Ryan Synk

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ryansynk

Scientific Interests

Generative AI, High Performance Computing, Machine Learning, Transformers, Long Context Inference, Fast Algorithms, Scientific Computing, Inverse Problems

Education

2021–2024 **Ph.D, Computer Science**, *University of Maryland*, College Park
Advisor: Ramani Duraiswami, Tom Goldstein

2016–2020 **B.S, Mathematics**, *University of Maryland*, College Park
Cum Laude, High Honors in Mathematics

2016–2020 **B.S, Computer Science**, *University of Maryland*, College Park
Cum Laude

Publications

[1] Pieter Ghysels and Ryan Synk. High performance sparse multifrontal solvers on modern GPUs. *Parallel Computing*, 110:102897, 2022.

[2] Ryan Synk, Monte Hoover, Neel Jain, John Kirchenbauer, Alex Stein, Manli Shu, Josue Melendez Sanchez, Ramani Duraiswami, and Tom Goldstein. Exploiting sparsity for long context inference: Million token contexts on commodity GPUs. 2025. Under review.

Research Experience

Summer 2023 **Research Scientist Intern**, *Adobe Inc.*

- Developed open-source, cross-platform C++ benchmarking library for sparse Cholesky factorization algorithms arising in graphics workloads
- Visualized data with polars and Altair, highlighting potential speedups for a bottleneck kernel across many different Adobe products
- Contributed efficient sparse solver wrappers to the open-source PolySolve library

Summer 2019 **BLUR Fellow (Berkeley Lab Undergrad Research)**, *Lawrence Berkeley National Laboratory*

- Contributed to the Structured Matrices Package, a high-performance computing (HPC) software library written in C++ designed for solving large sparse linear systems.
- Accelerated application by porting it to GPUs via CUDA. Outperformed the original, CPU-parallelized application and achieved 3x speedup
- Gained knowledge of GPU architectures and tested work on the Summit supercomputer

Summer 2018 **UMD Computer Science Research Experience for Undergraduates**, *UMD CS*

- Studied adversarial attacks on facial recognition neural networks.
- Created adversarial attacks and trained neural networks on standard datasets using Pytorch.

Industry Experience

Nov 2020-July 2021 **Software Engineer**, *Kythera Space Solutions*

- Revamped a software library used for the management of a satellite network. The network provided internet and telecommunications to the entire continent of Australia.
- Extended functionality of satellite resource management software to allow for up to 8 network service providers
- Codebase was written in C++

Awards and Honors

2021 **Dean's Fellowship**, *University of Maryland*

2019 **Strauss Teaching Assistantship**, *UMD Mathematics Dept*

2018 **Strauss Teaching Assistantship**, *UMD Mathematics Dept*
Teaching assistantship award given every year to select group of undergraduate mathematics majors

2018 **Higgenbotham Award**, *UMD Mathematics Dept*
Award given once a year to an outstanding mathematics major

Technical Skills

Programming Languages
Python, C/C++, Matlab

Libraries and Platforms
Cuda, Pytorch, Huggingface

Relevant Coursework

Graduate Courses
Numerical Linear Algebra, Advanced Numerical Optimization, Scientific Computing I/II, Deep Learning, Computational Geometry.

Seminar Talks

2021 **An Introduction to Density Functional Theory and the Quantum Many-Body Problem**, *Seminar on ML for Rare Events*

Teaching Experience

Spring 2025 **Teaching Assistant**, *CMSC714 – High Performance Computing*

Spring 2024, Fall 2024 **Teaching Assistant**, *CMSC416 – Parallel Computing*