Khaled Ahmed

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Summary

Expertise: Verification of large language models (LLMs). LLM software engineering including prompt engineering, LLM-as-a-judge, and model evaluation. Static and dynamic program analysis, formal methods, program optimization. Solid background: FPGAs, Computer Architecture, High Level Synthesis, and performance optimization.

Experience

Research Engineer, *Huawei Technologies Canada* **May 2024 – Present**
Waterloo, Ontario

- Semi-formal verification of large language models (LLMs), focusing on enhancing performance and reliability.
- Developed LLM-as-a-judge tool to automatically evaluate UML diagrams, achieving 90% accuracy.
- Lead the tool design, dataset cleaning, evaluation setup, and paper writing. Paper received **Distinguished paper award** in MODELS 2025.

Formal Methods Research Intern, *Huawei Technologies Canada* **May 2023 – Sep. 2023**
Markham, Ontario

- Developed and optimized software architecture for stateful property-based tests in C++ drivers of next-gen routers, ensuring robustness.
- Detected 3 critical, **system-crashing bugs**.

Research Intern, *Ecolé Polytechnique Fédérale de Lausanne* **Jul. 2014 – Sep. 2014**
Lausanne, Switzerland

- Built infrastructure for automatically re-configurable map-reduce accelerators using High Level Synthesis, optimizing for performance and memory.
- Evaluated the throughput of different configurations of the accelerator on a Xilinx Zynq FPGA.

Education

Ph.D. in Electrical and Computer Engineering, *The University of British Columbia.* **Sep. 2017 – Dec. 2025**
Vancouver, Canada.

- Advised by Professor Julia Rubin and Professor Mieszko Lis.
- Thesis: Efficient Dynamic Analysis of Android Applications.

M.Sc. in Electrical Engineering, *Alexandria University* **Sep. 2014 – Jul. 2017**
Alexandria, Egypt

- Advised by Professor Mohammed M. Farag and Professor Mohamed R. Rizk.
- Thesis: CDMA Interconnects for Systems on Chips.
- Grade: Distinction with the degree of honor (GPA: 3.95/4).

B.Sc. in Electrical Engineering, *Alexandria University* **Sep. 2010 – Jul. 2014**
Alexandria, Egypt

- Thesis: Design and layout of VLSI DSP chip.
- Grade: Distinction with the degree of honor (GPA: 3.94/4), **Ranked second** out of 332 graduates of the 2014 class.

Selected Research Projects

Verification of Large Language Models **at Huawei Technologies Canada**

- Semiformal verification of generative large language models, presented first fully automated tool that checks a diagram against its requirements, using self-consistency to curb hallucinations, raising precision from 0.58 to 0.81 and finding 90% more human-reported issues than a direct LLM compare.
- Evaluated on industrial requirements/AI-assisted diagrams; implementation, prompts, and dataset are available. Lead design, dataset cleaning, evaluation, and writing; paper received **Distinguished paper award** at MODELS 2025.

Dynamic Program Slicing of Android and Java Programs *with Mieszko Lis, Julia Rubin* **during Ph.D.**

- Proposed a trace-based alias analysis dynamic slicing technique that offloads alias analysis from tracing time to slicing time.
- Achieved **10X lower overhead** than state-of-the-art with higher accuracy.
- Open-sourced the approach as tools called Mandoline (github.com/resess/Mandoline) and Slicer4J (github.com/resess/Slicer4J).
- Mandoline was awarded the **distinguished paper award** at the International Conference on Software Testing (ICST).
- Slicer4J is utilized by several research groups for fault localization, dependency analysis, and test suite reduction.

- Collaborated with colleagues to explore the use of slicing in helping developers troubleshoot regression failures.

Dynamic Taint Analysis of Android Apps *with Yingying Wang, Mieszko Lis, Julia Rubin* **during Ph.D.**

- Proposed accurate, low-overhead dynamic taint analysis for Android that reports data flow paths to analysts.
- The analysis builds dynamic data flow graphs efficiently by leveraging garbage collections for graph pruning.
- Revealed a password encryption vulnerability in a popular Google Play app and a private **key leak in WhatsApp clones**.
- Open-sourced the approach as a tool called ViaLin (github.com/resess/ViaLin).

Malware Analysis and Detection *with Michael Cao, Sahar Badihi, Peiyu Xiong, Julia Rubin* **during Ph.D.**

- Analyzed and reverse-engineered Android malware, and characterized their behavior and resilience to existing detectors.
- Developed an automatic detection evasion technique for Android malware to evaluate the effectiveness of detectors.

High Throughput Hardware *with Mohammed M. Farag, Mohamed R. Rizk* **during M.Sc.**

- Developed techniques that improved Code-Division Multiple-Access Networks-on-Chip (NoC) **throughput by 100%**.
- Developed FPGA prototype for hardware/software co-design of SHA-3 accelerators using High Level Synthesis (HLS).

Selected Publications (Full list here: [Link])

1. **K. Ahmed**, J. Song, B. Chen, O. Wei, B. Zheng. "MCeT: Behavioral Model Correctness Evaluation using Large Language Models." The International Conference on Model Driven Engineering Languages and Systems (MODELS), **Distinguished Paper Award**, 2025 (25% acceptance rate).
2. **K. Ahmed**, Y. Wang, M. Lis, and J. Rubin. "ViaLin: Path-Aware Dynamic Taint Analysis for Android." The Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering (ESEC/FSE), 2023 (26% acceptance rate).
3. S. Badihi, **K. Ahmed**, Y. Li, and J. Rubin. "Responsibility in Context: On Applicability of Slicing in Semantic Regression Analysis." The International Conference on Software Engineering (ICSE), 2023 (26% acceptance rate).
4. M. Cao*, **K. Ahmed***, and J. Rubin. "Rotten Apples Spoil the Bunch: An Anatomy of Google Play Malware." The International Conference on Software Engineering (ICSE), 2022 (26% acceptance rate) *** Equal Contribution**.
5. **K. Ahmed**, M. Lis, and J. Rubin. "MANDOLINE: Dynamic Slicing of Android Applications with Trace-Based Alias Analysis." The International Conference on Software Testing, Verification and Validation (ICST), **Distinguished Paper Award**, 2021 (28% acceptance rate).
6. **K. Ahmed**, M. Rizk, M. Farag. "Overloaded CDMA Crossbar For Network-on-Chip." IEEE Transactions on Very Large Scale Integration (VLSI) Systems, 2017.
7. **K. Ahmed**, M. Farag. "Hardware/Software Co-Design of a Dynamically Configurable SHA-3 System-on-Chip (SoC)." The International Conference on Electronics, Circuits, and Systems (ICECS), 2015.

Research Advising

- Micahel Cao – Supervised research project on Android Malware analysis, 2019-2022, co-authored [P5] and [P8].
- Mahmoud Elmohr, Mostafa Saleh, Ahmed Eissa – Supervised research project on efficient implementation of encryption algorithms, 2015-2016, co-authored [P10] and [P13].
- Kevin Liu – Supervised project on analysis of suspicious flows in Android Malware, 2024.
- Zyad Ben-Suleiman – Supervised project on updating the implementation of our research tools, 2023.
- Danica Xiao – Supervised research project on studying effectiveness of slicing on developer productivity, 2022.
- Alexander Julianto – Supervised project on reproducing results of malware detection papers, 2018.

Teaching Experience

Teaching Assistant, *The University of British Columbia* **Sep. 2017 - Apr. 2023**

- Software Engineering (CPEN 321): *Vancouver, Canada.*
  Supervised student groups through the design, implementation, and testing of **full-stack mobile apps** while emphasizing performance optimization.
- Computing Systems I (CPEN 211), Computer Architecture (CPEN 411), Computing Systems II (CPEN 212): Supervised labs, graded assignments, and held office hours facilitating an understanding of parallel programming concepts.

Teaching Assistant, *Alexandria University* **Sep. 2014 - Jul. 2017**

- Logic Circuit Design (EE242), VLSI Integrated Circuits (EE432), Computer Architecture (CSx35), *Alexandria, Egypt.*
  Digital Integrated Circuits (EE431), Semiconductor Devices (EE336): Gave lectures, supervised labs, graded assignments, and held office hours.

Awards

- **Distinguished paper awards** at the International Conference on Software Testing (ICST), 2021 and the International Conference on Model Driven Engineering Languages and Systems (MODELS), 2025
- Natural Sciences and Engineering Research Council - Canada Graduate Scholarship (NSERC CGS-D), 2020-2021.
- Four-Year Fellowship (FYF) from the University of British Columbia, 2017-2020.
- President's Academic Excellence Initiative Ph.D. Award from the University of British Columbia, 2020-2023.
- Honored by Alexandria University for **ranking second** among all graduates of the 2014 B.Sc. in Electrical Engineering class.

Invited Talks

- **Google, 2022.** Guest speaker in "Malware Detection and Analysis" tech talk.
- **Huawei Canada, 2022.** Guest speaker in "Introduction to Program Analysis Techniques" workshop.
- **UBC, 2022.** Guest lecturer in the "CPEN 400P: Program Analysis for Reliability and Security" course.

Media Coverage

- "PhD student Khaled Ahmed, Dr. Mieszko Lis, and Dr. Julia Rubin win Distinguished Paper Award at ICST 2021", Link: https://ece.ubc.ca/phd-student-khaled-ahmed-dr-mieszko-lis-and-dr-julia-rubin-win-distinguished-paper-award-at-icst-2021/

Technical Skills

Main Languages: Python, C++, Java, Assembly, Verilog, VHDL.
Tools/Technologies: LangGraph, scikit-learn, OpenAI API, Android Studio, Git, Flutter, Google Test, RapidCheck, Vivado HLS, Synopsys Design & IC Compilers
Concepts/Skills: Software Architecture, Parallel Programming, Performance Optimization, Benchmarking Techniques, Low-level Software Drivers, Prompt Engineering.