Maxwell Fan

GitHub: InnovativeInventor | Website: https://max.fan | Email: myfan3@illinois.edu
Programming Languages: Rust, Haskell, Python, C++, Golang, Coq.
Skills include: AWS, Linux, Docker, MongoDB, Cryptography, Formal Verification, Operations Research.

Education

University of Illinois at Urbana-Champaign ***B.S. in Computer Science & Philosophy, 8/2021 - 5/2024 (expected)***

4.0/4 GPA, in the James Scholar Honors Program.

- Responsibly reported cybersecurity bugs in school infrastructure (publicly thanked by the cybersecurity vulnerability disclosure program).
- Courses include: Formal Methods Seminar (**graduate CS** class), ML in Compilers and Architecture (**graduate CS** class), Proof Automation (**graduate CS** class), Philosophy of Logic (**graduate** Philosophy class), Programming Languages and Compilers.
- Course Assistant (undergrad **TA**) for Data Structures. Sped up build tools and compiler infrastructure by **over 50x**, saving three years of time per semester waiting for programs to compile. Held office hours.

Work Experience

Illinois Theorem Provers Lab, University of Illinois ***Research Assistant, 8/2022 - present***

Conducted type theory and programming languages research at the Illinois Theorem Provers lab, under Professor Talia Ringer.

- Worked on building proof repair tools to make formal verification more practical using setoids and quotient types.
- Formally verified programs in Coq and Cubical Agda.

Fidelity Center for Applied Technology, Fidelity Investments ***Software Engineer Intern, 6/2022 - 8/2022***

Worked at the Fidelity research and development group as a software engineer intern in the blockchain incubator.

- Proposed and built a high-performance analytics engine in Rust to deliver more comprehensive insight into market activity (**over 100x** performance speedup over previous analysis infrastructure).
- Investigated applications of formal methods for smart contract safety, culminating in a presentation and report with firm-wide recommendations.

MGGG Redistricting Lab, Tufts University ***Software Developer, 6/2021 - 12/2022***

Worked on and researched non-partisan computational techniques to quantify gerrymandering for the redistricting process in several states.

- Provided quantitative analysis and tooling to support litigation efforts by major civil rights groups, including the **NAACP LDF**.
- Analyzed redistricting maps in various states for citizen-led redistricting using Markov Chain Monte Carlo computational ensembles.
- Examined citizen submissions of districting plans by semantically grouping text with natural language processing (NLP).
- Designed and implemented the data pipeline for processing 2020 Decennial Census Public Law 94-171 redistricting data.
- Developed a compression technique that sped up the analysis turnaround cycle and increased reproducibility.

IoT Systems Research Group, University of Illinois ***Security and Infrastructure Team Co-Lead, 1/2022 - 7/2022***

- Built an experimental Internet of Things (IoT) virtualization service that aims to make IoT development more accessible for all.
- Developed various high-severity exploits and wrote patches to fix affected code, as security co-lead.
- Implemented a continuous deployment pipeline to speed up development.

Leadership and Awards

- Co-chairing **ACM@UIUC SIGPLAN**, a student group on the implementation and verification of programming languages, 2022-present.
- Leading **Open Source @ Illinois**, the premiere open-source software club at the University of Illinois, as **Vice-President**, 2021-present.
- Won the **HackIllinois "top contributor" award** for contributions to open source projects over a short timeframe, 2021.
- Founded a cybersecurity capture-the-flag team that **won 8th and 14th place nationally at picoCTF**, a competition by CMU, 2018-2021.

Projects and Public Work

Michigan Independent Citizens Redistricting Commission, Communities of Interest Report, 2021

Designed and built semantic and geographical analysis infrastructure to cluster and aggregate citizen submissions with NLP for the State of Michigan's official independent redistricting commission.

Node-Kayles, 2021.

Generalized and made contributions to the non-attacking queens problem in combinatorial game theory. Expanded on the known values of Node-Kayles sequences played on the generalized Petersen graph and 3xN lattices by developing an efficient node-contraction algorithm in Rust.