Ali Hamza Malik

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TECHNICAL SKILLS

Programming Languages: Python, C/C++, Julia, Rust, JavaScript, Kotlin, MATLAB
Formal Methods: SMT Solving, Symbolic Execution, Theorem Proving, SMT Solvers (Z3, Bitwuzla), Model Checking (NuXmv, TLA+, STORM), Protocol Verifiers (Tamarin Prover, ProVerif, CryptoVerif)
DS/ML/AI: PostgreSQL, SQLite, PyTorch, TensorFlow, Scikit-Learn, Hugging Face/Transformers, Pandas, NumPy, LangChain, Ollama, OpenRouter, RAG, Knowledge-Based LLM Content Validation
DevOps & Cloud: Git, Docker, GitHub Actions, Shell Scripting, CMake, AWS (EC2, Route 53, AgentCore), N8N

EDUCATION

PhD in Electrical & Computer Engineering   Expected May 2028
University of Massachusetts Amherst
    Teaching Assistant: ECE 304: Junior Design Project, ECE 361: Fundamentals of Electrical Engineering

BE in Electrical Engineering *and* Minor in Computer Science   Completed June 2023
National University of Sciences and Technology, Pakistan
    Capstone Project: Logic-Locking Security Evaluation: Developed an end-to-end pipeline to analyze the security-cost tradeoffs of hardware obfuscation techniques on hardware design circuits.

RELEVANT EXPERIENCE

Graduate Research Assistant, Khwarizmi Lab   September 2023 – Present
University of Massachusetts Amherst
- Built a verification framework to analyze quantum key distribution (QKD) protocols; identified four new vulnerabilities arising from quantum–classical interactions.
- Applied formal analysis to U.S. ACH banking systems to uncover security vulnerabilities in the access control and authorization of ACH direct payments.

Undergraduate Research Assistant, Communication Systems and Networks Lab   September 2022 – July 2023
National University of Sciences & Technology, Pakistan
- Collaborated in the design and implementation of an event-driven coordination protocol for multi-agent aerial swarms on Raspberry Pi companion computers with Pixhawk/ArduPilot flight controllers.
- Designed and optimized leader–follower formation control (flock, line, helical) with dynamic reconfiguration, achieving under 2 min formation-switching latency.
- Engineered a mesh networking stack (IEEE 802.11, UDP/TCP, MAVLink) to enable fault-tolerant communication for control coordination in real-time (under 100 ms latency).

Hardware Security Intern, IC Design Lab   June 2022 – September 2022
National University of Sciences & Technology, Pakistan
- Lead the design of ENIGMA, a Python framework that automatically inserts logic-locking defenses into hardware designs, protecting IP designs from unauthorized use and reverse engineering.
- Designed a parametrized key-insertion system (64–256 bits) with user-defined cell libraries to analyze the impact of logic obfuscation on a chip's area, delay, and power.
- Achieved less than 3% area overhead for a logic-locking security feature by analyzing and optimizing algorithms on proprietary RISC-V designs within the ENIGMA framework.

Machine Learning Intern, TUKL Deep Learning Lab   June 2021 - September 2021
National University of Sciences & Technology, Pakistan
- Streamlined machine learning workflows by developing an automated Python pipeline to extract, structure, and preprocess data from raw court documents.
- Fine-tuned Transformer–based NLP models in TensorFlow and PyTorch for court-case outcome prediction, achieving 83% accuracy on a custom legal case dataset and improving model generalization.

HONORS AND AWARDS

2023 - Rector's Gold Medal: Awarded for best senior project, National University of Sciences & Technology.
2022 - 2nd Place, CSAW'22 LLC: For a global security hackathon competition, NYU School of Engineering.