

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

\$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

Research Funding

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

Karim Ali, Xioani Lai, Zhaoyi Luo, Ondřej Lhoták, Julian Dolby, and Frank Tip. “A Study of Call Graph Construction for JVM-Hosted Languages”. *IEEE Transactions on Software Engineering*, (accepted to appear), 2019.

TSE '19

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_{GEN} - 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”. <i>International Conference on Software Engineering (Companion Volume)</i> , 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”. <i>International Conference on Automated Software Engineering</i> , pp. 931–936, 2017.	ASE '17 Tool Paper
Johannes Späth, Karim Ali , and Eric Bodden. “IDE ^{al} : Efficient and Precise Alias-Aware Dataflow Analysis”. <i>ACM SIGPLAN Conference on Object-Oriented Programming, Systems, Languages and Applications</i> , 99:1–99:27, 2017.	OOPSLA '17
Mona Nashaat, Karim Ali , and James Miller. “Detecting Security Vulnerabilities in Object-Oriented PHP Programs”. <i>IEEE International Working Conference on Source Code Analysis and Manipulation</i> , 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”. <i>International Workshop on FPGAs for Software Programmers</i> , 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”. <i>International Symposium on Software Testing and Analysis</i> , 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”. <i>International Conference on Software Engineering - Companion Volume</i> , 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”. <i>European Conference on Object-Oriented Programming</i> , 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”. <i>ACM SIGPLAN Symposium on New Ideas in Programming and Reflections on Software at SPLASH</i> , pp. 1–13, 2015.	Onward! '15
Karim Ali , Marianna Rapoport, Ondřej Lhoták, Julian Dolby, and Frank Tip. “Constructing Call Graphs of Scala Programs”. <i>European Conference on Object-Oriented Programming</i> , pp. 54–79, 2014.	ECOOP '14 Distinguished Artifact
Karim Ali and Ondřej Lhoták. “Averroes: Whole-Program Analysis without the Whole Program”. <i>European Conference on Object-Oriented Programming</i> , pp. 378–400, 2013.	ECOOP '13
Karim Ali and Ondřej Lhoták. “Application-Only Call Graph Construction”. <i>European Conference on Object-Oriented Programming</i> , 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”. <i>Global Information Infrastructure Symposium</i> , 2009.	GIIS '09
Karim Ali and Raouf Boutaba. “Applying Kernel Methods to Anomaly-based Intrusion Detection Systems”. <i>Global Information Infrastructure Symposium</i> , 2009.	GIIS '09

Professional Service

PROGRAM COMMITTEE ORGANIZATION

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

PROGRAM COMMITTEE MEMBER

ICSE NIER , International Conference on Software Engineering	2021
OOPSLA , ACM SIGPLAN Conference on Object-Oriented Programming, Systems, Languages and Applications	2020
ECOOP , European Conference on Object-Oriented Programming	2020
MSR Mining Challenge , International Conference on Mining Software Repositories	2020
ISSTA , International Symposium on Software Testing and Analysis	2019
SOAP , ACM SIGPLAN International Workshop on the State Of the Art in Program Analysis @ PLDI	2019
SEAD , International Workshop on Software Security from Design to Deployment @ ASE	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 @SPLASH	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 , Programming Languages Mentorship Workshop @ OOPSLA	2019, 2020
Panathon Co-Organizer , Program Analysis Hackathon @ ECOOP	2018, 2019
BenchWork Co-Organizer , Workshop on Benchmarking @ ECOOP/ISSTA	2018
CDP Co-Organizer , Compiler-Driven Performance Workshop @ CASCON	2017
SOAP Co-Organizer , ACM SIGPLAN International Workshop on the State Of the Art in Program Analysis @ PLDI	2017
WALA Hackathon Co-Organizer , Program Analysis Hackathon @ PLDI	2017
DECAF Co-Organizer , Workshop on Designing Code Analysis Frameworks @ ISSTA	2016
Co-Organizer , Workshop on WALA @ PLDI	2015

JOURNAL 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

CANOSP Co-Founder , Canada Open-Source Projects initiative to provide and mentor open-source projects for students	2019–Present
Reverse EXPO Co-Organizer , Annual Computing Science Industry/Academia Conference at the University of Alberta	2018–Present
Associate Editor , IEEE Software Blog	2017–Present
Steering Committee Member , Undergraduate Capstone Open Source Projects (UCOSP)	2018
Faculty Mentor , Undergraduate Capstone Open Source Projects (UCOSP)	2018
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

Students

GRADUATE 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	Jeff Cho , Automatic Verification of Comparators and Hash Functions	2020–Present
Master's	Ahmed Elkhair , Proving Program Equivalence via Symbolic Execution	2019–Present
Master's	David Seekatz , Constructing Precise Library Summaries	2019–Present
Master's	Kristen Newbury , Automatic Hot-Fixing 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

Compiler Engineer at Theobroma Systems

GRADUATE 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

Ph.D. **Johannes Späth**, Synchronized Pushdown Systems for Pointer and Data-Flow Analysis

Software Engineer at Google
2015–2019
Research Associate at Fraunhofer IEM

GRADUATE STUDENTS, TU DARMSTADT

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

UNDERGRADUATE STUDENTS

UAlberta **Daniil Tiganov**, Program Analysis for Swift

2019

UAlberta **Revan MacQueen**, Symbolic Verification of Neural Networks

2018–2019

UAlberta **Jeff Cho**, Program Analysis for Swift

2017–2019

Master's at the University of Alberta

UAlberta **Supakorn 'Jamie' Rassameemasuang**, Formal Verification of String Equations

2019

Undergraduate at the University of Alberta

UAlberta **Spencer Killen**, Inlining Optimization in JIT Compilers

2019

Master's at the University of Alberta

UAlberta **Alexander MacKenzie**, Automated Benchmark Creation for Program Analysis Tools

2017–2018

Undergraduate at the University of Alberta

UofT **Bryan Tam**, Program Analysis for Swift

2018

Undergraduate at the University of Toronto

SFU **Leo Li**, Program Analysis for Swift

2017–2018

Master's at the University of Toronto

UofT **Swapnil Shah**, Automated Benchmark Creation for Program Analysis Tools

2018

Software Engineer at Okera

UNB **Tyler Pavlovic**, Automated Benchmark Creation for Program Analysis Tools

2018

Application Developer at ACOA

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 Hoye**, 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 664 **Secure Software Engineering**, University of Alberta, Canada

Winter 2020–Present

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**, 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