

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; and double-underlined names indicate students whom I led to publish their course projects.

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

GRAD STUDENTS, UNIVERSITY OF ALBERTA

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
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
Master's	Erick Ochoa , Guiding Inlining Decisions Using Post-Inlining Transformations (Main supervisor; Co-supervised with José Nelson Amaral)	2017–2019 <i>Compiler Engineer at Theobroma Systems</i>

GRAD STUDENTS, PADERBORN UNIVERSITY (CO-SUPERVISED WITH ERIC BODDEN)

Ph.D.	Stefan Krüger , Designing Language Support for Detecting Crypto APIs Misuses	2015–Present
Ph.D.	Lisa Nguyen Quang Do , User-Centered Tool Design for Data-Flow Analysis	2015–2019 <i>Senior Software Engineer at Google</i>
Ph.D.	Johannes Späth , Synchronized Pushdown Systems for Pointer and Data-Flow Analysis	2015–2019 <i>Research Associate at Fraunhofer IEM</i>

GRAD STUDENTS, TU DARMSTADT

Master's	Manuel Benz , Interprocedural Data Dependency Graphs	2016 <i>Ph.D. at the University of Paderborn, Germany</i>
Master's	Michael Appel , Call Graph Summaries for the Android SDK	2016

UNDERGRAD STUDENTS

UAlberta	Daniil Tiganov , Program Analysis for Swift	2019–Present
UAlberta	Revan MacQueen , Symbolic Verification of Neural Networks	2019–Present
UAlberta	Jeff Cho , Program Analysis for Swift	2017–2019 <i>Master's at the University of Alberta</i>
UAlberta	Supakorn 'Jamie' Rassameemasuang , Formal Verification of String Equations	2019 <i>Undergrad at the University of Alberta</i>
UAlberta	Alexander MacKenzie , Automated Benchmark Creation for Program Analysis Tools	2017–2018 <i>Undergrad at the University of Alberta</i>
UofT	Bryan Tam , Program Analysis for Swift	2018 <i>Undergrad at the University of Toronto</i>
SFU	Leo Li , Program Analysis for Swift	2017–2018 <i>Master's at the University of Toronto</i>
UofT	Swapnil Shah , Automated Benchmark Creation for Program Analysis Tools	2018 <i>Software Engineer at Okera</i>
UNB	Tyler Pavlovic , Automated Benchmark Creation for Program Analysis Tools	2018 <i>Application Developer at ACOA</i>

Western	Alex Li , Automated Benchmark Creation for Program Analysis Tools	2018
Dalhousie	Yaser Alkayale , Program Analysis for Swift	2017
		Software Engineer at Microsoft
SFU	Lydia Wu , Program Analysis for Swift	2017
		Master's at UC Berkley
SFU	Chen Song , Program Analysis for Swift	2017
		Ph.D. at UT Austin
UAlberta	Stuart Hoyer , Developing GitHub Classroom Management Tools	2017
		Application Consultant at Ontracks
UAlberta	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
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SUBSTITUTE LECTURER

DECA	Designing Code Analyses , 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