Zane Fink

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Education

2016–2020 **B.S. Computer Science**, *Northern Arizona University*.
GPA: 3.64

Experience

May 2019–Present **Undergraduate Research Assitant**, *NAU's Community-Aware Networks & Information Systems Lab (CANIS-Lab)*.

- Conducted research on low-bandwidth, long-ranged network architectures for resource-constrained environments.
- Supervisor: Morgan Vigil-Hayes

Jan 2019–Present **Undergraduate Research Assistant**, *NAU's School of Informatics, Computing, and Cyber Systems*.

- Investigating the acceleration of systems utilizing response-based cryptography using the GPU.
- Investigated hybrid algorithms to accelerate memory-bound algorithms on heterogeneous CPU/GPU platforms.
- Supervisor: Michael Gowanlock

March 2018–Present **Undergraduate Research Assitant**, *The Pathogen and Microbiome Institute*.

- Designed, implemented algorithms for efficient oligonucleotide probe design.
- Supervisor: Jason Ladner

Research Projects

Utilizing the GPU to Accelerate Response-Based Cryptography Systesm.

- Physical Unclonable Functions (PUFs) can provide strong, reliable sources of authentication. Previously, systems utilizing PUFs for authentication required error rates less than 10%. Errors are time-consuming to resolve on low-powered devices (cell phones and home computers), and result in large differences in computed cypertexts
- By utilizing high-performance computing clusters, error-tolerance grows and recovering from errors becomes faster. However, these clusters consume massive amounts of power, and by taking advantage of the massive parallelism afforded by the GPU, we may be able to achieve results comparable to those achieved by thousands of CPU cores on a single machine.

Using Low-Powered Wide-Area Networks as a Control Channel for Challenged Network Environments.

- A digital divide exists in the United States, where some communities have limited access to the high-bandwidth networks that connects the world. By utilizing Low-Powered Wide-Area Networks, we can help to bridge this divide.
- Currently, we are working to utilize ultra low-powered, long-ranged network architectures designed for connecting IoT devices to create a heterogeneous, delay-tolerant network that connects those in resource-constrained communities to the rest of the internet.

Hybrid CPU/GPU Memory-Bound Database Primitives.

- Because of their high memory-access to compute ratios, memory-bound algorithms such as the linear scan and multiway merge are not considered for acceleration using the GPU.
- We developed a model to evenly distribute the work between the CPU and GPU on heteregeneous computing platforms, enabling the acceleration of these memory-bound algorithms.
- Implemented hybrid algorithms to test the effectiveness of our model, resulting in up to $2.5\times$ speedup over CPU-only implementations with low average load imbalance $(5 - 20\%)$ between architectures.

Detection of Viral Exposure History Through Antiviral Antibody Response, *The Pathogen and Microbiome Institute (PMI)*.

- Assisted in the design and implementation of novel algorithms for the *Panviral PepSeq* assay, an amino acid library designed to comprehensively determine an individual's viral exposure history.
- Improved design algorithm resulted in similar levels of epitope coverage with $37 - 54\%$ fewer designed oligos.
- Wrote and was awarded two undergraduate research grants.
- Engaged in outreach activities to attract more students to participate in undergraduate research.

Publications

- Gowanlock, M., Karsin, B., **Fink, Z.** & Wright, J. (2019) Accelerating the Unacceleratable: Hybrid CPU/GPU Algorithms for Memory-Bound Database Primitives,in Proceedings of the 15^{th} *International Workshop on Data Management on New Hardware* in Conjunction with *ACM SIGMOD/PODS 2019*, Amsterdam, NL.

Papers in Preparation

- Gowanlock, M., **Fink, Z.**, Karsin, B., & Wright, J. Accelerating Memory-Bound Database Primitives on Heterogeneous CPU/GPU Architectures.

Posters

- **Zane Fink**, Jordan Wright, & Michael Gowanlock. The Acceleration of Algorithms With Low Compute to Memory Access Ratios on Heterogeneous CPU/GPU Platforms. Northern Arizona Planetary Science Alliance STEM Poster Session.
- **Zane Fink** & Jason Ladner. (2019) Panviral PepSeq: A Highly Multiplexed Serological Diagnostic. 58^{th} Annual ASM Regional Branch Conference.

Grants and Awards

April 2019 **Hooper Undergraduate Research Award**, $\$3,500$.
Introducing PepSIRF: PEPtide-Based Serological Immune Response Framework

March 2019 **Jean Shuler Research Mini-Grant**, $\$500$.

Employment History

June 2017–Jan 2018 **System Support Technician**, *Northern Arizona University*.
- Receive and manage technology support requests from library patrons, faculty, and staff.
- Support inventory management, software, printers, virtual infrastructure, and miscellaneous hardware.
- Supported the Cline Library MakerLab, involving processing 3D prints and advising patrons on how to make sure their parts print properly

Teaching Experience

Jan 2018–May 2018 **Computer Science II Lab Instructor**, *Northern Arizona University*.
- Presented and explained lab information to a class of 40 students.
- Explained technical details and helped guide students toward the proper solutions.
- Held office hours to further advance student understanding.

Extracurricular Activities

Jan 2019–Present **Student Representative, Academic Integrity Hearing Board**, *NAU's College of Engineering, Informatics, and Applied Sciences*.
- Listened to the cases of students who have either appealed alleged academic integrity violations, or who have been referred to the AIHB for multiple violations.
- Discussed details of each case with other board members, weighing evidence presented by both the student and the referrer.
- Helped determine appropriate course of action for students who are found in violation of NAU's academic integrity policy.