Karim Ali

Assistant Professor · University of Alberta

3-42 Athabasca Hall, Edmonton, Alberta, T6G 2E8, Canada

karim.ali@ualberta.ca | karimali.ca | themaplelab | @karimhamdanali

Research Areas

My primary research interest is to develop and evaluate various program analysis techniques that can be used in practice by exploring three aspects: scalability, precision, and usability. My interests span programming languages and software systems.

Education

Ph.D., Computer Science — *2014*

University of Waterloo, Canada

- Advisor: Ondřej Lhoták
- Thesis: The Separate Compilation Assumption
- Committee: Jan Vitek, Frank Tip, Reid Holmes, and Werner Dietl

MMath, Computer Science — *2010*

University of Waterloo, Canada

- Advisor: Raouf Boutaba
- Thesis: Algorizmi - A Configurable Virtual Testbed to Generate Datasets for Offline Evaluation of Intrusion Detection Systems
- Reviewers: Ian MacKillop and Urs Hengartner

B.Sc., Computer Science — *2007*

The American University in Cairo, Egypt

- Advisors: Sherif G. Aly and Sherif El-Kassas
- Thesis: A Jabber Framework for Building Communication Capable Java Mobile Applications
- Minor: Mathematics

Professional Experience

Assistant Professor, Department of Computing Science — *Jul 2017–Present*

University of Alberta, Canada

Research Assistant Professor, Department of Computing Science — *Jul 2016–Jul 2017*

University of Alberta, Canada

Postdoctoral Researcher, Secure Software Engineering — *Oct 2014–Jul 2016*

Technische Universität Darmstadt, Germany

- Host: Eric Bodden
- Designing novel static analyses to detect misuses of cryptographic APIs in software systems
- Exploring new static analysis techniques that incorporate user feedback in a just-in-time fashion
- Developing various extensions to the IFDS analysis framework

Graduate Research Assistant, Programming Languages Group — *2010–2014*

University of Waterloo, Canada

- Conducted research for constructing partial static call graphs for Java programs
- Developed various call graph construction algorithms for Scala
- Studied static analysis techniques for various JVM-hosted languages

Graduate Research Assistant, Network Security Research Group — *2008–2009*

University of Waterloo, Canada

- Worked on various models of Intrusion Detection Systems: e.g., peer-to-peer, kernel methods
- Developed Algorizmi, an open-source evaluation system for Intrusion Detection Systems

Researcher, Department of Computer Science — *2007*

The American University in Cairo, Egypt

- Studied new techniques to support location management in Java-based pervasive systems

Software Engineer, Execution Team — *2007*

ITWorx, Egypt

- Redesigned the graphical user interface of the stock brokerage system for Execution Ltd., London, UK

Awards and Honors

ACM SIGPLAN Distinguished Paper Award, ACM SIGPLAN Symposium on Principles of Programming Languages (POPL) *2019*
Student's Choice Award, University of Alberta, Canada *2018*
ACM SIGSOFT Distinguished Paper Award, International Symposium on Software Testing and Analysis (ISSTA) *2017*
Distinguished Artifact Award, European Conference on Object-Oriented Programming (ECOOP) *2014*
David R. Cheriton Scholarship, University of Waterloo, Canada *2012–2014*
$20,000
Special Graduate Scholarship, University of Waterloo, Canada *2012*
$2,500
Queen Elizabeth II Graduate Scholarship in Science and Technology, Canada *2012*
$5,000
Special Graduate Scholarship, University of Waterloo, Canada *2011*
$1,000
Graduate Entrance Scholarship, University of Waterloo, Canada *2008*
$3,000
B.Sc. Summa Cum Laude Honors, The American University in Cairo, Egypt *2007*
Best CS Group Graduation Project Award, The American University in Cairo, Egypt *2007*
Shell Endowed Scholarship, The American University in Cairo, Egypt *2003–2007*
30% off tuition

Professional Service

Program Committee Organization

SPLASH-I Co-Chair, ACM SIGPLAN Conference on Systems, Programming, Languages and Applications: Software for Humanity (SPLASH) *2018*
SPLASH-I Co-Chair, ACM SIGPLAN Conference on Systems, Programming, Languages and Applications: Software for Humanity (SPLASH) *2017*
Artifact Evaluation Co-Chair, International Symposium on Engineering Secure Software and Systems (ESSoS) *2017*
Demonstration Track Co-Chair, ACM SIGSOFT Symposium on the Foundations of Software Engineering (FSE) *2017*
Program Committee Co-Chair, ACM SIGPLAN International Workshop on the State Of the Art in Program Analysis (SOAP) @ PLDI *2017*

Program Committee Member

ECOOP, European Conference on Object-Oriented Programming *2020*
ISSTA, International Symposium on Software Testing and Analysis *2019*
SOAP @ PLDI, ACM SIGPLAN International Workshop on the State Of the Art in Program Analysis *2019*
SEAD @ ASE, International Workshop on Software Security from Design to Deployment *2019*
ECOOP, European Conference on Object-Oriented Programming *2018*
ISSTA, International Symposium on Software Testing and Analysis *2018*
CASCON, International Conference on Computer Science and Software Engineering *2017*
Onward!, ACM International Symposium on New Ideas, New Paradigms, and Reflections on Programming and Software *2017*

Artifact Evaluation Committee Member

ISSTA, International Symposium on Software Testing and Analysis *2016*
PLDI, ACM SIGPLAN Conference on Programming Language Design and Implementation *2015*
ECOOP, European Conference on Object-Oriented Programming *2015*
ECOOP, European Conference on Object-Oriented Programming *2014*

Workshop Organization

PLMW Co-Chair, ACM SIGPLAN Conference on Systems, Programming, Languages and Applications: Software for Humanity (SPLASH) *2019*
Co-Organizer, Program Analysis Hackathon (Panathon) @ ECOOP *2019*
Co-Organizer, Program Analysis Hackathon (Panathon) @ ECOOP/ISSTA *2018*
Co-Organizer, Workshop on Benchmarking (BenchWork) @ ECOOP/ISSTA *2018*
Co-Organizer, Compiler-Driven Performance Workshop @ CASCON *2017*
Co-Organizer, SOAP @ PLDI *2017*
Co-Organizer, WALA Hackathon @ PLDI *2017*
Co-Organizer, Workshop on Designing Code Analysis Frameworks (DECAF) @ ISSTA *2016*
Co-Organizer, Workshop on WALA @ PLDI *2015*

Reviewer

TSE, IEEE Transactions on Software Engineering *2013, 2019*
TOPLAS, ACM Transactions on Programming Languages and Systems *2018, 2019*
SCP, Science of Computer Programming *2015*

Other

Co-Founder, Canada Open-Source Projects (CANOSP) *2019–Present*
Co-Organizer, Reverse EXPO *2018–Present*
Steering Committee Member, Undergraduate Capstone Open Source Projects (UCOSP) *2018*
Faculty Mentor, Undergraduate Capstone Open Source Projects (UCOSP) *2018*
Associate Editor, IEEE Software Blog *2017–Present*
Web Chair, European Conference on Object-Oriented Programming (ECOOP) *2018*
Web Chair, International Symposium on Software Testing and Analysis (ISSTA) *2018*
Subreviewer, International Conference on Compiler Construction (CC) *2017*

Research Funding

Validating the Correct Usage of Cryptography Libraries *2018–2020*
- IBM Centre for Advanced Studies Research Fellowship
- With: Sole PI
- Amount: CAD$60,000

Scalable and Precise Program Analysis for Modern Software Systems *2017–2022*
- Natural Sciences and Engineering Research Council of Canada (NSERC) Discovery Grant
- With: Sole PI
- Amount: CAD$125,000

Improving the Inlining Algorithms in the IBM Just-in-Time (JIT) Compiler *2017–2020*
- IBM Centre for Advanced Studies Research Fellowship
- With: Sole PI
- Amount: CAD$90,000

Publications

Note: underlined names indicate students whom I have (co-)supervised in an official capacity.

Refereed Journal Articles

Stefan Krüger, Johannes Späth, **Karim Ali**, Eric Bodden, and Mira Mezini. "CrySL: An Extensible Approach to Validating the Correct Usage of Cryptographic APIs". *IEEE Transactions on Software Engineering*, (to appear), 2019. *TSE '19*

Lisa Nguyen Quang Do, Stefan Krüger, Patrick Hill, **Karim Ali**, and Eric Bodden. "Debugging Static Analysis". *IEEE Transactions on Software Engineering*, (to appear), 2018. *TSE '18*

Karim Ali, Marianna Rapoport, Ondřej Lhoták, Julian Dolby, and Frank Tip. "Type-Based Call Graph Construction Algorithms for Scala". *ACM Transactions on Software Engineering and Methodology*, 25(1), 9:1–9:43, 2015. *TOSEM '15*

Sherif Aly, Sarah Nadi, and **Karim Hamdan**. "A Java-Based Programming Language Support of Location Management in Pervasive Systems". *International Journal of Computer Science and Network Security*, 8(6), pp. 329–336, 2008. *IJCSNS '08*

Refereed Conference Publications

Stefan Krüger, **Karim Ali**, and Eric Bodden. "CogniCrypt$_{GEN}$ - Generating Code for the Secure Usage of Crypto APIs". *International Symposium on Code Generation and Optimization*, (to appear), 2020. *CGO '20*

Abdul Ali Bangash, Hareem Sahar, Shaiful Alam Chowdhury, Alexander William Wong, Abram Hindle, and **Karim Ali**. "What do developers know about machine learning: a study of ML discussions on StackOverflow". *International Conference on Mining Software Repositories*, pp. 260–264, 2019. *MSR '19 Mining Challenge*

Artem Chikin, José Nelson Amaral, **Karim Ali**, and Ettore Tiotto. "Toward an Analytical Performance Model to Select between GPU and CPU Execution". *IEEE International Workshop on High-Level Parallel Programming Models and Supportive Environments*, pp. 353–362, 2019. *HIPS '19*

Johannes Späth, **Karim Ali**, and Eric Bodden. "Context-, Flow-, and Field-Sensitive Data-Flow Analysis Using Synchronized Pushdown Systems". *ACM SIGPLAN Symposium on Principles of Programming Languages*, 48:1–48:29, 2019. *POPL '19 Distinguished Paper*

Stefan Krüger, Johannes Späth, **Karim Ali**, Eric Bodden, and Mira Mezini. "CrySL: An Extensible Approach to Validating the Correct Usage of Cryptographic APIs". *European Conference on Object-Oriented Programming*, 10:1–10:27, 2018. *ECOOP '18*

Lisa Nguyen Quang Do, Stefan Krüger, Patrick Hill, **Karim Ali**, and Eric Bodden. "VISUFLOW: A Debugging Environment for Static Analyses". *International Conference on Software Engineering (Companion Volume)*, pp. 89–92, 2018. — *ICSE '18 Tool Paper*

Stefan Krüger, Sarah Nadi, Michael Reif, **Karim Ali**, Mira Mezini, Eric Bodden, Florian Göpfert, Felix Günther, Christian Weinert, Daniel Demmler, and Ram Kamath. "CogniCrypt: Supporting Developers in using Cryptography". *International Conference on Automated Software Engineering*, pp. 931–936, 2017. — *ASE '17 Tool Paper*

Johannes Späth, **Karim Ali**, and Eric Bodden. "IDE^{al}: Efficient and Precise Alias-Aware Dataflow Analysis". *ACM SIGPLAN Conference on Object-Oriented Programming, Systems, Languages and Applications*, 99:1–99:27, 2017. — *OOPSLA '17*

Mona Nashaat, **Karim Ali**, and James Miller. "Detecting Security Vulnerabilities in Object-Oriented PHP Programs". *IEEE International Working Conference on Source Code Analysis and Manipulation*, pp. 159–164, 2017. — *SCAM '17*

Taylor Lloyd, Artem Chikin, Erick Ochoa, **Karim Ali**, and José Nelson Amaral. "A Case for Better Integration of Host and Target Compilation When Using OpenCL for FPGAs". *International Workshop on FPGAs for Software Programmers*, pp. 1–9, 2017. — *FSP '17*

Lisa Nguyen Quang Do, **Karim Ali**, Ben Livshits, Eric Bodden, Justin Smith, and Emerson Murphy-Hill. "Just-in-Time Static Analysis". *International Symposium on Software Testing and Analysis*, pp. 307–317, 2017. — *ISSTA '17 Distinguished Paper*

Lisa Nguyen Quang Do, **Karim Ali**, Ben Livshits, Eric Bodden, Justin Smith, and Emerson Murphy-Hill. "Cheetah: Just-in-Time Taint Analysis for Android Apps". *International Conference on Software Engineering - Companion Volume*, pp. 39–42, 2017. — *ICSE '17 Tool Paper*

Johannes Späth, Lisa Nguyen Quang Do, **Karim Ali**, and Eric Bodden. "Boomerang: Demand-Driven Flow-Sensitive, Field-Sensitive, and Context-Sensitive Pointer Analysis". *European Conference on Object-Oriented Programming*, 22:1–22:26, 2016. — *ECOOP '16*

Steven Arzt, Sarah Nadi, **Karim Ali**, Eric Bodden, Sebastian Erdweg, and Mira Mezini. "Towards Secure Integration of Cryptographic Software". *ACM SIGPLAN Symposium on New Ideas in Programming and Reflections on Software at SPLASH*, pp. 1–13, 2015. — *Onward! '15*

Karim Ali, Marianna Rapoport, Ondřej Lhoták, Julian Dolby, and Frank Tip. "Constructing Call Graphs of Scala Programs". *European Conference on Object-Oriented Programming*, pp. 54–79, 2014. — *ECOOP '14 Distinguished Artifact*

Karim Ali and Ondřej Lhoták. "Averroes: Whole-Program Analysis without the Whole Program". *European Conference on Object-Oriented Programming*, pp. 378–400, 2013. — *ECOOP '13*

Karim Ali and Ondřej Lhoták. "Application-Only Call Graph Construction". *European Conference on Object-Oriented Programming*, pp. 688–712, 2012. — *ECOOP '12*

Other Refereed Publications

Karim Ali, Issam Aib, and Raouf Boutaba. "P2P-AIS: A P2P Artificial Immune Systems architecture for detecting DDoS flooding attacks". *Global Information Infrastructure Symposium*, 2009. — *GIIS '09*

Karim Ali and Raouf Boutaba. "Applying Kernel Methods to Anomaly-based Intrusion Detection Systems". *Global Information Infrastructure Symposium*, 2009. — *GIIS '09*

Selected Invited Talks

"Is Program Analysis The Silver Bullet Against Software Bugs?" Papers We Love Conference, 2019. — *PWLConf '19*
"U Can't Inline This". TURBO Workshop at SPLASH, 2018. — *TURBO '18*
"SWAN: A Program Analysis Framework for Swift". NJR Workshop at SPLASH, 2018. — *NJR '18*
"Designing Tomorrow's Static Analyses - Addressing Scalability, Precision, and Usability". University of Colorado Boulder, 2016. — *Boulder '16*
"Designing Tomorrow's Static Analyses - Addressing Scalability, Precision, and Usability". Rochester Institute of Technology, 2016. — *RIT '16*
"Designing Tomorrow's Static Analyses - Addressing Scalability, Precision, and Usability". Iowa State University, 2016. — *ISU '16*
"Evaluating Call Graph Construction for JVM-hosted Language Implementations". IFIP Working Group 2.4 on Software Implementation Technology, 2015. — *IFIP '15*
"Averroes - Letting go of the library!" Samsung Research America, 2015. — *SRA '15*
"Whole-Program Analysis Without the Whole Program". McGill University, 2015. — *McGill '15*

Students

Current

Ph.D.	**Ifaz Kabir,** Designing Programming Languages for Non-Volatile Memory	*2018–Present*
Ph.D.	**Abdul Ali Bangash,** Detecting Energy-Inefficient Code via Program Analysis (Main supervisor; Co-supervised with Abram Hindle)	*2018–Present*
Ph.D.	**Stefan Krüger,** Designing Language Support for Detecting Crypto APIs Misuses (Co-supervised with Eric Bodden at University of Paderborn, Germany)	*2015–Present*
Master's	**Ahmed Elkhair,** Proving Program Equivalence via Symbolic Execution	*2019–Present*
Master's	**David Seekatz,** Detecting Security Vulnerabilities in IoT Devices	*2019–Present*
Master's	**Spencer Killen,** Synthesizing Data-Flow Analyses from Examples	*2019–Present*
Master's	**Kristen Newbury,** Automatic Hot-Patching of Crypto APIs Misuses	*2018–Present*
Undergrad	**Daniil Tiganov,** Program Analysis for Swift	*2019–Present*
Undergrad	**Revan MacQueen,** Symbolic Verification of Neural Networks	*2019–Present*

Alumni

Ph.D.	**Lisa Nguyen Quang Do,** User-Centered Tool Design for Data-Flow Analysis (Co-supervised with Eric Bodden at University of Paderborn, Germany)	*2015–2019* *Senior Software Engineer at Google*
Ph.D.	**Johannes Späth,** Synchronized Pushdown Systems for Pointer and Data-Flow Analysis (Co-supervised with Eric Bodden at University of Paderborn, Germany)	*2015–2019* *Research Associate at Fraunhofer IEM*
Master's	**Erick Ochoa,** Guiding Inlining Decisions Using Post-Inlining Transformations (Main supervisor; Co-supervised with José Nelson Amaral)	*2017–2019* *Compiler Engineer at Theobroma Systems*
Master's	**Manuel Benz,** Interprocedural Data Dependency Graphs	*2016* *Ph.D. at the University of Paderborn, Germany*
Master's	**Michael Appel,** Call Graph Summaries for the Android SDK	*2016*
Undergrad	**Jeff Cho,** Program Analysis for Swift	*2017–2019* *Master's at the University of Alberta*
Undergrad	**Supakorn 'Jamie' Rassameemasmuang,** Formal Verification of String Equations	*2019* *Undergrad at the University of Alberta*
Undergrad	**Alexander MacKenzie,** Automated Benchmark Creation for Program Analysis Tools	*2017–2018* *Undergrad at the University of Alberta*
Undergrad	**Bryan Tam,** Program Analysis for Swift	*2018* *Undergrad at the University of Toronto*
Undergrad	**Leo Li,** Program Analysis for Swift	*2017–2018* *Master's at the University of Toronto*
Undergrad	**Swapnil Shah,** Automated Benchmark Creation for Program Analysis Tools	*2018* *Software Engineer at Okera*
Undergrad	**Tyler Pavlovic,** Automated Benchmark Creation for Program Analysis Tools	*2018* *Application Developer at ACOA*
Undergrad	**Alex Li,** Automated Benchmark Creation for Program Analysis Tools	*2018*
Undergrad	**Yaser Alkayale,** Program Analysis for Swift	*2017* *Software Engineer at Microsoft*
Undergrad	**Lydia Wu,** Program Analysis for Swift	*2017* *Master's at UC Berkley*
Undergrad	**Chen Song,** Program Analysis for Swift	*2017* *Ph.D. at UT Austin*
Undergrad	**Stuart Hoye,** Developing GitHub Classroom Management Tools	*2017* *Application Consultant at Ontracks*
Undergrad	**Noah Weninger,** Program Analysis for Swift	*2017* *Master's at UBC*

Teaching

Instructor

CMPUT 497	**Foundations of Program Analysis,** University of Alberta, Canada	*Winter 2019–Present*
CMPUT 229	**Computer Organization and Architecture I,** University of Alberta, Canada	*Winter 2017–Present*
CMPUT 620	**Static Program Analysis,** University of Alberta, Canada	*Fall 2016–Present*
SAS	**Static Analysis Seminar,** Technische Universität Darmstadt, Germany	*Winter 2015*

Co-Instructor

APSA	**Applied Static Analysis,** Technische Universität Darmstadt, Germany	*Spring 2016*

Substitute Lecturer

DECA	**Designing Code Analyses for Large Software Systems,** Technische Universität Darmstadt, Germany	*Fall 2014*
CS 241	**Foundations of Sequential Programs,** University of Waterloo, Canada	*Spring 2013*

Graduate Teaching Assistant

CS 241	**Foundations of Sequential Programs,** University of Waterloo, Canada	*2011–2013*
CS 444/644	**Compiler Construction,** University of Waterloo, Canada	*2011–2013*
CS 446/646	**Software Design and Architectures,** University of Waterloo, Canada	*Spring 2011*
CS 456/656	**Computer Networks,** University of Waterloo, Canada	*2008–2010*
CS 125	**Introduction to Programming Principles,** University of Waterloo, Canada	*Winter 2008*
CS 448	**Security Engineering,** The American University in Cairo, Egypt	*Fall 2007*

Undergraduate Teaching Assistant

CS 448	**Security Engineering,** The American University in Cairo, Egypt	*Fall 2007*
CS 330	**Computer Architecture,** The American University in Cairo, Egypt	*2005–2006*
CS 106	**Fundamentals of Computer Science,** The American University in Cairo, Egypt	*2004–2005*

Volunteer Work

CyberPatriot Technical Mentor, Strathcona High School, Edmonton, Alberta, Canada	*2016–2018*
Graduate Student Ambassador, University of Waterloo, Canada	*Fall 2013*
Tour Guide, Computer Science Open House, University of Waterloo, Canada	*Winter 2012*
President, Egyptian Students Association, University of Waterloo, Canada	*2010–2011*
Ushers Committee Leader, Honors Assembly, The American University in Cairo, Egypt	*Spring 2007*
Academic Committee Head, ACM Chapter, The American University in Cairo, Egypt	*Spring 2007*