

DANIEL R. CARMODY

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EDUCATION Ph.D., Mathematics University of Illinois, Urbana-Champaign 2020
B.S., Mathematics Indiana University 2014

TECHNICAL SKILLS Python (pandas, numpy, sklearn, JAX, networkx), JavaScript, LaTeX, C, SQL, Github, Mapbox, topological data analysis, regression (linear/logistic), homotopy theory

WORK EXPERIENCE Postdoctoral Researcher in Complexity Science | MIT Senseable City Lab 2021 - Present
Led transit mode imbalance initiative sponsored by the city of Stockholm using persistent homology to identify transit deserts.
Identified the long-term impacts of remote-work on university research networks using Bayesian structural time series (18 months of email data from 3000 MIT researchers).

Susan C. Morisato IGL Scholar | University of Illinois, Urbana-Champaign Summer 2020
Improved classification accuracy of patients with tinnitus by 20% using SVM and a tangent space embedding from Riemannian geometry on fMRI time series from 300 patients.

Research Assistant | University of Illinois, Urbana-Champaign Spring 2020
Coded a persistent homology engine and visualization tool from scratch in python to identify emergent obstructions in Manhattan traffic due to geography and driver behavior.

MARTIANS Intern | Sandia National Labs Summer 2019
Laid entire pipeline from data preprocessing to binary classification with an RNN for RNA-seq data (50,000 transcripts).
Predicted 2 major conflicts weeks in advance in a video game time series data set using the Mapper algorithm from topological data analysis.

NSF PI4 Program Intern | University of Illinois, Urbana-Champaign Summer 2018
Developed city-wide measures of traffic risk using publicly available data from millions of yellow taxi trips (5 GB).
Parallelized computations of cheapest paths for different cost functions on a computing cluster using the multiprocessing, osmnx, and networkx python packages (11x runtime speedup).

MENTORING Postdoc Mentor | MIT UROP Program Spring 2022
Mentored an undergraduate researcher preparing a react Redux web-based isochrone tool for city planners in the Stockholm city planning office.

Graduate Mentor | Illinois Geometry Lab 2018-2019
Led an undergraduate team using non-negative matrix factorization to look for patterns in San Francisco parking data.
Co-wrote a novel non-negative matrix factorization algorithm in python which exploited periodicity in daily parking activity.
Led a team of undergraduates using the YOLO neural network for object classification and detection for video streams in urban environments.
Wrote C code to make the neural network utilize previous frames in a video to influence detections on the current frame.

SELECTED PUBLICATIONS Carmody D, Sowers R. "A Topological Analysis of Manhattan Traffic Congestion via Persistent Homology". 2020 J. Phys. Complex. https://doi.org/10.1088/2632-072X/abc96a

Carmody D, Mazzarello M, Santi P, Harris T, Lehmann S, Abbiasov T, Dunbar R, Ratti C. "The effect of co-location on human communication networks." (Under revision at Nat. Comp. Sci.).