Brian Wheatman

brianwheatman.com

EDUCATION

Johns Hopkins University (JHU) Baltimore, MD
PhD Computer Science; Advisor: Randal Burns December 2024
Dissertation: Cache and Memory Optimized Data Structures for High Performance Applications

Massachusetts Institute of Technology (MIT) Cambridge, MA
Master of Engineering in Computer Science and Engineering June 2019
Concentration in Systems

Massachusetts Institute of Technology (MIT) Cambridge, MA
Bachelor of Science in Computer Science and Engineering June 2017
Bachelor of Science in Mathematics - Minor in Economics - Minor in Management Science

RESEARCH EXPERIENCE

JHU Department of Computer Science Baltimore, MD
Researcher with Professor Randal Burns Jan 2020 - September 2024

- Designing and implementing new data structures to efficiently store dynamic graphs and matrices to reduce the memory bandwidth requirements of analysis and computations run on these structures

JHU Distributed Systems and Networks Lab Baltimore, MD
Researcher with Professor Yair Amir Sep 2019 - Sep 2021

- Investigated methods for providing theoretical guarantees in systems using artificial intelligence
- Designed a traffic light control algorithm, which outperforms static algorithms using machine learning, without suffering from edge cases, as in standard machine learning approaches

MIT Computer Science and Artificial Intelligence Laboratory (CSAIL) Cambridge, MA
Master of Engineering Thesis with Professor Charles Leiserson in Performance Computing Sep 2017 - June 2019

- Improved an image processing pipeline containing petabytes of images with approximate locations to create a single, large mosaic with accurate locations
- Decreased time and resource requirements, allowing the pipeline to run on one server, instead of a cluster

MIT Computer Science and Artificial Intelligence Laboratory (CSAIL) Cambridge, MA
SuperUROP Researcher with Professor Daniela Rus and Professor Sertac Karaman Sep 2016 – June 2017

- Designed and implemented a new, online algorithm for a NP-Hard variant of the Traveling Salesperson Problem, which enables solutions to be found ten times faster than the current approach

MIT Human Dynamics Laboratory at MIT Media Laboratory Cambridge, MA
Undergraduate Researcher with Professor Alex (Sandy) Pentland Sep 2015 – June 2016

- Modeled energy use given data from mobile phone records using machine learning.
- Created predictive models for population movement using mobile phone records

MIT Sloan School of Management Cambridge, MA
Undergraduate Researcher with Professor Stephen Graves Feb 2014 – Aug 2014

- Designed and developed a program for simulating a user-specified production line to be used as a visualization and teaching tool

TEACHING EXPERIENCE

Guest Lecture: SIMD and Vectorization (UMD CMSC858N) Spring 2023
Teaching Assistant/Course Assistant for Parallel Programing (JHU 601.320) Fall 2021/Fall 2022/Fall 2023
Teaching Assistant for Intermediate Programming (JHU 601.220) Fall 2020
Teaching Assistant for Computation Structures (MIT 6.004) Spring 2018/Fall 2018/Spring 2019
Teaching Assistant for Seminar in Undergraduate Advanced Research (MIT 6.UAR) Fall 2017
Lab Assistant for Introduction to Digital Communications (6.02) Fall 2016
Tutor for Introduction to Algorithms (6.006) and Design and Analysis of Algorithms (6.046)
Grader for Introduction to Algorithms (6.006) and Design and Analysis of Algorithms (6.046)

PROFESSIONAL EXPERIENCE

Lawrence Berkeley National Laboratory
Visiting Researcher Summer 2022
- Researched improvements to memory efficient data structures to improve their updatability and point query performance, while maintaining their near optimal scan performance
- Focused on exceptional, practical performance, while maintaining theoretical guarantees

Google
Software Engineering Intern Summer 2023
- Developed a simulator for a global network to investigate new strategies to increase reliability

Software Engineering Intern Summer 2021
- Investigated distributed processing frameworks to select one for a distributed solver
- Implemented the distributed solver on the selected distributed processing framework

Software Engineering Intern Summer 2020
- Investigated a hierarchical traffic engineering system to simplify routing
- Simulated the new system with past data to determine the impact of the hierarchical system

Software Engineering Intern Summer 2019
- Designed a machine learning model for use in a proprietary, truth inference problem
- Implemented the truth inference model and a distributed pipeline for preprocessing the data

Software Engineering Intern Summer 2018
- Worked on Akaros, a new operating system for high performance and real time applications
- Developed a port of the Go programming language to run on Akaros

Software Engineering Intern Summer 2017
- Enhanced a large, Map-Reduce data processing pipeline used to aggregate and report advertising data
- Created software cache for fast access to critical path metadata stored in slow storage

Five Rings Capital New York, NY
Software Engineering Intern January 2017
- Conducted an evaluation of different database solutions on the basis of cost, scalability and ease of use
- Reduced cost for the cloud database by structuring data to reduce the memory requirement

Facebook Menlo Park, CA
Data Engineering Intern Summer 2016
- Created pipelines to collect and organize third party data to be used for business intelligence purposes
- Worked with multiple, large databases using several database engines, including Oracle and Hive
- Created self-documenting code that generates textual and visual aids to help understand the pipeline

JP Morgan Chase & Co. New York, NY
Software Engineering Intern Summer 2015
- Designed and implemented an automated testing process for a large, transaction system with nightly generated statistics and visualizations of performance
- Created a website to display results of the tests and long term trends

AWARDS AND HONORS

- HPEC 2024 Outstanding Paper award
- PPoPP 2024 Best Artifact Award
- HPEC 2020 Best Student Paper Award
- Gordon Croft Fellow (PhD Fellowship)
- Lockheed Martin Undergraduate Research and Innovation Scholar
- Member of Eta Kappa Nu (Computer Science Honor Society)
- Member of Tau Beta Pi (Engineering Honor Society)
- Boy Scouts of America Eagle Scout

PAPERS, PRESENTATIONS AND PUBLICATIONS

For more information see brianwheatman.com

Brian Wheatman, Randal Burns, and Helen Xu, “Batch-Parallel Compressed Sparse Row: A Locality-Optimized Dynamic-Graph Representation” 2024 IEEE High Performance Extreme Computing Conference (HPEC). IEEE, 2024

T. Kaler et al., "Speedcode: Software Performance Engineering Education via the Coding of Didactic Exercises," 2024 IEEE International Parallel and Distributed Processing Symposium Workshops (IPDPSW), 2024

Brian Wheatman, Randal Burns, Aydin Buluc, and Helen Xu, “CPMA: An Efficient Batch-Parallel Compressed Set Without Pointers” ACM SIGPLAN Symposium on Principles and Practice of Parallel Programming (PPoPP) 2024

Helen Xu, Amanda Li, Brian Wheatman, Manoj Marneni, and Prashant Pandey, “BP-tree: Overcoming the Point-Range Operation Tradeoff for In-Memory B-trees” International Conference on Very Large Data Bases (VLDB) 2023

Brian Wheatman, Randal Burns, Aydın Buluc, and Helen Xu, "Optimizing Search Layouts in Packed Memory Arrays" 2023 SIAM Symposium on Algorithm Engineering and Experiments (ALENEX), 2023

So You Want to Make a Dynamic Graph Data Structure, Invited talk at Workshop on Large-Scale Graph Processing (SPAA), 2022

Brian Wheatman and Randal Burns, "Streaming Sparse Graphs using Efficient Dynamic Sets" 2021 IEEE International Conference on Big Data (Big Data), 2021

Prashant Pandey, Brian Wheatman, Helen Xu, and Aydın Buluc, "Terrace: A Hierarchical Graph Container for Skewed Dynamic Graphs" Proceedings of the International Conference on Management of Data (SIGMOD), 2021

Brian Wheatman, et al. "RADICS: Runtime Assurance of Distributed Intelligent Control Systems" 2021 51st Annual IEEE/IFIP International Conference on Dependable Systems and Networks Workshops (DSN-W). IEEE, 2021.

Brian Wheatman and Helen Xu. "A Parallel Packed Memory Array to Store Dynamic Graphs" 2021 Proceedings of the Workshop on Algorithm Engineering and Experiments (ALENEX). Society for Industrial and Applied Mathematics, 2021

Tim Kaler, Brian Wheatman, and Sarah Wooders. "High-Throughput Image Alignment for Connectomics using Frugal Snap Judgments" 2020 IEEE High Performance Extreme Computing Conference (HPEC). IEEE, 2020

Brian Wheatman. “Image alignment and dynamic graph analytics: two case studies of how managing data movement can make (parallel) code run fast” Diss. Massachusetts Institute of Technology, 2019

Brian Wheatman and Helen Xu. "Packed compressed sparse row: A dynamic graph representation" 2018 IEEE High Performance Extreme Computing Conference (HPEC). IEEE, 2018

Brian Wheatman, Alejandro Noriega, and Alex Pentland. "Electricity demand and population dynamics prediction from mobile phone metadata" International Conference on Social Computing, Behavioral-Cultural Modeling and Prediction and Behavior Representation in Modeling and Simulation. Springer, Cham, 2016

Community Service

I have served on the following committees

- Highlights of Parallel Computing (HOPC 2024)
- ACM SIGPLAN Principles and Practice of Parallel Programming (PPoPP 2024, 2025) Artifact Evaluation

I have served as a reviewer for the following conferences:

- ESA 2023, SEA 2022 and 2023, SPAA 2022 - 2024, SICOMP 2023, IPDPS 2023 and 2025, ALENEX 2023, BigData 2022, FOCS 2022, ACDA 2021