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Curriculum Vitae

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Citizenship: Finnish, Swedish
Date and place of birth: January 10, 1987, Jyväskylä, Finland
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Education

Doctor of Science (Technology), Aalto University, Computer Science, 14.2.2020, Espoo
Thesis title: On Bilinear Techniques for Similarity Search and Boolean Matrix Multiplication

Master of Science, University of Helsinki, Mathematics teacher education, 5.2.2020, Helsinki
MSc. thesis: The Programming Skills of Mathematics Teacher Students (in Finnish)

Master of Science (Technology), Aalto University, Computer Science, 29.8.2014, Espoo
MSc. thesis: Estimating Hand Configurations from Sign Language Videos

Bachelor of Science (Technology), Aalto University, Computer Science, 31.1.2014, Espoo
BSc. thesis: Model-based Hand Tracking Methods and their Applicability to Estimating Hand Configurations in Sign Language Videos, 2011 (in Finnish)

Matriculation Examination, Vääksyn Yhteiskoulu, 3.6.2006, Asikkala

Language skills

Finnish: native **English:** fluent **Swedish**: intermediate **Danish**: beginner

Work Experience

Senior lecturer, University of Gothenburg, 02/2023–
I am currently employed at University of Gothenburg and Chalmers University of Technology as a senior lecturer in the Data Science and Artificial Intelligence (DSAI) division.

Postdoctoral researcher, IT University of Copenhagen, 06/2020–01/2023
I worked as a postdoctoral researcher at ITU in the algorithms group, working on topics such as kernel density estimation and counting distinct elements, including implementation work with C++ and Python.

Teacher, Nurmijärven Yhteiskoulu, 01/2020–05/2020
I worked as a mathematics and physics teacher, teaching grades 7–9, including responsibilities as a class supervisor.

Software developer, Vincit Oyj, 02/2019–12/2019
I worked as a software developer consultant, doing various kinds of software development. The most important technologies were data science technologies with Python (such as Numpy, Pandas, matplotlib, etc.) and C#.

Postgraduate researcher, Aalto University, Department of Computer Science, 09/2014–01/2019
I worked as a doctoral student under Professor Petteri Kaski, researching algorithms. Publications include topics in *similarity search*, *symmetry breaking*, and *Boolean matrix multiplication*. The work has also included practical implementation work in C++ and Python, with technologies including MPI and CUDA parallelization.

Undergraduate researcher, Aalto University, Department of Information and Computer Science, 06/2010–08/2014
I worked in the Content-Based Image Retrieval research group on an interdisciplinary research project, implementing research software in C++/OpenCV for computer vision based automatic annotation of Finnish Sign Language videos.

System specialist, Finnish Food Safety Authority Evira, 01/2009–08/2009, 07/2007–08/2008
I worked as a full-time system specialist for the summers of 2008 and 2009, as a part-time system specialist for the spring of 2009, and before that as a civilian serviceman in the IT department. My responsibilities included user support and workstation and server system administration in a Microsoft Server 2003 AD and Microsoft Exchange environment.

Teaching Experience

Lecturer/Examiner, Introduction to Data Science, University of Gothenburg, 08/2023–10/2023
I gave an introductory course in data science to students in the "Applied Data Science" program at GU. The students had very variable background, so the course included basic math, such as sets and functions, and basic probability theory, together with introductory statistics, introduction to basic Python tools in data science, and some basic theoretical tools such as k-means, k-NN classifiers, and linear regression. The course was attended by ca. 30 students.

Lecturer/Examiner, Computational tehcniques for large scale data, University of Gothenburg / Chalmers University Technology, 03/2023–06/2023
I lectured and examined a course that addressed parallel programming and data structures and algorithms pertaining to the processing of large scale data. The course consisted of lectures and assignments where students worked in groups and implemented algorithms in Python to be executed in a cluster environment. Topics addressed included cache use, multiprocessing in Python, the MapReduce paradigm, Spark, and various algorithms and data structures (hashing, hyperloglog, spatial data structures etc.). The course was attended by ca. 90 students.

Lecturer, Applied Algorithms, IT University of Copenhagen, 08/2022–01/2023
I gave 100% of the lectures in the Applied Algorithms course, targeted at MSc. students in the Software Design program. The course aims at practical algorithm engineering work, where the students are expected to implement and experiment in practice algorithms that they have been taught in theory. The course is structured around mandatory course assignments that are done in groups, followed by an exam assignment also done in groups and an oral exam. In addition to giving lectures, I also gave exercise sessions, organized as self-directed lab sessions, oversaw two Teaching Assistants, updated and prepared new course assignments the exam, and created automatically-graded computer exercises to assist the students in their learning.

Master's thesis supervision, IT University of Copenhagen, 1/2022–6/2022
I supervised two masters' theses together with Associate Professor Riko Jacob. Nominally I was the co-supervisor with a 60% contribution. In practice, I supervised one of the theses fully, and had little contribution to the other. However, I was one of the three examiners for both theses.

Lecturer, Applied Algorithms, IT University of Copenhagen, 09/2021–01/2022
I gave approximately 50% of the lectures in the Applied Algorithms course, targeted at MSc. students in the Software Design program. The course aims at practical algorithm engineering work, where the students are expected to implement and experiment in practice algorithms that they have been taught in theory. The course is structured around mandatory course assignments that are done in groups, followed by an exam assignment also done in groups and an oral exam. In addition to giving lectures, I also gave exercise sessions, organized as self-directed lab sessions, updated and prepared new course assignments and a new exam assignment, and created automatically-graded computer exercises to assist the students in their learning.

Mathematics and physics teacher, grades 7–9, Nurmijärven yhteiskoulu, 01/2020–05/2020
I worked as a mathematics and physics teacher, as a temporary substitute teacher for the spring. I had full responsibility of all teaching activities for a large number of students in grades 7–9 (ages 13–16), preparing, teaching, and grading mathematics and physics courses, including all aspects of schoolwork from supervising physics laboratory sessions to teaching elementary programming in Python. I also worked as a class supervisor for a class in 7th grade.

Head Assistant, Aalto University, Department of Computer Science 01/2015–05/2018
I was the head assistant, in charge of some course organization and gave occasional exercises in the course "Programming II", a first year level programming course (Scala).

Teaching Assistant, Aalto University, Department of Information and Computer Science 09/2013 – 05/2014
I gave exercise sessions on the following courses:
ICS-A1120 Programming II (Spring 2014), tutored programming exercises in Scala language
T-61.5100 Digital Image Processing P (Autumn 2013), mathematical exercise sessions

Teaching Qualifications

Project and Thesis Supervision Course, IT University of Copenhagen, 3/2022
I attended a one-day course on project and thesis supervision offered by the learning support of the IT University of Copenhagen.

Pedagogical studies for teachers, University of Helsinki 2017–2018
I have a 60-ECTS-credit pedagogical qualification for working as a teacher. I also have 120-ECTS-credit qualification for working as a mathematics teacher or computer science teacher, and a 60-ECTS-credit qualification for working as a physics teacher.

Scype – Aalto SCI Pedagogical Training (10 ECTS credits, 9/2014–3/2015)
I completed pedagogical training consisting of two modules: introduction to teaching at Aalto (5 ECTS credits) and Course Planning (5 ECTS credits).

Tools for Teaching Training, Aalto University, 10/2013
A one-day long teaching training event aimed at teaching assistants.

Research Funding

Helsinki Doctoral Education Network in Information and Communications Technology (HICT), 06/2014–06/2018
I was granted a four-year funding for pursuing a doctoral degree at Aalto University.

IT skills

Programming languages:	C++	Most work experience
	Python	Second most work experience
	C#	Some work experience
	Matlab	Some work experience
	C	Some work experience
	Fortran	Basics, a little work experience
	Scala	Basics, some teaching experience
	Java	Basics, some teaching experience
	Shell scripts	Some BASH experience
Libraries:	Numpy, Pandas, matplotlib	Work experience
	OpenCV	Work experience
	MPI, CUDA	Basics, some implementation experience
	Spark	Basics, some teaching experince
	Miscellaneous:	GMP, nauty, Eigen, MKL, among others
Operating systems:	Microsoft Windows, GNU/Linux, Mac OS X	
Tools:	Emacs, git, CVS, GCC, CLang, make, CMake, GDB, Docker, among others	
Miscellaneous:	LaTeX	Strong (publications, theses, coursework)

Publications

Journal papers

Matti Karppa, Petteri Kaski, Jukka Kohonen, and Padraig Ó Catháin. "Explicit Correlation Amplifiers for Finding Outlier Correlations in Deterministic Subquadratic Time". In: *Algorithmica* 82.11 (2020), pp. 3306–3337. DOI: 10.1007/s00453-020-00727-1. URL: https://doi.org/10.1007/s00453-020-00727-1.

Tommi Junttila, Matti Karppa, Petteri Kaski, and Jukka Kohonen. "An Adaptive Prefix-Assignment Technique for Symmetry Reduction". In: *Journal of Symbolic Computation* 99 (2020), pp. 21–49. DOI: 10.1016/j.jsc.2019.03.002. URL: https://doi.org/10.1016/j.jsc.2019.03.002.

Matti Karppa, Petteri Kaski, and Jukka Kohonen. "A Faster Subquadratic Algorithm for Finding Outlier Correlations". In: *ACM Trans. Alg.* 14.3 (2018), Article 31. DOI: 10.1145/3174804. URL: https://dx.doi.org/10.1145/3174804.

Conference papers

Matti Karppa and Rasmus Pagh. "HyperLogLogLog: Cardinality Estimation With One Log More". In: *Proceedings of the 28th ACM SIGKDD Conference on Knowledge Discovery and Data Mining (KDD 2022)*. (Accepted for publication). 2022.

Matti Karppa, Martin Aumüller, and Rasmus Pagh. "DEANN: Speeding up Kernel-Density Estimation using Approximate Nearest Neighbor Search". In: *Proceedings of the 25th International Conference on Artificial Intelligence and Statistics (AISTATS 2022)*. 2022.

Matti Karppa and Petteri Kaski. "Probabilistic Tensors and Opportunistic Boolean Matrix Multiplication". In: *Proceedings of the Thirtieth Annual ACM-SIAM Symposium on Discrete Algorithms (SODA 2019)*. Philadelphia, PA, USA: Society for Industrial and Applied Mathematics, 2019, pp. 496–515. DOI: 10.1137/1.9781611975482.31. URL: https://doi.org/10.1137/1.9781611975482.31.

Tommi Junttila, Matti Karppa, Petteri Kaski, and Jukka Kohonen. "An Adaptive Prefix-Assignment Technique for Symmetry Reduction". In: *Theory and Applications of Satisfiability Testing – SAT 2017*. Cham, Switzerland: Springer International Publishing, 2017, pp. 101–118. ISBN: 978-3-319-66263-3. DOI: 10.1007/978-3-319-66263-3_7. URL: http://dx.doi.org/10.1007/978-3-319-66263-3_7.

Matti Karppa, Petteri Kaski, Jukka Kohonen, and Padraig Ó Catháin. "Explicit correlation amplifiers for finding outlier correlations in deterministic subquadratic time". In: *Proceedings of the 24th Annual European Symposium on Algorithms (ESA 2016)*. Dagstuhl, Germany: Schloss Dagstuhl–Leibniz-Zentrum fuer Informatik, 2016, 52:1–52:17. ISBN: 978-3-95977-015-6. DOI: 10.4230/LIPIcs.ESA.2016.52. URL: http://dx.doi.org/10.4230/LIPIcs.ESA.2016.52.

Matti Karppa, Petteri Kaski, and Jukka Kohonen. "A Faster Subquadratic Algorithm for Finding Outlier Correlations". In: *Proceedings of the 27th Annual ACM-SIAM Symposium on Discrete Algorithms (SODA 2016)*. Philadelphia, PA, USA: Society for Industrial and Applied Mathematics, 2016, pp. 1288–1305. DOI: 10.1137/1.9781611974331.ch90. URL: http://dx.doi.org/10.1137/1.9781611974331.ch90.

Ville Viitaniemi, Matti Karppa, and Jorma Laaksonen. "2D Appearance Based Techniques for Tracking the Signer Configuration in Sign Language Video Recordings". eng. In: *Proceedings of 11th International Conference on Image Analysis and Recognition (ICIAR 2014)*. Vol. 2. Berlin, Germany, 2014, pp. 29–38. ISBN: 978-3-319-11754-6. DOI: 10.1007/978-3-319-11755-3_4. URL: http://dx.doi.org/10.1007/978-3-319-11755-3_4.

Ville Viitaniemi, Matti Karppa, and Jorma Laaksonen. "Experiments on Recognising the Handshape in Blobs Extracted from Sign Language Videos". In: *Proceedings of 22nd International Conference on Pattern Recognition (ICPR 2014)*. Los Alamitos, CA, USA: IEEE Computer Society, Aug. 2014. DOI: 10.1109/ICPR.2014.446. URL: http://dx.doi.org/10.1109/ICPR.2014.446.

Matti Karppa, Ville Viitaniemi, Marcos Luzardo, Jorma Laaksonen, and Tommi Jantunen. "SLMotion – An extensible sign language oriented video analysis tool". eng. In: *Proceedings of 9th Language Resources and Evaluation Conference (LREC 2014)*. Ed. by Nicoletta Calzolari (Conference Chair), Khalid Choukri, Thierry Declerck, Hrafn Loftsson, Bente Maegaard, Joseph Mariani, Asuncion Moreno, Jan Odijk, and Stelios Piperidis. Reykjavík, Iceland: European Language Resources Association, May 2014. ISBN: 978-2-9517408-8-4. URL: http://www.lrec-conf.org/proceedings/lrec2014/pdf/209_Paper.pdf.

Ville Viitaniemi, Tommi Jantunen, Leena Savolainen, Matti Karppa, and Jorma Laaksonen. "S-pot – a benchmark in spotting signs within continuous signing". eng. In: *Proceedings of 9th Language Resources and Evaluation Conference (LREC 2014)*. Ed. by Nicoletta Calzolari (Conference Chair), Khalid Choukri, Thierry Declerck, Hrafn Loftsson, Bente Maegaard, Joseph Mariani, Asuncion Moreno, Jan Odijk, and Stelios Piperidis. Reykjavík, Iceland: European Language Resources Association, May 2014. ISBN: 978-2-9517408-8-4. URL: http://www.lrec-conf.org/proceedings/lrec2014/pdf/440_Paper.pdf.

Marcos Luzardo, Ville Viitaniemi, Matti Karppa, Jorma Laaksonen, and Tommi Jantunen. "Estimating Head Pose and State of Facial Elements for Sign Language Video". In: *Proceedings of the 6th Workshop on the Representation and Processing of Sign Languages: Beyond the Manual Channel (LREC 2014)*. Reykjavík, Iceland: European Language Resources Association, May 2014. URL: http://www.lrec-conf.org/proceedings/lrec2014/workshops/LREC2014Workshop-SignLanguage%20Proceedings.pdf.

Ville Viitaniemi, Matti Karppa, Jorma Laaksonen, and Tommi Jantunen. "Detecting Hand-Head Occlusions in Sign Language Video". eng. In: *Proceedings of the 18th Scandinavian Conference on Image Analysis*. Vol. 7944. LNCS. Berlin, Germany: Springer, June 2013, pp. 361–372. DOI: 10.1007/978-3-642-38886-6_35. URL: http://dx.doi.org/10.1007/978-3-642-38886-6_35.

Marcos Luzardo, Matti Karppa, Jorma Laaksonen, and Tommi Jantunen. "Head Pose Estimation for Sign Language Video". eng. In: *Proceedings of the 18th Scandinavian Conference on Image Analysis*. Vol. 7944. LNCS. Berlin, Germany: Springer, June 2013, pp. 349–361. DOI: 10.1007/978-3-642-38886-6_34. URL: http://dx.doi.org/10.1007/978-3-642-38886-6_34.

Matti Karppa, Tommi Jantunen, Ville Viitaniemi, Jorma Laaksonen, Birgitta Burger, and Danny De Weerdt. "Comparing computer vision analysis of signed language video with motion capture recordings". eng. In: *Proceedings of 8th Language Resources and Evaluation Conference (LREC 2012)*. Istanbul, Turkey: European Language Resources Association, May 2012, pp. 2421–2425. URL: http://www.lrec-conf.org/proceedings/lrec2012/pdf/321_Paper.pdf.

Matti Karppa, Tommi Jantunen, Markus Koskela, Jorma Laaksonen, and Ville Viitaniemi. "Method for visualisation and analysis of hand and head movements in sign language video". eng. In: *Proceedings of the 2nd Gesture and Speech in Interaction conference (GESPIN 2011)*. Bielefeld, Germany: University of Bielefed, 2011. URL: http://coral2.spectrum.uni-bielefeld.de/gespin2011/final/Jantunen.pdf.

Other scientific work

Matti Karppa and Petteri Kaski. "Engineering Boolean Matrix Multiplication for Multiple-Accelerator Shared-Memory Architectures". In: *CoRR* abs/1909.01554 (2019). arXiv: 1909.01554. URL: http://arxiv.org/abs/1909.01554.

Matti Karppa. "On Bilinear Techniques for Similarity Search and Boolean Matrix Multiplication". PhD thesis. Espoo, Finland: Aalto University, 2020. URL: https://aaltodoc.aalto.fi/handle/123456789/42426.