Christian Lentz

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Education

Macalester College St. Paul, MN
BA, Mathematics and Computer Science 05/2024

- Summa Cum Laude
- Advisors: Lori Ziegelmeier and Susan Fox
- Honors Thesis: *Persistent Relative Homology for Topological Data Analysis*

Oxford University Oxford, England, UK
Visiting Student, Mathematics 01/2023 - 06/2023

Interests

Mathematics – Topology, Geometry, Homological algebra
Applied Mathematics – Numerical analysis, Applied algebra, Computational geometry
Algorithms and Data Science – Topological data analysis**,** Machine learning, Complexity theory

Research

University of Minnesota/Macalester College St. Paul, MN
Research Assistant 05/2023 - present

- Algebraic and computational topology, homological and sparse matrix algebra.
- Developed and implemented a novel algorithm to compute persistent relative homology which provides cycle representatives, persistence modules and barcode decompositions.
- Advisors: Lori Ziegelmeier (Macalester Col.) and Gregory Henselman-Petrusek (PNNL).

Teaching

Macalester College St. Paul, MN
Teaching Assistant 01/2022 - 05/2024

- Responsibilities: Attend lectures, design and grade homework, hold office hours twice weekly.
- *Linear Algebra*, Spring 2022
- *Introduction to Statistical Modeling*, Fall 2022
- *Computational Geometry*, Fall 2023
- *Algorithm Design and Analysis*, Spring 2024

Publications

Lentz, C. (2024). Persistent Relative Homology for Topological Data Analysis. *Mathematics, Statistics, and Computer Science Honors Projects*. 85. https://digitalcommons.macalester.edu/mathcs_honors/85.

Lentz C., Henselman-Petrusek G., Ziegelmeier L. (in prep). A U-match Algorithm for Persistent Relative Homology.

Talks & Presentations

Invited Talks

2024 January: Joint Mathematics Meetings, AIM-AMS Special Session on Applied Topology Beyond Persistence Diagrams, *A computational approach for persistent relative homology.*

Contributed Talks

2023 September: Fall Meeting of Mathematical Association of America NCS, *A matrix factorization algorithm for persistent relative homology.*

Undergraduate Sessions

2024 January: Joint Mathematics Meetings, PME Undergraduate Student Poster Session, *A computational approach for persistent relative homology.*

2023 October: Macalester College, Summer Showcase Seminar, *A matrix factorization algorithm for persistent relative homology.*

2024 April: Undergraduate honors defense, Macalester College, Department of Mathematics, Statistics and Computer Science, *Persistent relative homology for topological data analysis.*

Awards

Konhauser Achievement Award Macalester College, 2024

- Awarded each year to a single student majoring in mathematics at Macalester College for outstanding academic record and demonstrated dedication to and interest in the field.

Dewitt Wallace Distinguished Scholarship Macalester College, 2020 - 2024

- Based on academic merit and awarded on a highly-competitive basis.

Open Source Contributions

Open Applied Topology (in progress) Repository

Contributions:

- A low-level Rust module for computing persistent relative homology from point cloud data which uses modern data structures and matrix factorization schemes.
- Python bindings which provide accessible methods for cycle representatives and barcodes.

Other Experience

Maverick Software Consulting Minneapolis, MN

QA Software Engineer, Internship 06/2022 - 01/2023

- Supervisor: Tracy Olhausen, Senior Director of Quality Assurance.

Relevant Skills

Languages | Python, Java, JavaScript, R, Rust, C

Software Engineering | HTML, CSS, Node.js, Google Firebase

ML & Data Science | NumPy, SciPy, PyTorch, matplotlib, RStudio, Tidyverse, numerical & ML algorithms

Misc. Technologies | VS Code, Git/GitHub, Mathematica, Jira

Research | literature review, technical & academic writing, project management, collaboration

General | customer service, teaching, technical presentations