Matthew Laws

609-917-4870 • mdl4@williams.edu • mattdlaws.com • github.com/mlaws21

EDUCATION

Williams College, Williamstown, MA | GPA: 3.95 (Major) / 3.89 (All), Bachelor of Arts in Computer Science, June 2025.

Selected Coursework: Distributed Systems, Operating Systems, Computer Organization, Causal Inference, Deep Learning, Natural Language Processing, Machine Learning, Probability, Linear Algebra, Algorithms & Analysis, Data Structures.

Honors*:* CRA Undergraduate Researcher Award: Honorable Mention, Williams College x Mysten Labs Hackathon: 1st Place, Ward Prize for Best Project in Computer Science: Department Nomination, Class of 1960 Scholar of Computer Science, Dean's List.

TECHNICAL SKILLS

Programming Languages: Python, C/C++, Go, Java, JavaScript / TypeScript (Proficient) | SQL, Move, Shell, R, F# (working knowledge)

Tools: Torch, Tensorflow (Keras), Scikit-learn, OpenCV, Hydra (AI/ML) | React, AWS S3, R53 and CloudFront, Node, Git, Ab Initio, CSS (Development) | Snowflake, Postgres, MySQL (Database) | OpenGL, GLSL, x86, LaTeX, .NET (Other)

SELECTED PROJECTS

Peer-to-Peer Federated Learning: Developed a system using Go and Python for a P2P federated learning system. Clients join the network and receive a model to train on and periodically they send an aggregation request to a random subset of nodes. We also developed support for managing multiple models at a time.

ASL Interpreter: Developed a computer vision model that identifies ASL letters. Attained 97% accuracy for letters and 95% accuracy for words. Ships with a live video recognition feature for real time translation.

Bookstore: Developed a test scale Bookstore application in Go using XML-RPC to communicate with clients. Additionally connected the store to an SQL database to store inventory.

Web Server: Built a web server application in C++ from the socket level up that parses HTTP requests and serves pages back to the web browser.

Thread Library, Disk Scheduler, & Memory Manager: Using C, implemented a uni-core thread library with synchronization primitives and a process level disk scheduler using my thread library. Additionally, implemented a memory pager with multi-process scaling.

Causal Feature Finding: Developed a user friendly framework for pruning feature spaces in ML models using Causal Inference. Improved test accuracy by up to 50% when reducing feature space by more than 50%.

Williams College Rugby Website: Developed a website for the Williams College Rugby Team from scratch using React and hosted through AWS s3 @ williamscollegerugby.com.

SOFTWARE EXPERIENCE

Sanofi, Cambridge, MA, *AI/ML Intern* May 2024 - August 2024 • Worked in the ML / AI team to leverage computer vision techniques in the clinical setting • Contributed a framework for evaluating the NHPT to Sanofi's growing library of tools.

Williams College, Williamstown, MA, *Computer Science Research Fellowship* June 2023 - May 2024 • Worked with Professor Sam McCauley to develop a state-of-the-art Succinct Rank and Select Data Structure •

Developed theoretical algorithms, implemented, and optimized them in C • Presented my research in a talk at the Symposium on Experimental Algorithms 2024.

Integral Ad Science, New York, NY, *Data Engineering Intern* June 2022 - August 2022 • Worked in a team of 4 using the Agile methodology to develop a regression testing software IAS's twitter brand safety pipeline • Completed a full data profile of the relevant IAS Twitter data using complex SQL queries in Postgres.

Williams College, Williamstown, MA, *Teaching Assistant* Sept 2022 - Present • Host 3 TA sessions a week to help students with lab assignments • Current Deep Learning TA and have TAed Computer Organization and Data Structures in the past.

Williams Students Online (WSO), Williamstown, MA, *President / Lead Developer* June 2024 - Present • Maintain full stack (React + Go) codebase for student website and mobile app used daily by over 70% of Williams students and faculty • Manage roughly 25 students across 3 projects • Personally working to develop improved admin tooling for the site.

PUBLICATIONS

SPIDER: Improved Succinct Rank and Select Performance

M. D. Laws, J. Bliven, K. Conklin, E. Laalai, S. McCauley, and Z. S. Sturdevant Symposium on Experimental Algorithms (SEA), 2024. [arXiv] [LIPIcs]

Description: Developed a Succinct Rank and Select Data Structure that uses machine-learned predictions, cache-efficient storage, and a multi-level select to achieve state-of-the-art rank and select query time.

Contribution: Responsible for a large portion of the general implementation • Developed a technique for optimizing rank queries to achieve state-of-the-art performance • Theorized and constructed novel select structure that allowed for highly accurate predictions • Ran extensive experiments to test the structure • Worked with Professor McCauley in writing the paper • Presented paper in a talk at SEA 2024.

CURRENT RESEARCH

Using AlphaFold to Determine Causal Relationships between Diseases and Mutations, Advisor: Rohit Bhattacharya (Williams College); Goal: Develop a system capable of estimating the causal effect that a given mutation has on an individual's chance of having a certain disease by using protein folding as a proxy for function; Contributions: Explored literature to define concrete causal structure for our problem • Developed a scoring metric for determining the validity of a folded protein • Designed a pipeline for running my analysis with AlphaFold; Next Step: Quantifying the intrinsic measurement error of AlphaFold

Automatic Evaluation of the Nine Hole Peg Test, Advisor: Hillol Sarker (Sanofi); Goal: Develop lightweight computer vision software for analyzing clinical trial participants performance on the Nine Hole Peg Test; Contributions: Developed a tool that could score performance on the Nine Hole Peg Test based on a video • Employed zero and one-shot learning techniques allowing system to work with little to no training data • Wrote up work in an academic paper; Next Steps: Paper is currently under review by Sanofi.

Minimal Space Practical Filters, Advisor: Sam McCauley (Williams College), Goal: Develop a new space-efficient Approximate Membership Query Filter that is fast enough for practical use; Contributions: Completed a comprehensive literature review on filters and synthesized a research topic • devised a technique for compressing our data using tANS • Calculated the expected distribution of data to ensure the structure filter would work; Next Steps: Combining separate pieces of research into a single unified implementation.

LEADERSHIP EXPERIENCE

Williams College Rugby Football Club (WRFC): *Captain* May 2024 - Present.

Williams Record, *Website Editor* Jan 2024 - Present.

Williams College Junior Advisor Program: *Junior Advisor* May 2023 - May 2024.