Curriculum Vitae

Personal details

Name:	Arjan Cornelissen
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Research interests

My primary research area is the field of quantum algorithms. I investigate the quantum query, time and space complexity of computational problems, by proving lower bounds on these quantities and constructing quantum algorithms that are efficient with regards to these measures.

Publications

Quantum tomography using state-preparation unitaries ***(July 2022)***
In collaboration with Joran van Apeldoorn, András Gilyén and Giacomo Nannicini. arXiv:2207.08800

A Sublinear-Time Quantum Algorithm for Approximating Partition Functions ***(July 2022)***
In collaboration with Yassine Hamoudi. arXiv:2207.08643

Improved Quantum Query Upper Bounds Based on Classical Decision Trees ***(March 2022)***
Presented at the 17th Conference on Theory of Quantum Computation, Communication and Cryptography (TQC 2022).
In collaboration with Nikhil S. Mande and Subhasree Patro. arXiv:2203.02968

Exact quantum query complexity of computing Hamming weight modulo powers of two and three ***(December 2021)***
In collaboration with Nikhil S. Mande, Māris Ozols and Ronald de Wolf. arXiv:2112.14682

Near-Optimal Quantum Algorithms for Multivariate Mean Estimation ***(November 2021)***
Presented at the 25th Annual Conference on Quantum Information Processing (QIP 2022).
In Proceedings of the 54th Annual ACM Symposium on Theory of Computing (STOC 2022).
In collaboration with Yassine Hamoudi and Sofiene Jerbi. arXiV:2111.09787

Quantum algorithms for multivariate Monte Carlo estimation ***(July 2021)***
In collaboration with Sofiene Jerbi. arXiv:2107.03410

Scalable Benchmarks for Gate-Based Quantum Computers ***(April 2021)***
In collaboration with Johannes Bausch and András Gilyén. arXiv:2104.10698

Span programs and quantum time complexity ***(May 2020)***
In Proceedings of the 45th International Symposium on Mathematical Foundations of Computer Science (MFCS 2020).
In collaboration with Stacey Jeffery, Māris Ozols and Alvaro Piedrafita. arXiv:2005.01323

Last updated: July 21st, 2022

Quantum gradient estimation of Gevrey functions ***(September 2019)***
arXiv:1909.13528

Talks

Improved Quantum Query Upper Bounds Based on Classical Decision Trees (July 11th, 2022)
Talk at the 17th Conference on Theory of Quantum Computation, Communication and Cryptography (TQC 2022).

Quantum Algorithms for Multivariate Mean Estimation ***(April 20th, 2022)***
Talk at the AlgoComp Seminar at IRIF in Paris.

Near-Optimal Quantum Algorithms for Multivariate Mean Estimation ***(March 10th, 2022)***
Talk at the 25th Annual Conference on Quantum Information Processing (QIP 2022).

Reflection programs and quantum approximate counting ***(November 9th, 2021)***
Invited talk at the Analysis Seminar at the Analysis Group at the Delft University of Technology.

Quantum algorithms for multivariate Monte Carlo estimation ***(September 15th, 2021)***
Talk at the Junior Seminar of QuSoft.

A self-contained, simplified analysis of span program algorithms ***(September 18th, 2020)***
Invited talk at the theory seminar of QuSoft.

Span programs and quantum time complexity ***(August 26th, 2020)***
At the 45th International Symposium on Mathematical Foundations of Computer Science (MFCS 2020).

Span programs and quantum time complexity ***(June 22nd, 2020)***
Invited talk at the colloquium of the Institute for Quantum Computing (IQC).

Quantum gradient estimation and its application to reinforcement learning (June 5th, 2019).
Invited talk at the theory seminar of QuTech.

Quantum gradient estimation ***(April 24th, 2019)***
Invited talk at the Dutch Mathematical Congress (NMC 2019).

The triangle finding problem ***(April 3rd, 2019).***
Talk at the Junior Seminar of QuSoft.

Work experience

PhD in Quantum Computing at University of Amsterdam (October 2018 — February 2023)
I developed a deep understanding of the computational model that captures the key characteristics of quantum devices, and developed several novel quantum algorithms and algorithmic techniques.
Supervisor: Māris Ozols.
Promotor: Ronald de Wolf.

Internship Quantum Algorithm Design at IBM Research ***(May 2022 — August 2022)***
I worked on developing quantum algorithms to estimate partition functions, and proved lower bounds for state tomography of mixed states, given access to a state-preparation unitary of a purification.

Supervisor: Kristan Temme.

Internship Mathematical Consulting at SIOUX Lime ***(September 2017 — November 2017)***
I developed a software package that simulates the propagation of monochromatic waves through optical setups, alongside with numerical methods that orthonormally integrates moving frames.
Supervisor: Lense Swaenen.

Teaching Assistant at Delft University of Technology ***(September 2014 — September 2018)***
I taught several courses at the Bachelor and Master of Applied Mathematics, with subjects including calculus, mechanics and relativity, complex analysis and partial differential equations.

Freelance Writer at Malmberg ***(September 2014 — August 2016)***
I assisted in the writing of a mathematics textbook for secondary school students by providing real-world demonstrations of the theory.

Education

Master Applied Mathematics at Delft University of Technology
Average grade: 9.4/10. ***(September 2016 — September 2018)***
Master thesis: *Quantum gradient estimation and its application to quantum reinforcement learning.*
Supervisors: Martijn Caspers and Ronald de Wolf.

Bachelor Applied Mathematics & Applied Physics at Delft University of Technology
Average grade: 9.3/10. ***(September 2013 — July 2016)***
Bachelor thesis: *Quantum Computation: Shor's algorithm.*
Supervisors: Jan van Neerven and Miriam Blaauboer.

Awards

ASML Graduation Prize for Mathematics ***(November 2018)***
Koninklijke Hollandsche Maatschappij der Wetenschappen (KHMW)
Award for the best master's thesis in mathematics in the Netherlands.

Young Talent and Encouragement Award ***(November 2014)***
Koninklijke Hollandsche Maatschappij der Wetenschappen (KHMW)
Award for obtaining the highest average grade among the first-year students of Applied Physics.

Other activities

CWI PhD Activity Committee ***(January 2020 – December 2021)***
I was co-chair of this committee, that organizes social events for employees of the research institute CWI.

Google Hashcode Finalist ***(April 2021)***
We ranked 22nd in this team-based programming competition out of over 9000 competing teams.

Google Code Jam Contestant ***(May 2021 & 2022)***
I ranked 1752nd and 2287th in the second round of the Google Code Jam competition.

Benelux Algorithm and Programming Contest (BAPC) ***(Fall 2017, 2019, 2020 & 2021)***
This is a programming competition for teams from the Netherlands, Belgium and Luxembourg.

North-Western European Regional Contest (NWERC) ***(November 2017)***
We ranked 42nd out of 119 competing student teams in this team-based programming competition in Bath, UK.

International Mathematics Competition (IMC) ***(August 2017, July 2018, August 2019)***
I earned a silver medal at this worldwide mathematics competition in Blagoevgrad, Bulgaria.

National Inter-University Mathematics Olympiad (LIMO) ***(May 2016, 2017 & 2018)***
We ranked 12th, 11th and 6th in this mathematics competition for Dutch and Belgian university teams.

FIRST Tech Challenge (FTC) ***(March 2012 & 2013)***
We participated in an international robotics competition for high school students.

Skills

Programming skills: I am comfortable with these programming languages:

- Python 2/3
- Java, C/C++
- MATLAB/Octave
- HTML/CSS/Javascript/PHP
- TI BASIC/Zilog Z80 Assembly

Language skills:

- Fluent: Dutch, English
- High-school level: French

Interactive skills: I enjoy giving presentations and explaining complicated ideas in a simple manner.