

Benjamin Holmgren

Montana State University

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Education

2018–present **Computer Science (Interdisciplinary) and Mathematics (Pure) Majors.**

Montana State University, Bozeman, MT

2018 **General Coursework with focus in Neuroscience and Economics.**

Middlebury College, Middlebury, Vermont

Projects

November **Research in Discrete Morse Theory (DMT).**

2019 to **Publication:** CCCG 2020: *If You Must Choose Among Your Children, Always Pick the Right One*

present **Description:** Proposal of novel efficient algorithms to generate Discrete Morse Functions on a simplicial complex. I also gave a presentation on this at CCCG. I later implemented these algorithms in Python.

Talk: *Using Hasse Diagrams to Compute a Gradient Vector Field*

Description: Poster Presentation accepted to NCUR 2020 (which was later cancelled due to COVID-19)

Video: *Poking a Simplicial Complex*

Description: Multidisciplinary Research Project to visualize Morse Theory and simplicial collapses.

Ongoing Work: I am working on a couple of additional papers, which deal with generating discrete Morse functions on dynamic data and provide further improvements on static generation of Morse functions.

Fall 2018 to **R Package 'TDA'.**

present **Description:** Generated tutorials for the R package 'TDA'. Implemented website tutorials using a combination of R, html, javascript, and CSS, which culminated in a nationwide workshop funded by the NSF. Also a featured story on the *Montana State University homepage*.

Fall 2018 to **Relevant Course Projects.**

present **Graphics:** Implemented interactive scenes in C++ with movement, smoothing, shading, and other linear algebra intensive techniques using OpenGL and Ray-tracing.

Machine Learning: Implemented algorithms including Bayesian learning models, nearest neighbor, k-means clustering algorithms.

Networks: Implemented HTTP client-server networks to play simple games, protocols for RDT.

Advanced Algorithms: Provided novel discrete Morse theory techniques to categorize neurons for my final project which could replace persistent homology techniques used by Hess et. al.

Fall 2018 to **Other Side Projects.**

present Working currently on developing new persistent homology techniques for categorizing neurons, on implementing new models to categorize economic data on the Numerai platform, as well as continued theoretical contributions in computational topology and geometry. I also make personal websites upon request.

Honors and Awards

- Montana State University Cameron Presidential Scholar
- School of Engineering John C. Felton and John L. Magaret Scholarships
- Member of Phi Kappa Phi and Pi Mu Epsilon Academic Societies
- 2019-2020 MSU School of Computing Undergraduate Researcher of the Year
- MSU Honors College, 3.95 GPA, President's List

Other Skills

Proficient In: Java, C, C++, Python, Git **Experience with:** R, MATLAB, Fortran, Dart, Go, Lisp, Javascript, CSS

Interests: Rock/Ice/Alpine Climbing, Trail Ultra-marathon Running, Fly Fishing, Hunting, Painting

Website: <https://benholmgren.github.io/ben-holmgren/>