

PRAGYA SHARMA

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Research Interests: 5G, IoT, Network Security, AI for Security, Reinforcement Learning, Federated Learning

EDUCATION

Virginia Tech — Arlington, Virginia, USA Jan 2021 - Dec 2025 (anticipated)
Ph.D. in Computer Engineering GPA: 4.0/4.0
System and Software Security, Network Security, Fundamentals of Information Security, Blockchain Technologies

Indian Institute of Technology Bombay — Mumbai, India Jul 2013 - Jun 2018
B.Tech. & M.Tech. in Electrical Engineering GPA: 8.36/10.0
Fundamentals of Machine Learning, Markov Chains and Queuing Systems, Wireless and Mobile Communications

WORK EXPERIENCE

Kryptowire Labs — McLean, Virginia, USA May 2022 - Aug 2022
Research & Development Intern

- Deployed WAVE, a decentralized authorization framework, on a Kubernetes cluster and conducted stress-testing experiments to assess the scalability of the distributed system under constrained resources.
- Evaluated the performance of WAVE to propose and further integrate the framework as an authorization mechanism in the 5G core network.

Cadence Design Systems — Pune, India Jul 2018 - Dec 2020
Senior Design Engineer

- Developed standardized libraries for Tensilica FixedPoint and FloatingPoint MathX Digital Signal Processors (DSPs) and optimized the code to achieve best possible performance by the DSPs.
- Contributed to the optimization of Instruction Set Architecture (ISA) of Tensilica ConnX family DSPs by analyzing the assembly level code for effective utilization of VLIW slots. Achieved faster performance of these DSP cores and benchmarked compilation of arithmetic operations on both GCC and LLVM C-compilers.
- Co-developed the neural network (NN) library of the Tensilica HiFi4 DSP to enhance Automatic Speech Recognition (ASR) capabilities of voice-controlled digital assistants.

PUBLICATIONS

1. **5G-WAVE: A Core Network Framework with Decentralized Authorization for Network Slices**
P. Sharma, T. Atalay, H. Gibbs, D. Stojadinovic, A. Stavrou and H. Wang
IEEE INFOCOM 2024 - IEEE International Conference on Computer Communications
2. **FedMADE: Robust Federated Learning for Intrusion Detection in IoT Networks Using a Dynamic Aggregation Method**
S. Sun, P. Sharma, K. Nwodo, A. Stavrou and H. Wang
ISC 2024 - Information Security Conference
3. **Adaptive Flow-Level Scheduling for the IoT MAC**
P. Sharma, J. Nair and R. Singh
COMSNETS 2020 - International Conference on COMmunication Systems & NETworks

RESEARCH PROJECTS

Conflict Mitigation of xApps and rApps in 5G Open RAN Intelligent Controller (RIC) (Current)
Primary Researcher

- **Goal:** To design an AI-based conflict mitigation framework for xApps in 5G Open RAN RIC
- **Contribution:** Working on a conflict mitigation framework to detect and prevent conflicts on xApps deployed on an O-RAN compliant near real-time RIC. Training a reinforcement learning (RL) agent using Key Performance Measurement (KPM) metrics collected from a digital twin RAN simulator to integrate with an end-to-end 5G deployment.

5G-WAVE: Decentralized Authorization of Network Functions (NFs) in 5G core

Primary Researcher

- **Goal:** To create a decentralized authorization framework for service access among 5G core VNFs
- **Contribution:** Integrated 5G core with WAVE, a decentralized authorization mechanism, to grant service access among VNFs. Replaced the OAuth2.0 authorization with WAVE to eliminate security vulnerabilities caused by a central authorization server. Demonstrated the functionality of 5G-WAVE by modifying OAI 5G core entities deployed on a Kubernetes cluster and validated the design scalability by measuring timing overhead in deployments with multiple slices.

Autonomous Cyber Agents for Security Testing and Learning Environments

Collaborating Researcher

- **Goal:** To develop an RL-based autonomous cyber range with varying degrees of fidelity to train red (attacker) and blue (defender) agents that dynamically adapt to network changes.
- **Contribution:** Worked towards building a high-fidelity network digital twin emulator by analyzing methods to clone softwares and known vulnerabilities from real networks. Built a test environment consisting of Metasploit, Kali Linux VMs, OpenVSwitch and Faucet SDN controller to demonstrate CAGE challenge scenarios.

Federated Learning-based Intrusion Detection in IoT Networks

Collaborating Researcher

- **Goal:** To develop a robust intrusion detection system for IoT networks using federated learning
- **Contribution:** Co-designed a dynamic aggregation method within the federated learning framework to address data heterogeneity from varying device vulnerabilities, significantly improving attack classification accuracy on real-world IoT traffic datasets.

AWARDS

- IEEE INFOCOM Student Travel Grant (2024)
- Pratt Fellowship by ECE Department, Virginia Tech (2024)
- IIT Bombay Institute Organizational Color (2016)
- CBSE Merit Certificate for 12th grade Maths and Sanskrit (99.9th percentile) (2013)
- Government of India INSPIRE Scholarship (2013)

COURSE PROJECTS

- Detecting price manipulation vulnerabilities in DeFi flash loan attacks using static taint analysis
- Feature-fingerprinting of SSH login attacks and countermeasures with honeypots
- Anomaly detection in network traffic data using deep Q-learning
- Securing private DNS records with DNSSEC and DANE
- Demonstrating key re-installation vulnerabilities in WPA2

TECHNICAL SKILLS

- * **Software/Packages** - Kubernetes, Docker, OpenStack, PyTorch, Gymnasium, Wireshark
- * **Languages** - C, C++, Python, Bash, MATLAB

LEADERSHIP/VOLUNTEERING SERVICES

- * **Student Volunteer** - srsRAN Project Fall Workshop (2024)
- * **Technical Reviewer** - Journal of Computer Security, IEEE ICDCS, ESORICS (2024)
- * **Campus Representative, Arlington** - Virginia Tech Graduate Student Assembly (VT-GSA) (2022)
- * **President, Washington DC Chapter** - IIT Bombay Heritage Foundation (IITB-HF) (2022-24)
- * **Web Nominee** - Hostel Affairs, IIT Bombay (2015-16)