Ahmer Raza

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Education

Clemson University Clemson, SC
M.S. in Mathematics, Statistics concentration August 2024 – May 2026 (expected)
4.0/4.0 GPA

Clemson University Clemson, SC
B.S. in Computer Science, Mathematics minor August 2021 – May 2024
4.0/4.0 GPA, Departmental Honors

Publications

[1] **A. Raza** and Z. Zhang, "CAROT: A Secure RISC-V ECU with TEEs and MTD", in *2025 IEEE SecDev*, in review.

[2] **A. Raza**, C. S. McMahan, and R. G. D'Oliveira, "Private and efficient surveillance using sample pooling", Manuscript in preparation, 2025.

[3] **A. Raza** and H. Smith, "Large-Scale Hawkes Process Modeling of Social Media Data", Manuscript in preparation, 2025.

Posters and Presentations

[1] **A. Raza**, *A novel cost-effective surveillance strategy that guarantees differential privacy*, Presentation at the SC-ASA Palmetto Symposium, Available at: https://ahmerr.com/posters/Sample_Pooling_Presentation.pdf, Apr. 2025.

[2] **A. Raza**, *Large-scale hawkes process modeling of social media data*, Poster presented at the Clemson AI Symposium, Available at: https://ahmerr.com/posters/Hawkes_CIO_Poster.pdf, Apr. 2025.

[3] **A. Raza**, *Roar-e: A winning autonomous robot for the ieee southeastcon 2024 hardware competition*, Poster presented at the Clemson Focus on Creative Inquiry, Available at: https://ahmerr.com/posters/Robotics_FoCI_Poster.pdf, Mar. 2024.

Research Experience

Graduate Research Assistantship Clemson, SC
Hawkes Process Modeling (advisor: Dr. Hudson Smith) Spring 2024 – Present

- Working on fitting a multivariate Hawkes model on a massive social media dataset with 217M events and 87K event types in order to detect large-scale Coordinated Information Operations (CIOs), which will enable better.
- Devised and implemented novel theoretical and practical optimizations to alleviate the time and memory complexity of the Hawkes process likelihood function. Observed orders of magnitude improvement in speed and memory usage.
- Releasing a feature-rich, open-source, optimized PyTorch Hawkes library, supporting a wide range of multivariate Hawkes process configurations.
- Ongoing work on paper preparation, further scaling optimizations, integration of marks into the Hawkes model, and Bayesian inference for model fitting [3].

Graduate Research Clemson, SC

Differential Privacy and Statistics (advisors: Dr. Chris McMahan and Dr. Rafael D'Oliveira) Fall 2024 – Present

- Conducting research on a novel theoretical application of differential privacy to sample pooling.
- Completely characterized the privacy of sample pooling, and showed that it always provides better privacy guarantees than unpooled testing. In conjunction with previous work, in many scenarios, sample pooling is more cost-effective, accurate, and private than conventional unpooled testing.
- Outlined a framework for designing experiments that achieves a chosen level of differential privacy while maintaining optimal estimation efficiency.
- Ongoing work on paper preparation, exploring diagnostic test cost as a constraint, and creating software to enable practitioners to easily use these results. [2].
- This work won 1st place in the presentation competition at the SC-ASA Palmetto Symposium.

Undergraduate Research Assistantship Clemson, SC

Automotive Cybersecurity (advisor: Dr. Zhenkai Zhang) Spring 2024 – Fall 2024

- Designed and implemented a secure automotive Electronic Control Unit (ECU) for connected vehicles using RISC-V, Trusted Execution Environments (TEEs), and Moving Target Defense (MTD). Secure ECU built from the bottom-up using Rocket Chip and Keystone Enclave.
- To prototype the platform, I designed and deployed a Rocket core-based System-on-Chip (SoC) on an Artix-7 FPGA; built and ran a custom embedded version of Debian Linux on the SoC; substantially modified Keystone Enclave to port it to the system; wrote complex custom SPI and CAN drivers for Keystone Enclave; and added the Instruction Set Randomization (ISR) MTD to the Rocket core CPU pipeline.
- To test the platform, I created a CAN interface for the CARLA simulator and a CV pipeline for lane assist, with controller logic implemented on the ECU.
- This work has resulted in a first-author paper, which is currently under review [1].

Creative Inquiry (Student-Driven Undergraduate Research) Clemson, SC

Robotics Systems Research (advisor: Dr. William J. Reid) Fall 2023 – Spring 2024

- As team leader, designed and built a fully autonomous robot that won 1st place among more than 50 universities at the IEEE SoutheastCon 2024 Hardware Competition.
- Design and implementation work included 3D modeling and printing robot components; verifiably safe power management for electronic components; design of an extremely robust chassis and drivetrain; low-level microcontroller programming; sensor fusion for advanced localization; robot policy development and refinement; and solving the inverse kinematics of a 4 degrees-of-freedom robotic arm manipulator.
- Presented a research poster and gave a live demonstration at the Clemson Focus on Creative Inquiry.

Undergraduate Research Clemson, SC

Side-Channel Attacks (advisor: Dr. Zhenkai Zhang) Summer 2023 – Fall 2023

- Investigated feasibility of launching bit disturbance attacks (e.g., Rowhammer, RowPress) from discrete GPUs via CUDA DMA to exploit motherboard DRAM.
- Successfully reproduced Rowhammer behavior on standard desktop hardware using CPU-based access patterns.
- Performed experiments using pinned memory and CUDA DMA transfers to thoroughly explore cross-device bit disturbance attack vectors.
- Demonstrated that GPU-based Rowhammer/RowPress is infeasible under typical DMA constraints, primarily due to CUDA's high-bandwidth but high-latency memory model.

Scholarships and Awards

- SC-ASA Palmetto Symposium April 2025
  Awarded 1st place in the Presentation Competition
- IEEE SoutheastCon 2024 March 2024
  Awarded 1st place in the Hardware Competition
- Garrison Family Annual Scholarship 2023 – 2024

- Frank M. Gunby Memorial Scholarship   2023 – 2024
- South Carolina LIFE Enhancement   2022 – 2024
- South Carolina LIFE Scholar   2021 – 2024
- Clemson University Scholarship   2021 – 2023
- Clemson University Honors College   Fall 2021 – Spring 2024
- Clemson University President's List   Fall 2021 – Spring 2024
- GaSTC 2019   March 2019
  Awarded 1st place in Project Programming at the Georgia Student Technology Competition

SKILLS

- **Programming Languages:** C/C++, Python, R, Java, JavaScript/TypeScript, HTML/CSS

- **Software Tools:** Git/GitHub, NodeJS platform, many web and app frameworks, Xilinx Vivado EDA, SolidWorks 3D design, KiCad/EasyEDA

- **Hardware Experience:** Through-hole and SMD PCB soldering, Rasperry Pi and Arduino MCUs and SBCs, Xilinx Artix A7 FPGAs, 3D printing

- **Mathematics Concepts:** Probability theory, cryptography and differential privacy, optimization and numerical methods

PROJECTS

- **MIPS Simulator** (C/C++/Python), Spring 2023: Cycle-accurate command-line simulation of a MIPS pipelined processor. Handles `lw`, `sw`, `beq`, `add`, `sub`, `and`, `or`, `slt`, and `j` instructions. Dynamically detects and handles data and control hazards

- **C-Natural** (C/C++, Spring 2023): Custom programming language and transpiler made to facilitate beginners' learning of advanced programming concepts. Developed for CUHackit 2023.

- **Periodic Table** (Java/JApplet): Interactive Java-based Periodic Table app. Won 1st place in Project Programming at GaSTC 2019.

EXTRACURRICULAR ACTIVITIES

- IEEE Student Branch Leadership   Spring 2024 – Fall 2024
  Webmaster for the IEEE Student Branch at Clemson

- VEX V5   Fall 2024
  Mentored and refereed VEX V5 teams from 6 high schools, middle schools, and elementary schools. Taught and helped transition to Python for robot programming.

- Pickens County Career & Technology Center   Fall 2024
  Organized interactive 2-hour Python workshops at the PCCTC to teach Python to high school students.

LANGUAGES

- **English:** native proficiency.
- **Urdu:** bilingual/fluent proficiency.