**, DrSc.

October 2012 — September 2014: master studies, Faculty of Mathematics and Physics, Charles University, Prague, Czech Republic.

**Bc.** — 2012, Charles University, bachelor thesis *Artificial intelligence in abstract 2-player games*. Advisor RNDr. **Tomáš Valla**, Ph.D.

October 2010 — September 2012: bachelor studies, Faculty of Mathematics and Physics, Charles University, Prague, Czech Republic.

## AWARDS

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**2022 ACM SIGMOD Research Highlight Award** for the PODS 2021 paper *Relative Error Streaming Quantiles*.

**Best Paper Award** at the 40th ACM SIGMOD-SIGACT-SIGAI Symposium on Principles of Database Systems (PODS 2021) for paper *Relative Error Streaming Quantiles*.

**Faculty Post-Doctoral Research Prize** at the University of Warwick’s Faculty of Science, Engineering and Medicine (SEM) for paper *A Tight Lower Bound for Comparison-Based Quantile Summaries*.

Tutorial for *Linear algebra I* in winter semester 2016/2017 was awarded by dean as **one the best tutorials in the student rating** at the Faculty of Mathematics and Physics, Charles University.

Paper *Online Chromatic Number is PSPACE-Complete* received the **Best Student Paper Award** at the 27th International Workshop on Combinatorial Algorithms (IWOCA 2016).

Thesis *Artificial intelligence in abstract 2-player games* obtained the **Dean's award for the best bachelor thesis** at the Faculty of Mathematics and Physics, Charles University in academic year 2011/2012.

Paper *Online Colored Bin Packing* won the 1st place in the student contest SVOČ 2014 in section Theoretical computer science.

Paper *Artificial intelligence in abstract 2-player games* won the 3rd place at SVOČ 2013 in section Applied computer science.

## SUPERVISION OF POSTDOCTORAL FELLOWS

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**Nicolaos Matsakis** (2022 — present)

## SUPERVISION OF STUDENTS

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**Ondřej Sladký** (2022 — present): bachelor student working on a project in computational genomics (in collaboration with K. Břinda and N. Matsakis)

**Ekaterina Milyutina** (2022 — present) — bachelor thesis *Efficient representation of  $k$ -mer sets* (in preparation; supervised together with K. Břinda)

**Petra Kaštánková** (2016) — bachelor thesis *Artificial intelligence for Mariáš* (thesis successfully defended with the highest grade; Mariáš is a card game popular in Czech republic)

## ORGANIZATION OF SCIENTIFIC MEETINGS

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**Spring School of Combinatorics 2022** (an event held in the Czech countryside consisting of student presentations of research papers; I will organize the spring school also in 2023)

## GRANT PROJECTS

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### Principal Investigator

*Effective scheduling in overloaded systems*, 2017 – 2018. Grant 634217 of the Charles University Grant Agency. Principal investigator Mgr. Pavel Veselý. Supervisor prof. RNDr. Jiří Sgall, DrSc.

### Team Member

*Efficient and Realistic Models for Computational Social Choice*, 2022 – present. Grant 22-22997S of the Czech Science Foundation (GAČR). Principal investigator Martin Koutecký.

*EPAC: Efficient approximation algorithms and circuit complexity*, 2021 – present. Grant 19-27871X of the Czech Science Foundation (GAČR). Principal investigators Michal Koucký and Pavel Hrubeš.

*Center for Foundations of Modern Computer Science*, 2021 – present. Charles University research center in the program UNCE. Principal investigator prof. RNDr. Jiří Sgall, DrSc.

*Small Summaries for Big Data*, 2018 – 2021. European Research Council grant ERC-2014-CoG 647557. Principal investigator prof. Graham Cormode.

*Modern algorithms: New challenges of complex data sets*, 2017 — 2018. Grant 17-09142S of the Czech Science Foundation (GAČR). Principal investigator prof. RNDr. Jiří Sgall, DrSc.

*Parameterized Approximation Algorithms*, 2017 – 2018. Grant 1514217 of the Charles University Grant Agency. Principal investigator RNDr. Tomáš Masařík. Supervisor Dr. Andreas Emil Feldmann.

*Restricted types of computation: algorithms, models, complexity*, 2014 – 2016. Grant 14-10003S of the Czech Science Foundation (GAČR). Principal investigator prof. RNDr. Jiří Sgall, DrSc.

*Configuration LP and other modern methods for approximation and online algorithms*, 2014 – 2016. Grant 548214 of the Charles University Grant Agency. Principal investigator Mgr. Martin Böhms. Supervisor prof. RNDr. Jiří Sgall, DrSc.

*Publications are listed chronologically.*

### Journal Publications

- [1] P. Veselý, M. Chrobak, Ľ. Jež, J. Sgall: *A  $\phi$ -Competitive Algorithm for Scheduling Packets with Deadlines*. SIAM Journal on Computing, vol. 51(5), p. 1626–1691, 2022. doi:10.1137/21M1469753
- [2] P. Dvořák, A.E. Feldmann, D. Knop, T. Masařík, T. Toufar, P. Veselý: *Parameterized Approximation Schemes for Steiner Trees with Small Number of Steiner Vertices*. SIAM Journal on Discrete Mathematics, vol. 35(1), p. 546–574, 2021. doi:10.1137/18M1209489
- [3] M. Bienkowski, M. Böhm, J. Byrka, M. Chrobak, C. Dürr, L. Folwarczný, Ľ. Jež, J. Sgall, N. K. Thang, P. Veselý: *New Results on Multi-Level Aggregation*. Theoretical Computer Science, vol. 861, p. 133–143, 2021. doi:10.1016/j.tcs.2021.02.016.
- [4] M. Böhm, Ľ. Jež, J. Sgall, P. Veselý: *On Packet Scheduling with Adversarial Jamming and Speedup*. Annals of Operations Research, vol. 298, p. 7–42, 2021. doi:10.1007/s10479-019-03153-x.
- [5] G. Cormode, P. Veselý: *Streaming Algorithms for Bin Packing and Vector Scheduling*. Theory of Computing Systems, vol. 65, p. 916–942, 2021. doi:10.1007/s00224-020-10011-y.
- [6] M. Bienkowski, M. Böhm, J. Byrka, M. Chrobak, C. Dürr, L. Folwarczný, Ľ. Jež, J. Sgall, N. K. Thang, P. Veselý: *Online Algorithms for Multi-Level Aggregation*. Operations Research, vol. 68(1), p. 214–232, 2020. doi:10.1287/opre.2019.1847.
- [7] M. Böhm, M. Chrobak, Ľ. Jež, F. Li, J. Sgall, P. Veselý: *Online Packet Scheduling with Bounded Delay and Lookahead*. Theoretical Computer Science, vol. 776, p. 95–113, 2019. doi:10.1016/j.tcs.2019.01.013.
- [8] M. Bienkowski, M. Böhm, Ľ. Jež, P. Laskoś-Grabowski, J. Marcinkowski, J. Sgall, A. Spyra, P. Veselý: *Logarithmic price of buffer downscaling on line metrics*. Theoretical Computer Science, vol. 707, p. 89–93, Elsevier, 2018. doi:10.1016/j.tcs.2017.10.008.
- [9] M. Böhm, P. Veselý: *Online Chromatic Number is PSPACE-Complete*. Theory of Computing Systems, vol. 62(6), p. 1366–1391, Springer, 2018. doi:10.1007/s00224-017-9797-2.
- [10] M. Böhm, G. Dósa, L. Epstein, J. Sgall, P. Veselý: *Colored Bin Packing: Online Algorithms and Lower Bounds*. Algorithmica, vol. 80(1), p. 155–184, Springer, 2018. doi:10.1007/s00453-016-0248-2.
- [11] M. Böhm, J. Sgall, R. van Stee, P. Veselý: *A Two-Phase Algorithm for Bin Stretching with Stretching Factor 1.5*. Journal of Combinatorial Optimization, vol. 34(3), p. 810–828, Springer, 2017. doi:10.1007/s10878-017-0114-4.
- [12] M. Böhm, J. Sgall, R. van Stee, P. Veselý: *Online Bin Stretching with Three Bins*. Journal of Scheduling, vol. 20(6), p. 601–621, Springer, 2017. doi:10.1007/s10951-016-0504-y.

### Publications in Conference Proceedings

- [13] A. Czumaj, S. H.-C. Jiang, R. Krauthgamer, P. Veselý, M. Yang: *Streaming Facility Location in High Dimension via Geometric Hashing*. To appear in Proc. of the 63rd IEEE Symposium on Foundations of Computer Science (FOCS 2022).
- [14] A. Czumaj, S. H.-C. Jiang, R. Krauthgamer, P. Veselý: *Streaming Algorithms for Geometric Steiner Forest*. In Proc. of the 49th International Colloquium on Automata, Languages, and Programming (ICALP 2022), p. 47:1–47:20. doi:10.4230/LIPIcs.ICALP.2022.47.
- [15] M. Englert, N. Matsakis, P. Veselý: *Improved Approximation Guarantees for Shortest Superstrings using Cycle Classification by Overlap to Length Ratios*. In Proc. of the 54th ACM Symposium on Theory of Computing (STOC 2022), p. 317–330, ACM, 2022. doi:10.1145/3519935.3520001.
- [16] M. Bienkowski, M. Böhm, M. Koutecký, T. Rothvoß, J. Sgall, P. Veselý: *Improved Analysis of Online Balanced Clustering*. In Proc. of the 19th Workshop on Approximation and Online Algorithms (WAOA 2021), LNCS 12982, p. 224–233, Springer, 2022. doi:10.1007/978-3-030-92702-8\_14.
- [17] G. Cormode, A. Mishra, J. Ross, P. Veselý: *Theory meets Practice at the Median: a worst case comparison of relative error quantile algorithms*. In Proc. of the 27th ACM SIGKDD Conference on Knowledge Discovery and Data Mining (KDD 2021), pp 2722–2731, ACM, 2021. doi:10.1145/3447548.3467152

- [18] A. Antoniadis, M. Englert, N. Matsakis, P. Veselý: *Breaking the Barrier Of 2 for the Competitiveness of Longest Queue Drop*. In Proc. of the 48th International Colloquium on Automata, Languages, and Programming (ICALP 2021), LIPIcs, p. 17:1–17:20, Schloss Dagstuhl, 2021. doi:10.4230/LIPIcs.ICALP.2021.17.
- [19] G. Cormode, Z. Karnin, E. Liberty, J. Thaler, P. Veselý: *Relative Error Streaming Quantiles*. In Proc. of the 40th ACM SIGMOD-SIGACT-SIGAI Symposium on Principles of Database Systems (PODS 2021), p. 96–108, ACM, 2021. **Best Paper Award. Invited to JACM. ACM SIGMOD Research Highlight Award.** doi:10.1145/3452021.3458323.
- [20] G. Cormode, P. Veselý: *Tight Lower Bound for Comparison-Based Quantile Summaries*. In Proc. of the 39th ACM SIGMOD-SIGACT-SIGAI Symposium on Principles of Database Systems (PODS 2020), p. 81–93, ACM, 2020. doi:10.1145/3375395.3387650.
- [21] G. Cormode, P. Veselý: *Streaming Algorithms for Bin Packing and Vector Scheduling*. In Proc. of the 17th Workshop on Approximation and Online Algorithms (WAOA 2019), LNCS 11926, p. 72–88, Springer, 2020. doi:10.1007/978-3-030-39479-0\_6.
- [22] P. Veselý, M. Chrobak, Ľ. Jež, J. Sgall: *A  $\phi$ -Competitive Algorithm for Scheduling Packets with Deadlines*. In Proc. of the 30th Annual ACM-SIAM Symposium on Discrete Algorithms (SODA 2019), p. 123–142, Society for Industrial and Applied Mathematics, 2019. doi:10.1137/1.9781611975482.9.
- [23] P. Dvořák, A.E. Feldmann, D. Knop, T. Masařík, T. Toufar, P. Veselý: *Parameterized Approximation Schemes for Steiner Trees with Small Number of Steiner Vertices*. In Proc. of the 35th International Symposium on Theoretical Aspects of Computer Science (STACS 2018), LIPIcs, p. 26:1–26:15, Schloss Dagstuhl, 2018. doi:10.4230/LIPIcs.STACS.2018.26.
- [24] M. Böhm, Ľ. Jež, J. Sgall, P. Veselý: *On Packet Scheduling with Adversarial Jamming and Speedup*. In Proc. of the 15th Workshop on Approximation and Online Algorithms (WAOA 2017), LNCS 10787, p. 190–206, Springer, 2018. doi:10.1007/978-3-319-89441-6\_15.
- [25] M. Böhm, P. Veselý: *Online Chromatic Number is PSPACE-Complete*. In Proc. of the 27th International Workshop on Combinatorial Algorithms (IWOCA 2016), LNCS 9843, p. 16–28, Springer, 2016. doi:10.1007/978-3-319-44543-4\_2.
- [26] M. Böhm, M. Chrobak, Ľ. Jež, F. Li, J. Sgall, P. Veselý: *Online Packet Scheduling with Bounded Delay and Lookahead*. In Proc. of the 27th International Symposium on Algorithms and Computation (ISAAC 2016), LIPIcs, p. 21:1–21:13, Schloss Dagstuhl, 2016. doi:10.4230/LIPIcs.ISAAC.2016.21.
- [27] M. Bienkowski, M. Böhm, J. Byrka, M. Chrobak, C. Dürr, L. Folwarczny, Ľ. Jež, J. Sgall, N. K. Thang, P. Veselý: *Online Algorithms for Multi-Level Aggregation*. In Proc. of the 24th Annual European Symposium on Algorithms (ESA 2016), LIPIcs, p. 12:1–12:17, Schloss Dagstuhl, 2016. doi:10.4230/LIPIcs.ESA.2016.12.
- [28] M. Böhm, J. Sgall, P. Veselý: *Online Colored Bin Packing*. In Proc. of the 12th Workshop on Approximation and Online Algorithms (WAOA 2014), LNCS 8952, p. 35–46, Springer, 2015. doi:10.1007/978-3-319-18263-6\_4.
- [29] M. Böhm, J. Sgall, R. van Stee, P. Veselý: *Better Algorithms for Online Bin Stretching*. In Proc. of the 12th Workshop on Approximation and Online Algorithms (WAOA 2014), LNCS 8952, p. 236–247, Springer, 2015. doi:10.1007/978-3-319-18263-6\_3.
- [30] T. Valla, P. Veselý: *WALTZ: a strong Tzaar-playing program*. Computer Games, vol. 408 of series Communications in Computer and Information Science, p. 81–96, Springer, 2014. doi:10.1007/978-3-319-05428-5\_7.

#### ACM newsletters

- [31] G. Cormode, Z. Karnin, E. Liberty, J. Thaler, P. Veselý: *Relative Error Streaming Quantiles*. ACM SIGMOD Record, vol. 51(1), p. 69–76, 2022. doi:10.1145/3542700.3542717.
- [32] P. Veselý: *Packet Scheduling: Plans, Monotonicity, and the Golden Ratio*. ACM SIGACT News, vol. 52(2), p. 72–84, 2021. doi:10.1145/3471469.3471481

## TEACHING

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**Lectures** at the Faculty of Mathematics and Physics, Charles University:

- *Algorithms and data structures I* (core bachelor course; summer semester 21/22)
- *Algorithms for Data Streams* (designed new course; summer semester 21/22)

**Tutorials** for the following courses at the Faculty of Mathematics and Physics, Charles University:

- *Data structures I* (core master course; winter semester 22/23),
- *Mathematical skills* (bachelor course; winter semesters 21/22 and 22/23),
- *Approximation and online algorithms* (master course; summer semester 17/18, together with Martin Böhm),
- *Introduction to approximation and randomized algorithms* (bachelor course; winter semester 17/18),
- *Optimization methods* (core bachelor course; summer semesters 15/16 and 16/17),
- *Linear algebra I* (core bachelor course; winter semester 16/17 and 21/22),
- *Algorithms and data structures II* (core bachelor course; winter semesters 14/15, 15/16, and 22/23),
- *Algorithms and data structures I* (core bachelor course; summer semesters 12/13, 14/15, and 21/22),

2019: Seminar tutor for *Discrete Mathematics and its Applications 2* (term 2 of 18/19) at University of Warwick.

2016: Mentoring computer science students enrolled in English programs at the Faculty of Mathematics and Physics.

## SELECTED TALKS

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**Streaming Facility Location in High Dimension via Geometric Hashing:**

- 63rd IEEE Symposium on Foundations of Computer Science (FOCS 2022),
- Seminar on Theory of Computing at Charles University, 2022.

**Improved Approximation Guarantees for Shortest Superstrings using Cycle Classification by Overlap to Length Ratios:**

- Seminar on Theory of Computing at Charles University, 2022.

**Breaking the Barrier of 2 for the Competitiveness of Longest Queue Drop:**

- 48th International Colloquium on Automata, Languages, and Programming (ICALP 2021),
- Current Trends in Theoretical Computer Science 2021 (“Současné trendy teoretické informatiky”, in Czech).

**Streaming Algorithms for Geometric Steiner Forest:**

- Seminar on Theory of Computing at Charles University, 2021.

**Relative Error Streaming Quantiles:**

- Workshop on Local Algorithms (WOLA) 2020,
- British Colloquium for Theoretical Computer Science 2021,
- Highlights of Algorithms 2021 (contributed talk),
- ACM SIGMOD-SIGACT-SIGAI Symposium on Principles of Database Systems (PODS 2021),
- Seminar on Theory of Computing at Charles University, 2021.

**Tight Lower Bound for Comparison-Based Quantile Summaries:**

- Warwick-Weizmann workshop 2019,
- Noon seminar at Department of Applied Mathematics, Charles University, 2019,
- British Colloquium for Theoretical Computer Science 2020,
- ACM SIGMOD-SIGACT-SIGAI Symposium on Principles of Database Systems (PODS 2020).

**Streaming Algorithms for Bin Packing and Vector Scheduling:**

- 17th Workshop on Approximation and Online Algorithms (WAOA 2019),
- DIMAP Workshop: Research Day 2019.

### A $\phi$ -Competitive Algorithm for Scheduling Packets with Deadlines:

- Current Trends in Theoretical Computer Science 2019 (“Současné trendy teoretické informatiky”, in Czech),
- British Colloquium for Theoretical Computer Science 2019,
- Mittagsseminar at Max Planck Institute for Informatics, 2019,
- 30th Annual ACM-SIAM Symposium on Discrete Algorithms (SODA 2019),
- DIMAP Seminar at University of Warwick, 2018,
- Midsummer Combinatorial Workshop 2018,
- Modern Online Algorithms 2018.

### On Packet Scheduling with Adversarial Jamming and Speedup:

- New Challenges in Scheduling Theory 2018,
- 15th Workshop on Approximation and Online Algorithms (WAOA 2017).

### Online Packet Scheduling with Bounded Delay and Lookahead:

- Current Trends in Theoretical Computer Science 2017 (“Současné trendy teoretické informatiky”, in Czech),
- 13th Workshop on Models and Algorithms for Planning and Scheduling Problems (MAPSP 2017),
- 27th International Symposium on Algorithms and Computation (ISAAC 2016).

### Complexity of Online Coloring with Constant Pre-coloring:

- EURO Summer Institute on Online Optimization 2015.

### Online Colored Bin Packing:

- 12th Workshop on Models and Algorithms for Planning and Scheduling Problems (MAPSP 2015),
- 12th Workshop on Approximation and Online Algorithms (WAOA 2014),
- Trends in Online Algorithms 2014,
- Middle-European Conference on Applied Theoretical Computer Science (MATCOS) 2013.

## OTHER ACADEMIC ACTIVITIES

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**Collaboration with Splunk Inc.**, a US-based company that focuses on processing machine-generated big data, on algorithms for estimating quantiles in data streams that resulted in a joint publication at KDD 2021.

**Collaboration with Apache DataSketches**, an open-source software library of stochastic streaming algorithms, on implementing the algorithm for relative-error streaming quantiles from the PODS 2021 paper.

**Program committee** member of the 18th Workshop on Approximation and Online Algorithms (**WAOA 2020**).

Referee for journals JACM, SIAM J. Comp., IEEE Trans. Dependable Secure Comput, Math. Prog., ACM Trans. Database Syst., Comput. Netw., Discrete Appl. Math., Theor. Comp. Sci., and Inf. Comput.; reviewer for various TCS conferences incl. STOC, FOCS, SODA, PODS, ICALP, ESA, MFCS; reviewed four bachelor theses (three as opponent) at the Faculty of Mathematics and Physics, Charles University.

Participated in *Open Days* and *Days of Computer Science and Mathematics* of the Faculty of Mathematics and Physics in 2012, 2013, 2014, and 2017. I had a stall and a poster about combinatorial games.

M. Böhm, K. Král, J. Novotná, K. Tesař, P. Veselý: *Restricted Packing of 12 and 13 Unit Squares in a Square*. The paper got a honorable mention at SVOČ 2013 in section Theoretical computer science.

June — July 2012: Participated at Research Experiences for Undergraduates, Rutgers University, USA.

2009 — 2014: Organizer of the *Correspondence Programming Seminar* (“Korespondenční seminář z programování”, KSP) under the Faculty of Mathematics and Physics. The aim of the seminar is to teach basics of computer science to high school students.

M. Böhm, L. Lánský, P. Veselý, and collective: *Programátorské kuchařky* (“Programmer’s cookbooks”, in Czech). MatfyzPress Praha, 2011, ISBN 978-80-7378-181-1. A collection of texts on basic algorithmic and programming techniques, written for KSP.

## SKILLS, INTERESTS, AND OTHER

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2018: Attended an educational workshop for pedagogical skills (called “Vzdělávací program pedagogických zkušeností”, in Czech).

2015: Attended workshop FOCUS by the GrowJob institute to improve focus, mindfulness, learning ability, and creativity.

2010 and 2011: Participated in Central European Regional Contest of the ACM International Collegiate Programming Contest.

2008 — 2015: collaboration with SGP Systems, s.r.o., a company that develops software for children to learn basic principles of programming. The collaboration included programming in C#, ASP.NET, and organizing programming contests for children.

Non-professional interests and hobbies: personal development, mountain hiking, distance running, cipher games, board games, juggling.

Married,  $\Theta(1)$  children.