Karim Ali

Assistant Professor · University of Alberta

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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 *2019*
ACM SIGPLAN Symposium on Principles of Programming Languages

Student's Choice Award *2018*
University of Alberta

ACM SIGSOFT Distinguished Paper Award *2017*
International Symposium on Software Testing and Analysis

Distinguished Artifact Award *2014*
European Conference on Object-Oriented Programming

David R. Cheriton Scholarship *2012–2014*
University of Waterloo, Canada *$20,000*

Special Graduate Scholarship *2012*
University of Waterloo, Canada *$2,500*

Queen Elizabeth II Graduate Scholarship in Science and Technology *2012*
Canada *$5,000*

Special Graduate Scholarship *2011*
University of Waterloo, Canada *$1,000*

Graduate Entrance Scholarship *2008*
University of Waterloo, Canada *$3,000*

B.Sc. Summa Cum Laude Honors *2007*
The American University in Cairo, Egypt

Best CS Group Graduation Project Award *2007*
The American University in Cairo, Egypt

Shell Endowed Scholarship *2003–2007*
The American University in Cairo, Egypt *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

Refereed Journal Articles

Johannes Späth, **Karim Ali**, and Eric Bodden. "Context-, Flow-, and Field-Sensitive Data-Flow Analysis Using Synchronized Pushdown Systems". *PACMPL*, 3(POPL), 48:1–48:29, 2019. *POPL '19* *Distinguished Paper*

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*

Johannes Späth, **Karim Ali**, and Eric Bodden. "IDE^{al}: Efficient and Precise Alias-Aware Dataflow Analysis". *PACMPL*, 1(OOPSLA), 99:1–99:27, 2017. *OOPSLA '17*

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

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*

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*

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 J 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*, *St. Louis, MO, USA*

"U Can't Inline This". TURBO Workshop, 2018. — *TURBO at SPLASH '18*, *Boston, MA, USA*

"SWAN: A Program Analysis Framework for Swift". NJR Workshop, 2018. — *NJR at SPLASH '18*, *Boston, MA, USA*

"Designing Tomorrow's Static Analyses - Addressing Scalability, Precision, and Usability". University of Colorado Boulder, 2016. — *Boulder '16*, *Boulder, CO, USA*

"Designing Tomorrow's Static Analyses - Addressing Scalability, Precision, and Usability". Rochester Institute of Technology, 2016. — *RIT '16*, *Rochester, NY, USA*

"Designing Tomorrow's Static Analyses - Addressing Scalability, Precision, and Usability". Iowa State University, 2016. — *ISU '16*, *Ames, IA, USA*

"Evaluating Call Graph Construction for JVM-hosted Language Implementations". IFIP Working Group 2.4 on Software Implementation Technology, 2015. — *IFIP '15*, *Boppard, Germany*

"Averroes - Letting go of the library!" Samsung Research America, 2015. — *SRA '15*, *Mountain View, CA, USA*

"Whole-Program Analysis Without the Whole Program". McGill University, 2015. — *McGill '15*, *Montreal, QC, Canada*

Students

Current

Spencer Killen — *2019–Present*
University of Alberta, Canada — *Master's*

David Seekatz — *2019–Present*
University of Alberta, Canada — *Master's*

Ahmed Elkhair — *2019–Present*
University of Alberta, Canada — *Master's*

Ifaz Kabir — *2018–Present*
University of Alberta, Canada — *Ph.D.*

Abdul Ali Bangash — *2018–Present*
University of Alberta, Canada, (main supervisor; co-supervised with Abram Hindle) — *Ph.D.*

Kristen Newbury — *2018–Present*
University of Alberta, Canada — *Master's*

Stefan Krüger — *2015–Present*
University of Paderborn, Germany, (co-supervised with Eric Bodden) — *Ph.D.*

Lisa Nguyen — *2015–Present*
University of Paderborn, Germany, (co-supervised with Eric Bodden) — *Ph.D.*

Alumni

Erick Ochoa — *2019*
University of Alberta, Canada, (main supervisor; co-supervised with José Nelson Amaral)
- Master's Thesis: Guiding Inlining Decisions Using Post-Inlining Transformations

Johannes Späth — *2019*
University of Paderborn, Germany, (co-supervised with Eric Bodden) — *Research Associate at Fraunhofer IEM*
- Ph.D. Thesis: Synchronized Pushdown Systems for Pointer and Data-Flow Analysis

Manuel Benz *2016*
Technische Universität Darmstadt, Germany *Ph.D. at University of Paderborn*
- Master's Thesis: Interprocedural Data Dependency Graphs

Michael Appel *2016*
Technische Universität Darmstadt, Germany
- Master's Thesis: Call Graph Summaries for the Android SDK

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*