

# Karim Ali

ASSISTANT PROFESSOR · UNIVERSITY OF ALBERTA

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## Research Areas

My primary research interest is to develop and evaluate static analysis techniques that are applicable in real-world settings by exploring three aspects: scalability, precision, and usability. My interests span programming languages and software systems.

## Academic Appointments

**Assistant Professor**, Department of Computing Science, University of Alberta, Canada

Jul 2017–Present

**Research Assistant Professor**, Department of Computing Science, University of Alberta, Canada

Jul 2016–Jul 2017

## Education

**Ph.D., Computer Science**, University of Waterloo, Canada

2014

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

**MMath, Computer Science**, University of Waterloo, Canada

2010

- 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**, The American University in Cairo, Egypt

2007

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

## Professional Experience

**Postdoctoral Researcher**, Secure Software Engineering, Technische Universität Darmstadt, Germany

Oct 2014–Jul 2016

**Software Engineer**, Execution Team, ITWorx, Egypt

Jun 2007–Dec 2007

**Researcher**, Software Engineering, The American University in Cairo, Egypt

May 2007–Dec 2007

## Awards and Honours

**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

**Special Graduate Scholarship**, University of Waterloo, Canada

\$20,000

2012

**Queen Elizabeth II Graduate Scholarship in Science and Technology**, Canada

\$2,500

2012

**Special Graduate Scholarship**, University of Waterloo, Canada

\$5,000

2011

**Graduate Entrance Scholarship**, University of Waterloo, Canada

\$1,000

2008

**B.Sc. Summa Cum Laude Honors**, The American University in Cairo, Egypt

\$3,000

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

## Research Funding

### Analysis-Driven Inlining Algorithms

2020–2023

- IBM Centre for Advanced Studies Research Fellowship
- With: Sole PI
- Amount: CAD\$90,000

### Improving JVM Startup Performance Through Static Analysis

2020–2023

- IBM Centre for Advanced Studies Research Fellowship
- With: Sole PI
- Amount: CAD\$90,000

### Automatic Verification of Comparators and Hash Functions

2019–2020

- Mitacs Accelerate (in collaboration with Synopsys)
- With: Sole PI
- Amount: CAD\$30,000

### 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; double-underlined names indicate students whom I led to publish their course projects; and authors are ordered according to their contributions.

### REFEREED JOURNAL ARTICLES

Lisa Nguyen Quang Do, James R. Wright, and **Karim Ali**. “Why Do Software Developers Use Static Analysis Tools? A User-Centered Study of Developer Needs and Motivations”. *IEEE Transactions on Software Engineering*, (accepted to appear), 2020.

TSE '20

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*, (accepted 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*, (accepted 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<sub>GEN</sub> - Generating Code for the Secure Usage of Crypto APIs”. *International Symposium on Code Generation and Optimization*, pp. 185–198, 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<sup>al</sup>: 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

## Professional Service

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### PROGRAM COMMITTEE ORGANIZATION

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

### PROGRAM COMMITTEE MEMBER

<b>ICSE NIER</b> , International Conference on Software Engineering	2021
<b>OOPSLA</b> , ACM SIGPLAN Conference on Object-Oriented Programming, Systems, Languages and Applications	2020
<b>ECOOP</b> , European Conference on Object-Oriented Programming	2020
<b>MSR Mining Challenge</b> , International Conference on Mining Software Repositories	2020
<b>ISSTA</b> , International Symposium on Software Testing and Analysis	2019
<b>SOAP</b> , ACM SIGPLAN International Workshop on the State Of the Art in Program Analysis @ PLDI	2019
<b>SEAD</b> , International Workshop on Software Security from Design to Deployment @ ASE	2019
<b>ECOOP</b> , European Conference on Object-Oriented Programming	2018
<b>ISSTA</b> , International Symposium on Software Testing and Analysis	2018
<b>CASCON</b> , International Conference on Computer Science and Software Engineering	2017
<b>Onward!</b> , ACM International Symposium on New Ideas, New Paradigms, and Reflections on Programming and Software @SPLASH	2017

### ARTIFACT EVALUATION COMMITTEE MEMBER

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

### WORKSHOP ORGANIZATION

<b>PLMW Co-Chair</b> , Programming Languages Mentorship Workshop @ OOPSLA	2019, 2020
<b>Panathon Co-Organizer</b> , Program Analysis Hackathon @ ECOOP	2018, 2019
<b>BenchWork Co-Organizer</b> , Workshop on Benchmarking @ ECOOP/ISSTA	2018
<b>CDP Co-Organizer</b> , Compiler-Driven Performance Workshop @ CASCON	2017
<b>SOAP Co-Organizer</b> , ACM SIGPLAN International Workshop on the State Of the Art in Program Analysis @ PLDI	2017
<b>WALA Hackathon Co-Organizer</b> , Program Analysis Hackathon @ PLDI	2017
<b>DECAF Co-Organizer</b> , Workshop on Designing Code Analysis Frameworks @ ISSTA	2016
<b>Co-Organizer</b> , Workshop on WALA @ PLDI	2015

### JOURNAL REVIEWER

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

### OTHER

<b>CANOSP Co-Founder</b> , Canada Open-Source Projects initiative to provide and mentor open-source projects for students	2019–Present
<b>Reverse EXPO Co-Organizer</b> , Annual Computing Science Industry/Academia Conference at the University of Alberta	2018–2019
<b>Associate Editor</b> , IEEE Software Blog	2017–2020
<b>Steering Committee Member</b> , Undergraduate Capstone Open Source Projects (UCOSP)	2018
<b>Faculty Mentor</b> , Undergraduate Capstone Open Source Projects (UCOSP)	2018
<b>Web Chair</b> , European Conference on Object-Oriented Programming (ECOOP)	2018
<b>Web Chair</b> , International Symposium on Software Testing and Analysis (ISSTA)	2018
<b>Subreviewer</b> , International Conference on Compiler Construction (CC)	2017

## Students

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### GRADUATE STUDENTS, UNIVERSITY OF ALBERTA

Ph.D.	<b>Ifaz Kabir</b> , Designing Programming Languages for Non-Volatile Memory	2018–Present
Ph.D.	<b>Abdul Ali Bangash</b> , Detecting Energy-Inefficient Code via Program Analysis (Main supervisor; Co-supervised with Abram Hindle)	2018–Present

Master's	<b>Jeff Cho</b> , Automatic Verification of Comparators and Hash Functions	2020–Present
Master's	<b>Ahmed Elkhair</b> , Proving Program Equivalence via Symbolic Execution	2019–Present
Master's	<b>David Seekatz</b> , Constructing Precise Library Summaries	2019–Present
Master's	<b>Kristen Newbury</b> , Automatic Hot-Fixing of Crypto APIs Misuses	2018–Present
Master's	<b>Erick Ochoa</b> , Guiding Inlining Decisions Using Post-Inlining Transformations	2017–2019
(Main supervisor; Co-supervised with José Nelson Amaral)		Compiler Engineer at Theobroma Systems

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

Ph.D.	<b>Stefan Krüger</b> , Designing Language Support for Detecting Crypto APIs Misuses	2015–2020
		Software Consultant at CQSE GmbH
Ph.D.	<b>Lisa Nguyen Quang Do</b> , User-Centered Tool Design for Data-Flow Analysis	2015–2019
		Software Engineer at Google
Ph.D.	<b>Johannes Späth</b> , Synchronized Pushdown Systems for Pointer and Data-Flow Analysis	2015–2019
		Research Associate at Fraunhofer IEM

## GRADUATE STUDENTS, TU DARMSTADT

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

## UNDERGRADUATE STUDENTS

UAlberta	<b>Daniil Tiganov</b> , Program Analysis for Swift	2019
UAlberta	<b>Revan MacQueen</b> , Symbolic Verification of Neural Networks	2018–2019
UAlberta	<b>Jeff Cho</b> , Program Analysis for Swift	2017–2019
		Master's at the University of Alberta
UAlberta	<b>Supakorn 'Jamie' Rassameemasuang</b> , Formal Verification of String Equations	2019
		Undergraduate at the University of Alberta
UAlberta	<b>Spencer Killen</b> , Inlining Optimization in JIT Compilers	2019
		Master's at the University of Alberta
UAlberta	<b>Alexander MacKenzie</b> , Automated Benchmark Creation for Program Analysis Tools	2017–2018
		Undergraduate at the University of Alberta
UofT	<b>Bryan Tam</b> , Program Analysis for Swift	2018
		Undergraduate at the University of Toronto
SFU	<b>Leo Li</b> , Program Analysis for Swift	2017–2018
		Master's at the University of Toronto
UofT	<b>Swapnil Shah</b> , Automated Benchmark Creation for Program Analysis Tools	2018
		Software Engineer at Okera
UNB	<b>Tyler Pavlovic</b> , Automated Benchmark Creation for Program Analysis Tools	2018
		Application Developer at ACOA
Western	<b>Alex Li</b> , Automated Benchmark Creation for Program Analysis Tools	2018
Dalhousie	<b>Yaser Alkayale</b> , Program Analysis for Swift	2017
		Software Engineer at Microsoft
SFU	<b>Lydia Wu</b> , Program Analysis for Swift	2017
		Master's at UC Berkley
SFU	<b>Chen Song</b> , Program Analysis for Swift	2017
		Ph.D. at UT Austin
UAlberta	<b>Stuart Hoye</b> , Developing GitHub Classroom Management Tools	2017
		Application Consultant at Ontracks
UAlberta	<b>Noah Weninger</b> , Program Analysis for Swift	2017
		Master's at UBC

## Teaching

### INSTRUCTOR

CMPUT 664	<b>Secure Software Engineering</b> , University of Alberta, Canada	Winter 2020–Present
CMPUT 497	<b>Foundations of Program Analysis</b> , University of Alberta, Canada	Winter 2019–Present

CMPUT 229 **Computer Organization and Architecture I**, University of Alberta, Canada  
CMPUT 620 **Static Program Analysis**, University of Alberta, Canada  
SAS **Static Analysis Seminar**, Technische Universität Darmstadt, Germany

*Winter 2017–Present*  
*Fall 2016–Present*  
*Winter 2015*

## CO-INSTRUCTOR

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

*Spring 2016*

## SUBSTITUTE LECTURER

DECA **Designing Code Analyses**, Technische Universität Darmstadt, Germany  
CS 241 **Foundations of Sequential Programs**, University of Waterloo, Canada

*Fall 2014*  
*Spring 2013*

## GRADUATE TEACHING ASSISTANT

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

*2011–2013*  
*2011–2013*  
*Spring 2011*  
*2008–2010*  
*Winter 2008*  
*Fall 2007*

## UNDERGRADUATE TEACHING ASSISTANT

CS 448 **Security Engineering**, The American University in Cairo, Egypt  
CS 330 **Computer Architecture**, The American University in Cairo, Egypt  
CS 106 **Fundamentals of Computer Science**, The American University in Cairo, Egypt

*Fall 2007*  
*2005–2006*  
*2004–2005*

## Volunteer Work

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**CyberPatriot Technical Mentor**, Strathcona High School, Edmonton, Alberta, Canada  
**Graduate Student Ambassador**, University of Waterloo, Canada  
**Tour Guide, Computer Science Open House**, University of Waterloo, Canada  
**President, Egyptian Students Association**, University of Waterloo, Canada  
**Ushers Committee Leader, Honors Assembly**, The American University in Cairo, Egypt  
**Academic Committee Head, ACM Chapter**, The American University in Cairo, Egypt

*2016–2018*  
*Fall 2013*  
*Winter 2012*  
*2010–2011*  
*Spring 2007*  
*Spring 2007*