William Maxwell

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EDUCATION

OREGON STATE UNIVERSITY
PhD in Computer Science
2017 - 2021 | Corvallis, OR

PORTLAND STATE UNIVERSITY
MS in Mathematics
2014 - 2017 | Portland, OR

WICHITA STATE UNIVERSITY
BS in Computer Science
2008 - 2012 | Wichita, KS

RESEARCH INTERESTS

QUANTUM COMPUTING
Quantum compilation algorithms
Quantum circuit synthesis
Hamiltonian simulation
Topological algorithms

GRAPH ALGORITHMS
Spectral graph algorithms
Graph Laplacians
Complexity of graph algorithms
Graph parameters (e.g. treewidth)
Approximation algorithms

COMPUTATIONAL TOPOLOGY
Topological data analysis
Simplicial (co)homology
Generalized graph algorithms
Surface embedded graphs
Cellular sheaves

SOFTWARE

Languages:
Python • R • Julia • Haskell • Idris • C/C++ • PHP • JavaScript • Coq

Tools:
Linux • Web servers • Databases • Version control •LaTeX

EXPERIENCE

SANDIA NATIONAL LABORATORIES | Postdoctoral Researcher
2023 - present | Albuquerque, NM
- Postdoc in the quantum algorithms research group
- Emphasis on quantum topological data analysis
- Research in quantum complexity of topological problems
- Research in graph theory and combinatorial topology
- Peer reviewed QTDA papers for the PRX journal

NAVAL SURFACE WARFARE CENTER | Research Scientist
2021 - 2023 | Dahlgren, VA
- Directed research into quantum compilation algorithms, quantum circuit synthesis, and Hamiltonian simulation.
- Obtained funding and started a research program for cellular sheaves and their applications to graph algorithms and topological data analysis.
- Collaborated with a research team in spectral graph theory which has resulted in two papers being written for publication.
- Implemented machine learning algorithms in R and Julia.
- Organized research with external collaborators across academia and industry.

OREGON STATE UNIVERSITY | Research/Teaching Assistant
2017 – 2021 | Corvallis, OR
- Research focus in computational topology and graph theory.
- Research resulted in six published papers.
- Generalized problems in graph theory to the domain of algebraic topology.
- Obtained hardness results, fixed-parameter tractable algorithms, approximation algorithms, and quantum algorithms for topological problems.
- Obtained combinatorial results about graph parameters such as treewidth.
- TA for the following courses: Analysis of Algorithms, Introduction to Databases, and graduate level Data Structures and Algorithms.

GALOIS, INC | Machine Learning Intern
2017 | Portland, OR
- Researched applications of artificial intelligence to the domain of cybersecurity.
- Applied anomaly detection algorithms to the detection of advanced persistent threats.
- Trained graph embedding models such as graph2vec.
- Maintained a large codebase written in Scala and a graph database using the Gremlin query language.
- Our work resulted in two publications.

INTEL | Software Engineering Intern
2015 | Hillsboro, OR
- Worked for the Math Kernel Library team which is responsible for the development of math libraries optimized for Intel's proprietary C compiler.
- Optimized the testing suite for floating-point math functions by implementing parallelism.
- Wrote implementations for several floating-point math functions.

PIXIUS COMMUNICATIONS, LLC | Web Developer
2008 - 2014 | Wichita, KS
- Full stack developer for the company's internal web tools.

PUBLICATIONS

1. Mitchell Black, William Maxwell, and Amir Nayyeri. An incremental span-program-based algorithm and the fine print of quantum topological data analysis. *arXiv preprint arXiv:2307.07073*, 2023

2. Matthew Amy, Andrew N. Glaudell, Shaun Kelso, William Maxwell, and Neil J. Ross Samuel S. Mendelson. Exact synthesis of multiqubit clifford-cyclotomic circuits. *In preparation*, 2023

3. Matthew Crawford, David Marchette, William Maxwell, and Samuel Mendelson. Spectral properties of graphs with fixed equitable partitions. *In preparation*, 2023

4. David Eppstein, Daniel Frishberg, and William Maxwell. On the expansion of hanoi graphs. *In preparation*, 2023

5. David Eppstein, Daniel Frishberg, and William Maxwell. On the treewidth of hanoi graphs. *Theor. Comput. Sci.*, 2022

6. Mitchell Black, William Maxwell, Amir Nayyeri, and Eli Winkelman. Computational topology in a collapsing universe: Laplacians, homology, cohomology. In *SODA*. SIAM, 2022

7. Mitchell Black and William Maxwell. Effective resistance and capacitance in simplicial complexes and a quantum algorithm. In *ISAAC*. Schloss Dagstuhl - Leibniz-Zentrum für Informatik, 2021

8. William Maxwell and Amir Nayyeri. Generalized max-flows and min-cuts in simplicial complexes. In *ESA*. Schloss Dagstuhl - Leibniz-Zentrum für Informatik, 2021

9. Ghita Berrada, James Cheney, Sidahmed Benabderrahmane, William Maxwell, Himan Mookherjee, Alec Theriault, and Ryan Wright. A baseline for unsupervised advanced persistent threat detection in system-level provenance. *Future Gener. Comput. Syst.*, 2020

10. Glencora Borradaile, Erin Wolf Chambers, David Eppstein, William Maxwell, and Amir Nayyeri. Low-stretch spanning trees of graphs with bounded width. In *SWAT*. Schloss Dagstuhl - Leibniz-Zentrum für Informatik, 2020

11. Glencora Borradaile, William Maxwell, and Amir Nayyeri. Minimum bounded chains and minimum homologous chains in embedded simplicial complexes. In *SoCG*. Schloss Dagstuhl - Leibniz-Zentrum für Informatik, 2020

12. Md Amran Siddiqui, Alan Fern, Ryan Wright, Alec Theriault, David W. Archer, and William Maxwell. Detecting cyberattack entities from audit data via multi-view anomaly detection with feedback. In *AAAI Workshops*. AAAI Press, 2018

13. JJP Veerman, William J Maxwell, Victor Rielly, and Austin K Williams. Classification of minimal separating sets in low genus surfaces. *arXiv preprint arXiv:1701.04496*, 2017