

Axel Feldmann

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EDUCATION

Massachusetts Institute of Technology, Cambridge, Massachusetts

Ph.D. in Electrical Engineering and Computer Science

anticipated in December 2024

- Advisor: Daniel Sanchez

S.M. in Electrical Engineering and Computer Science

May 2021

- GPA: 5.0 / 5.0

Carnegie Mellon University, Pittsburgh, Pennsylvania

BS in Computer Science

May 2019

- GPA: 3.9 / 4.0

Selected coursework: computer architecture, operating systems, compilers, algorithms, computer networks, numerical algorithms

EXPERIENCE

Research Assistant

September 2019 – present

MIT CSAIL - Cambridge, MA

- Currently working on designing hardware accelerators for sparse linear algebra, specifically focused on scientific computing.
- Designed *Spatula*, an accelerator for sparse matrix factorization that outperforms GPU baselines by $47\times$.
- Worked on designing hardware accelerators for Fully Homomorphic Encryption (FHE), a computationally expensive cryptographic system that enables arithmetic operations on encrypted data.
- Designed *F1*, the first proposed ASIC accelerator capable of executing entire FHE programs.
- Developed compilation techniques that enabled *F1* and *CraterLake* (our second-generation accelerator design) to achieve $5000\times$ speedups over CPU baselines.

Intern

Summer 2022

Cerebras Systems - Sunnyvale, CA

- Worked on the CSL (Cerebras Systems Language) team to designing new abstractions for programming the Cerebras Wafer Scale Engine.
- Designed and built a complete MPI-style collectives library for CSL programmers.

Undergraduate Research Assistant

2018 – 2019

Computer Organization Research Group - Pittsburgh, PA

- Worked with Prof. Nathan Beckmann on *Livia*, a system architecture for data centric computing.
- Created zsim-based simulation infrastructure to evaluate our proposed architecture.
- Wrote applications to effectively utilize *Livia*'s novel hardware features.

Systems Software Intern

Summer 2018

NVIDIA - Santa Clara, CA

- Improved display driver performance for existing and upcoming Tegra SoCs.
- Reduced kernel test time by 30% via improved thread synchronization.

Software Engineering Intern

Summer 2017

Yahoo, Flurry Analytics - Sunnyvale, CA

- Created webapp to help users design metrics API queries.
- Re-engineering User Acquisition Analysis (UAA) features on the Flurry data platform.

PAPERS

Spatula: A Hardware Accelerator for Sparse Matrix Factorization

Axel Feldmann, Daniel Sanchez, *MICRO* 2023.

An Architecture to Accelerate Computation on Encrypted Data

Axel Feldmann*, Nikola Samardzic*, Aleksander Krastev, Srinivas Devadas, Ronald Dreslinski, Chris Peikert, Daniel Sanchez, *IEEE Micro Top Picks* 2022.

CraterLake: A Hardware Accelerator for Efficient Unbounded Computation on Encrypted Data

Nikola Samardzic, **Axel Feldmann**, Aleksander Krastev, Nathan Manohar, Nicholas Genise, Srinivas Devadas, Chris Peikert, Daniel Sanchez, *ISCA* 2022.

F1: A Fast and Programmable Accelerator for Fully Homomorphic Encryption

Axel Feldmann*, Nikola Samardzic*, Aleksander Krastev, Srinivas Devadas, Ron Dreslinski, Chris Peikert, Daniel Sanchez, *MICRO* 2021.

Livia: Data-Centric Computing Throughout the Memory Hierarchy

Eliot Lockerman, **Axel Feldmann**, Mohammad Bakhshalipour, Alexandru Stanescu, Shashwat Gupta, Daniel Sanchez, and Nathan Beckmann, *ASPLOS 2020*.

TEACHING

Teaching Assistant

2018-2019

15-410: Operating System Design and Implementation, CMU

- Held office hours and designed class projects.
- Graded student projects and exams.

Teaching Assistant

2017-2018

15-213: Introduction to Computer Systems, CMU

- Taught a recitation section and held office hours.
- Graded student projects and exams.

SKILLS

Computer architecture research, hardware prototyping/development, parallel programming models, analytical and simulation-based performance modeling, hardware-software codesign.

C++, C, Python, Rust, CUDA, x86/64 assembly, Julia, PyTorch, Triton, Pandas, cuBLAS, cuSPARSE

[Resume compiled on 2023-12-05]