ALAN DEVKOTA

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PROFILE

- Strength in Computer Architecture, DNN, Transformer Neural Networks, Machine Learning Reliability, Adversarial Attack and Defenses, CUDA, FPGAs, VLSI Systems Implementation with HDL, Wireless Communication, and Information Theory
- Programming experience in C, C++, Python and program solving skills using OOP principles
- Self-motivated, problem-solving, analytical and collaborative individual with excellent communication skills
- Interested in Machine Learning Security, AR/VR/MR Security, Transformer Neural Networks, Cryptography, Multimodality Neural Networks, Computer Vision, Generative AI, Robotics, Embedded Systems, HPC, and Wireless Communication

EDUCATION

George Mason University, Fairfax, VA **Aug 2025 - Present**

PhD, Cybersecurity | Advisor: Dr. Tanvir Arafin

University of Houston, Houston, TX **Aug 2022 - May 2025**

PhD, Electrical and Computer Engineering | Advisor: Dr. Albert M. Cheng

- **Coursework:** Advanced Machine Learning, Advanced Computer Architecture, GPU / heterogeneous programming, Operating Systems, Real-Time Systems and Embedded Programming, Advanced Hardware Design, VLSI Design

Southern Illinois University Carbondale, Carbondale, IL **Jan 2020 - Aug 2022**

M.S. Electrical and Computer Engineering | Advisor: Dr. Gayan Amarasuriya Aruma Baduge

- **Coursework:** Adv. Wireless Communication, Digital Communications, Intro to Information Theory, Signal Detection and Estimation, Probability and Stochastic Processes, Communication Systems, Digital Signal Processing, Implement VLSI Systs w/HDL

TECHNICAL SKILLS

- **Programming:** C, C++, Python, Core Java and Web Basics
- **Scripting:** Python, MATLAB
- **HDL, Synthesis and Verification:** Verilog RTL, SystemVerilog, VHDL, Xilinx Vivado
- **Version Control:** Git
- **Libraries:** Numpy, Pandas, Matplotlib
- **Machine Learning:** Pytorch, Tensorflow
- **Developer Tools:** Visual Studio Code, Jupyter Notebook, Anaconda
- **Operating Systems:** Linux, Windows

WORK EXPERIENCE AND RESEARCH

SPIRE Lab, Department of Cybersecurity **George Mason University**

Graduate Research Assistant *Aug 2025 to Present*

- Hardware implementation of interactive proof-based chiplet-to-chiplet Built-In-Self-Test (BIST) system that integrates the sum-check protocol with an innovative on-site computation engine based on dynamically reconfigurable scan chains
- Side-channel analysis of CUDA applications on NVIDIA GPUs (Instrument, trace and analyze GPU kernel execution to detect timing-based, control-flow, and data-flow side channel leakage in GPU for AES cryptography and Number Theoretic Transform)

Department of Electrical and Computer Engineering **University of Houston**

Graduate Research Assistant *Aug 2022 - May 2025*

- Transformer Neural Networks Attack and Defense, Multimodal Neural Networks, Convolutional Neural Network, Object Detection Transformers, Vision Transformers, Machine learning and AI, Computer Architecture, Computer vision, and Object Detection
- Adversarial Attack and Defense on Vision Transformers, Noised based Adversarial Training (Gaussian and Undervolting Noise)
- Localized Fault Recovery in FPGA BRAMs with pre-characterized fault clustering and priority-based event scheduling

Graduate Teaching Assistant *Spring 2023, Fall 2023, Spring 2024, Fall 2024*

- ECE 5357 – Intro to Cybersecurity, ECE 6373 – Adv Computer Arch, ECE – 5330/6397 Intro to Robotics

Office of Information Technology **Southern Illinois University**

Technical Student, Network Security (Part time) *Jan 2022 to May 2022*

- Working with various customers, end-users, and vendors to troubleshoot issues pertaining to wired and wireless network access, DHCP, DNS, firewalls, VPN, subnetting, routing, and other network services

Wireless Communication and Information System Laboratory **Southern Illinois University**

Graduate Research Assistant *Spring 2021 - Summer 2022*

- Intelligent Reflecting Surface-Assisted Relay Networks, Simultaneously Transmitting and Reflecting Reconfigurable Intelligent Surface (STAR-RIS), and Simultaneous Wireless Information and Power transfer technology (modeling, simulation, statistical characterization, performance analysis, study of phase-shift quantization, Energy Harvesting, and achievable rate-energy trade-off).
- Modeling and simulation of Relay Assisted Cooperative Communication System, RIS-aided NOMA, and Massive MIMO systems

Department of Electrical and Computer Engineering **Southern Illinois University**

Graduate Teaching Assistant *Spring 2020, Fall 2020*

- *Electronics ECE-345:* Lab instructor, design and simulation of Electronics circuits, grade assignment and reports
- *Intro to Biomedical Imaging ECE-467:* Lab instructor, image processing, 3D image projection, grade assignment and reports

- *Digital Signal Processing ECE-468:* Lab instructor, signal processing and analysis, filter design, grade assignment and reports

PUBLICATIONS

- Diluka Loku Galappaththige, **Alan Devkota**, and Gayan Amarasuriya, "On the Performance of IRS-Assisted Relay System", 2021 IEEE Global Communications Conference (GLOBECOM). IEEE, 2021. (Link)
- **Alan Devkota**, " Performance Analysis of RIS-Assisted Relay Systems", Southern Illinois University at Carbondale, 2022. (Link)
- **Alan Devkota**, and Albert M. K. Cheng, "Localized Fault Recovery in FPGA BRAMs with Pre-Characterized Scheduling and Redundancy", IEEE Embedded Systems Letters, 2025 **(Submitted)**

NOTABLE COURSE PROJECTS

Advanced Machine Learning
- Implemented a DETR transformer for Multispectral Object Detection with ResNet50 backbone, concatenation of RGB and thermal tokens for early fusion, DETR encoder and decoder, and a MLP block is used to predict the object with bounding box.

Advanced Computer Architecture
- Investigated the performance impact of several basic cache configuration parameters, such as the L1, L2, and TLB cache size, associativity, and block size using the SimpleScalar "sim-outorder" model and the SPEC 2000 benchmark suite.

GPU/Heterogeneous Programming
- Simulated gravitational interactions among n bodies using a Python serial implementation and a C++/CUDA parallel approach, leveraging GPGPU architecture for efficiency.

Operating Systems
- Developed and integrated the Banker deadlock avoidance algorithm into the Process Manager to prevent deadlocks in a Unix/Linux system. Implemented EDF and LLF scheduling with tiebreakers, using semaphores and pipes for inter-process communication.
- Simulated the Chor and Coan Randomized Byzantine Agreement Algorithm using real Unix/Linux processes. Used shared memory and semaphores to model communication links between processor pairs.

VLSI Design
- Implemented a D flip-flop (D-FF) circuit cascading two MUXs in Cadence and LTspice using 180nm technology for Mosfets.

Advanced Hardware Design
- Designed a Vehicular Robotic Arm using ESP32 microcontroller and developed an Android app for control using Android Studio.

Implementation of VLSI Systems with HDL
- Design of adder, multiplexer, register, flip-flops, counter circuits, and memory using Synopsys VCS and Xilinx Vivado and implementation in Bays3 FPGA board.

Introduction to Information Theory
- Realized entropy in terms of the asymptotic behavior of independent and identically distributed sequence and verified the weak asymptotic equipartition property through simulation in MATLAB.

Signal Detection and Estimation
- Generated random variates, derived statistical properties, and determined the asymptotic properties of the MLE estimator and the CRLB estimator via MATLAB.

CONFERENCE PRESENTATIONS AND POSTERS

- **Conference Presentation:** "On the Performance of IRS-Assisted Relay System" at 2021 IEEE Global Communications Conference: Wireless Communications Conference (GLOBECOM), held in Madrid, Spain [Presented Online]
- **Poster Presentation:** "Harnessing Heterogeneous Healthcare Data: An Attention Neural Network Approach" at 2023 AI in Health Conference (AIHC), Hosted by the Ken Kennedy Institute at Rice University

OTHER PROGRAMMING PROJECTS

Single and Multi-Modality Object Detection Transformer leveraging cross-attention across modalities
- Developed a transformer model that integrates the information from different modalities together to enhance the prediction as well as address the challenges posed by missing modalities via cross-attention encoders.
- Developed a RT-DETR, an extension to Detection Transformers (DETR), as a means to conduct real-time Object Detection from saved video as well as webcam video.

Harnessing Heterogeneous Healthcare Data: An Attention Neural Network Approach
- I will be developing an attention neural network-based model to fuse heterogeneous healthcare data, focusing on cross-modality attention transformer blocks for modality integration. Moreover, prompt learning will be utilized to effectively address the challenge of missing modalities in the dataset.

Performance Analysis of IRS-Assisted Relay Systems
- Investigated the performance of intelligence reflective surface (IRS)-assisted relay systems via modeling, simulation, and statistical characterization in MATLAB.

Energy Harvesting in RIS-Assisted Relay Networks
- Investigated the performance of intelligence reflective surface (IRS)-assisted relay systems for Simultaneous Wireless Information and Power transfer (SWIPT) technology, Energy Harvesting, effects of phase-shift quantization and achievable rate-energy trade-off in SWIPT technology via modeling, simulation, statistical characterization in MATLAB.