Benjamin Lovitz

benjamin.lovitz@gmail.com
www.benjaminlovitz.com

Employment

Fall 2022— **Department of Mathematics, Northeastern University**
–NSF postdoctoral fellow
–Zelevinsky postdoctoral fellow
–Mentor: Harm Derksen

Education

Spring 2018 **Institute for Quantum Computing, University of Waterloo**
—Winter 2022 –PhD in Applied Math (Quantum Information)
–Advisors: William Slofstra and John Watrous
–Thesis: *Tensors: Entanglement, Geometry, and Combinatorics*

Fall 2015 **Institute for Quantum Computing, University of Waterloo**
—Fall 2018 –MSc in Physics (Quantum Information)
–Advisor: Norbert Lütkenhaus
–Thesis: *Practical quantum fingerprinting and appointment scheduling*

Fall 2011 **Bates College**
—Winter 2015 –BA double degree in Math and Physics (Honors)
–Magna Cum Laude

Research Interests

Tensors, quantum information theory, entanglement theory, optimization, applied algebraic geometry, representation theory, combinatorics, matroid theory.

Publications and preprints

Nearly tight bounds for testing tree tensor network states
Benjamin Lovitz and Angus Lowe
Submitted, 2024
To appear in *Quantum Information Processing (QIP)* 2025

X-arability of mixed quantum states
Harm Derksen, Nathaniel Johnston, and Benjamin Lovitz
Submitted, 2024

Linear preservers of secant varieties and other varieties of tensors
Fulvio Gesmundo, Young In Han, and Benjamin Lovitz
Submitted, 2024

A hierarchy of eigencomputations for polynomial optimization on the sphere
Benjamin Lovitz and Nathaniel Johnston
Submitted, 2023

Computing linear sections of varieties: quantum entanglement, tensor decompositions and beyond
Nathaniel Johnston, Benjamin Lovitz, and Aravindan Vijayaraghavan
64th IEEE Symposium on Foundations of Computer Science (FOCS), 2023

A generalization of Kruskal's theorem on tensor decomposition
Benjamin Lovitz and Fedor Petrov
Forum of Mathematics, Sigma, 2023

A complete hierarchy of linear systems for certifying quantum entanglement of subspaces
Nathaniel Johnston, Benjamin Lovitz, and Aravindan Vijayaraghavan
Physical Review A, 2022 and *Quantum Information Processing (QIP)* 2023

Entangled subspaces and generic local state discrimination with pre-shared entanglement
Benjamin Lovitz and Nathaniel Johnston
Quantum, 2022

New techniques for bounding stabilizer rank
Benjamin Lovitz and Vincent Steffan
Quantum, 2022 and *Quantum Information Processing (QIP)* 2022

On decomposable correlation matrices
Benjamin Lovitz
Linear and Multilinear Algebra, 2021

Toward a generalization of Kruskal's theorem on tensor decomposition
Benjamin Lovitz
arXiv preprint, 2020

The non-m-positive dimension of a positive linear map
Nathaniel Johnston, Benjamin Lovitz, and Daniel Puzzuoli
Quantum, 2019

Families of quantum fingerprinting protocols
Benjamin Lovitz and Norbert Lütkenhaus
Physical Review A, 2018

Practical quantum appointment scheduling
Dave Touchette, Benjamin Lovitz, and Norbert Lütkenhaus
Physical Review A, 2018

Perfect state transfer in Laplacian quantum walk
Rachael Alvir, Sophia Dever, Benjamin Lovitz, James Myer, Christino Tamon, Yan Xu, and Hanmeng Zhan
Journal of Algebraic Combinatorics, 2016

Awards

September 2022— NSF Mathematical Sciences Postdoctoral Research Fellowship (MSPRF)
National Science Foundation
150,000 USD

September 2021 —April 2022 Ontario Graduate Scholarship (international competition)
Government of Ontario, Canada
10,000 CAD

Talks

August 2024 Effective methods in algebraic geometry (MEGA) 2024
A hierarchy of eigencomputations for polynomial optimization on the sphere

May 2024 University of Toulouse geometry seminar
Computing linear sections of varieties: quantum entanglement, tensor decompositions and beyond

May 2024 SIAM conference on applied linear algebra
Algorithms and uniqueness of tensor decompositions

April 2024 Georgia Tech algebra seminar
Computing linear sections of varieties: quantum entanglement, tensor decompositions and beyond

January 2024 Tel Aviv University applied math seminar
Old dog, new tricks: Tensor decompositions in quantum information and machine learning

January 2024 Northwestern University TCS seminar
Old dog, new tricks: Tensor decompositions and applications

November 2023 FOCS 2023
Computing linear sections of varieties: quantum entanglement, tensor decompositions and beyond

November 2023 UMASS Boston math seminar
Algorithms and uniqueness of tensor decompositions

August 2023 IWOTA 2023
A complete hierarchy of linear systems for certifying quantum entanglement of subspaces

July 2023 SIAM conference on applied algebraic geometry 2023
Computing linear sections of varieties: quantum entanglement, tensor decompositions and beyond

June 2023 ILAS 2023
A complete hierarchy of linear systems for certifying quantum entanglement of subspaces

June 2023	NESS 2023 *Algorithms and uniqueness of tensor decompositions*
March 2023	WACT 2023 *Computing linear sections of varieties: quantum entanglement, tensor decompositions and beyond*
February 2023	QIP 2023 *A complete hierarchy of linear systems for certifying quantum entanglement of subspaces*
December 2022	IPAM Tensor Methods Reunion Conference *Computing linear sections of varieties: quantum entanglement, tensor decompositions and beyond*
November 2022	University of Western Ontario mathematics seminar *Nullstellensatz-inspired algorithms for certifying entanglement of subspaces*
November 2022	Tensors: Quantum Information, Complexity and Combinatorics conference held at the Centre de Recherches Mathématiques in Montréal *Nullstellensatz-inspired algorithms for certifying entanglement of subspaces*
November 2022	Portland State University Computer Science seminar *New techniques for bounding stabilizer rank*
October 2022	Northeastern University GASC seminar *New techniques for bounding stabilizer rank*
September 2022	Algebraic Geometry with Applications to TEnsors and Secants (AGATES) Plenary talk: *New techniques for bounding stabilizer rank*
September 2022	SIAM Conference on Mathematics of Data Science *Tensor Decompositions: Algorithms and Uniqueness*
May 2022	QLunch Seminar at QMATH, University of Copenhagen *A splitting theorem for product tensors*
March 2022	QIP 2022 *New techniques for bounding stabilizer rank*
March 2022	AMS Special Session on Nonlinear Algebra with Applications to Statistics *A generalization of Kruskal's theorem*
March 2022	Random Tensors at CIRM *New techniques for bounding stabilizer rank*

January 2022	GIC seminar at the Universitat Autonoma de Barcelona *Entangled subspaces and generic local state discrimination with pre-shared entanglement*
December 2021	Theory Lunch Seminar at Northeastern University *A generalization of Kruskal's theorem*
November 2021	IDEAL Seminar at Northwestern University *A generalization of Kruskal's theorem*
November 2021	Algebra Seminar at Auburn University *A generalization of Kruskal's theorem*
April 2021	IPAM Tensor Methods weekly seminar *A generalization of Kruskal's theorem*
March 2021	Copenhagen QIT group meeting *Entangled subspaces and generic local state discrimination with pre-shared entanglement*
February 2021	IQST seminar at the University of Calgary *Entangled subspaces and generic local state discrimination with pre-shared entanglement*
January 2021	Quantum information seminar at the Perimeter Institute *Entangled subspaces and generic local state discrimination with pre-shared entanglement*
October 2014	Bates College *Laplacian quantum walk on graphs*
August 2014	Mathematical Association of America (MAA) Mathfest *Laplacian quantum walk on graphs*

Teaching

Winter 2024	Graduate course: Geometry and Applications of Tensors *Instructor, Northeastern University*
Fall 2023	MATH 2331: Linear Algebra (two sections) *Instructor, Northeastern University*
Fall 2021	QIC 820: Theory of Quantum Information *Teaching Assistant, University of Waterloo*
Fall 2019	Math 127: Calculus 1 for the sciences *Instructor, University of Waterloo*

Advising

Fall 2021 — Mentor to undergraduate student Daniel Han, in collaboration with William Slofstra
Undergraduate Research Assistantship program, University of Waterloo

Service

- Co-organized JMM 2023 special session "Applications of tensors in computer science" with Harm Derksen and Neriman Tokcan
- Co-organized SIAM AG 2023 minisymposium "Geometric and algebraic structures in quantum information" with Eliana Duarte and Luke Oeding
- Reviewer for *Mathematical Reviews,* American Mathematical Society
- Referee for:
  - *Journal of Physics A: Mathematical and Theoretical*, IOP Publishing
  - *Machine Learning: Science and Technology*, IOP Publishing
  - *Quantum Information and Computation*, Rinton Press
  - *Linear and Multilinear Algebra*, Taylor and Francis
  - *Linear Algebra and its Applications*, Elsevier
  - *Foundations of Computer Science (FOCS)*, IEEE
  - *Symposium on the Theory of Computing (STOC)*, ACM
  - *SIAM Journal on Computing (SICOMP)*, SIAM
  - *Asian Quantum Information Science Conference (AQIS)*

Further education

March 2021—June 2021 — Tensor Methods and Emerging Applications to the Physical and Data Sciences
Industry for Pure and Applied Mathematics, UCLA

2018—2020 — Fundamentals of University Teaching Program
Centre for Teaching Excellence, University of Waterloo

References

Matthias Christandl
University of Copenhagen
christandl@math.ku.dk

Harm Derksen
Northeastern University
ha.derksen@northeastern.edu

Nathaniel Johnston
Mount Allison University
njohnston@mta.ca

Lieven De Lathauwer
KU Leuven
lieven.delathauwer@kuleuven.be

Monique Laurent
CWI Amsterdam
m.laurent@cwi.nl

Lek-Heng Lim
University of Chicago
lekheng@statistics.uchicago.edu

William Slofstra
Institute for Quantum Computing, University of Waterloo
william.slofstra@uwaterloo.ca

Aravindan Vijayaraghavan
Northwestern University
aravindv@northwestern.edu

John Watrous
IBM
john.watrous@ibm.com

Oana Veliche (teaching reference)
Northeastern University
o.veliche@northeastern.edu