

Shawal Khalid

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🏠 <https://scholar.google.com/citations?user=z175t0oAAAAJ&hl=en>

EDUCATION

Doctor of Science in Computer Science & Applications

Virginia Polytechnic Institute and State University

12/2026

Blacksburg, VA

Research Focus: Machine learning and large language models for automated vulnerability detection, explainable AI for program analysis, and multi-agent AI systems for secure software development.

Master of Science in Computer Science & Applications

Virginia Polytechnic Institute and State University

05/2024

Blacksburg, VA

Bachelor of Science in Computer Science

Merit based scholarship Awardee - Comsats University Islamabad

01/2022

Islamabad

SKILLS

AI/ML Research: LLM Fine-Tuning (Mistral, LLaMA, Phi-2), Domain Pretraining, RAG, Multimodal Models, Diffusion Models, Prompt Engineering, Evaluation Pipelines, Explainability (SHAP/LIME), Contrastive Learning, Reinforcement Learning (RL)

Model Optimization: Quantization (4-bit/8-bit), Pruning, Distillation, Distributed Training (DDP/FSDP), Hardware-Aware Optimization, ONNX Runtime, TensorRT, On-Device ML, GPU Profiling (Nsight, PyTorch Profiler)

AI Security & Blockchain ML: Smart Contract Analysis, Vulnerability Detection, Multi-Agent AI Architectures, EVM Debugging, Slither, Mythril, SmartBugs, Formal Methods (SMT/Solver basics), Gas Optimization

Programming & Tools: Python, PyTorch, TensorFlow, JAX, LangChain, Hugging Face Transformers, Docker, Kubernetes, GitHub Actions, FastAPI, Solidity, TypeScript, Bash, Faiss, Redis, PostgreSQL

WORK EXPERIENCE

Graduate Research Assistant

05/2022 – present

Virginia Tech

~ Multi-Agent LLM Framework for Smart Contract Security

- Designing a multi-agent LLM architecture (Auditor–Critic–Validator–Generator) to improve vulnerability detection, explainability, and developer usability in smart contract auditing.
- Conducting early-stage experiments with domain-pretraining and fine-tuning of models (Mistral, LLaMA, Phi-2) on curated smart contract datasets (e.g., SmartBugs).
- Developing the research methodology for quantization strategies, distributed inference, and hybrid LLM + static analysis pipelines.

~ AI Benchmarking Framework for Smart Contract Auditing

- Engineered a benchmarking pipeline for evaluating smart contract auditing tools (Slither, Mythril, FTSmartAudit, Smart-LLaMA) across 140+ Solidity contracts from the SmartBugs Curated dataset.
- Designed fuzzy line-matching algorithms and standardized precision/recall scoring to improve cross-tool comparability.
- Integrated LLM-based explainability layers to analyze root causes of detection failures, enhancing interpretability for researchers.
- Designed a benchmarking framework enabling consistent comparison of AI and static analysis tools for secure smart contract auditing.

React Native Developer Intern

01/2025 – 05/2025

XNET Mobile Inc, CA

- Engineered a cross-platform Web3 mobile dApp in React Native, emphasizing dynamic UI/UX and responsive user interactions.
- Integrated blockchain authentication using ethers.js to enable secure wallet connectivity and decentralized identity management.
- Connected front-end components to backend databases through RESTful APIs, improving data handling and reducing load time.
- Collaborated in an Agile team environment using Git, Docker, and CI/CD pipelines, accelerating feature deployment and quality assurance.

Blockchain Developer & Research Analyst

01/2021 – 12/2021

Block Ventors Lahore


- Implemented and analyzed consensus algorithms in Hyperledger Fabric to study distributed-ledger performance and reliability.
- Architected and deployed a decentralized web application for pharmaceutical supply-chain tracking, leveraging CouchDB for data replication and traceability.
- Developed smart-contract logic and REST APIs enabling transparent drug-shipment auditing across stakeholders.

- Collaborated with a research team to evaluate scalability trade-offs and propose optimizations for future production rollout.

SELECTED PUBLICATIONS

Evaluating Capabilities and Perspectives of Generative AI Tools in Smart Contract Development  03/2025
ACM International Symposium on Blockchain and Secure Critical Infrastructure (BSCI 2025), Vietnam.

- Scope: Survey (n=114) of blockchain devs; benchmark on 102 Solidity DApps 17 categories.
- Key findings: Developers cite security/reliability risks (31.6%) and accuracy concerns (29.0%) as top blockers to LLM adoption; ask for automated testing and IDE/VCS integration.
- Results (benchmark): Google Gemini compiled 10% of targets ($p < 0.0001$ vs. originals), while ChatGPT and ChainGPT compiled 70% and 67% in one configuration; originals compiled 80%.
- Takeaway: Emphasizes the need for stronger test harnesses and CI hooks around LLM-generated contracts (unit tests, static checks, security gates).

Exploring User Perceptions of Crypto Signals: An Empirical Study from Social Media  08/2024
IEEE Cybermatics Congress 2024, held in Copenhagen, Denmark.

- Scope: Analyzed 100 crypto-signal tweets and corresponding GitHub activity using a 48-hour pre/post window; evaluated commits, churn, issues, and SanAPI's GitHub Activity Score.
- Key findings: Crypto signals led to significant rises in development activity — GitHub Activity Score +17.7% (171.69 \rightarrow 202.08, $p = 0.0094$) and code churn +103 lines on average ($p = 0.0382$), especially after high-influencer tweets (commits 8.66 \rightarrow 9.83). Sentiment analysis of 1,372 commit messages showed negative sentiment increased from 58.2% \rightarrow 75.4% ($p = 0.002$) after signals.
- Takeaway: Crypto-signal tweets act as external stressors that alter both development pace and developer emotional tone, creating a measurable socio-technical feedback loop between social-media hype and open-source crypto development.


Decoding the Influence: Analyzing the Impact of Crypto Signals on Software Repositories  08/2024
IEEE International Conference on Software Analysis, Evolution, and Reengineering (SANER 2025), Canada.

- Scope: Links popular X (Twitter) “crypto signals” to subsequent GitHub activity on related repos; uses Mann-Whitney U and interrupted time-series models.
- Key results: Crypto-signal windows show significant increases in GitHub activity (e.g., GitHub Activity metric $W = 412.5$, $p = 0.0094$; ITS model $F = 1.037$, $p < 0.001$).
- Influencer effect: For “top-influencer” posts, commits per window rose 8.66 \rightarrow 9.83, with significant upticks in code churn ($W = 97$, $p = 0.0382$) and GitHub Activity ($W = 100$, $p = 0.0036$).

Software Engineering Approaches Adopted By Blockchain Developers  09/2023
Software defined Systems, San Antonio, Texas.

- Scope: IRB-approved survey of 54 blockchain developers on SDLC adoption and practices.
- Findings: 84% follow SDLC; design being critical stage (43%); Kanban/Scrum preferred by 63%.
- Takeaway: Despite process adoption, tooling gaps persist especially in debugging, testing, and security.


RELEVANT PROJECTS

Xnet-go Decentralized Mobile Network  01/2025 – present

- Built a cross-platform Web3 mobile app using React Native + ethers.js with secure wallet authentication.
- Optimized global state using Redux, improving UI responsiveness and reducing render overhead.
- Integrated REST APIs and implemented automated testing (Jest, Detox) for mobile reliability.

Remote Assistant Bot - Helps onboard new SDE  01/2022 – 05/2022

- Developed a GCP-hosted onboarding assistant for new software engineers, supporting FAQ retrieval, meeting scheduling, and “reverse search” across documents.
- Implemented multimodal features combining text, metadata, and screen context for improved relevance.
- Designed analytics for identifying common onboarding bottlenecks.

Omniscient Debugger  08/2022 – 12/2022

- Created a lightweight time-travel debugger using ptrace to capture and replay register states, stack frames, and execution steps.
- Implemented breakpoints, backward stepping, and trace visualization for program analysis.
- Demonstrated debugging of multi-step execution faults with deterministic replay.

Predicting NYC Taxi trip duration-Urban computing problem  08/2022 – 12/2022

- Built an ML pipeline using XGBoost to predict trip duration by merging taxi logs, weather data, and OSRM route features.
- Applied K-fold cross-validation, feature engineering, and correlation heatmaps to improve predictive accuracy.
- Evaluated model performance under varying traffic/weather conditions and route categories.