

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

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

Abdul Ali Bangash, Hareem Sahar, Abram Hindle, and **Karim Ali**. “On the Time-Based Conclusion Stability of Software Defect Prediction Models”. *International Journal on Empirical Software Engineering*, (accepted to appear), 2020.

EMSE '20

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

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*, 46(7), pp. 697–709, 2020.

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

- Daniil Tiganov, Jeff Cho, **Karim Ali**, and Julian Dolby. “SWAN: A Static Analysis Framework for Swift.” *ACM Joint Meeting on European Software Engineering Conference and Symposium on the Foundations of Software Engineering*, (accepted to appear), 2020. ESEC/FSE '20
Tool Paper
- 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”. *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

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 2018–2019

Associate Editor, IEEE Software Blog 2017–2020

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	2015–2020
Software Consultant at CQSE GmbH		
Ph.D.	Lisa Nguyen Quang Do , User-Centered Tool Design for Data-Flow Analysis	2015–2019
Software Engineer at Google		
Ph.D.	Johannes Späth , Synchronized Pushdown Systems for Pointer and Data-Flow Analysis	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	Cijie Xia , Just-in-Time Compiler Optimizations	2020–Present
UAlberta	Daniil Tiganov , Program Analysis for Swift	2019–Present
UAlberta	Revan MacQueen , Symbolic Verification of Neural Networks	2018–2019
Master's at the University of Alberta		
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		

Teaching

INSTRUCTOR

CMPUT 664	Secure Software Engineering , University of Alberta, Canada	Winter 2020–Present
CMPUT 416	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–Fall 2017
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