Karim Ali

ASSISTANT PROFESSOR · UNIVERSITY OF ALBERTA

3-42, Athabasca Hall, Edmonton, Alberta, T6G 2E8, Canada

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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

PLMW Co-Chair, ACM SIGPLAN Conference on Systems, Programming, Languages and Applications: Software for Humanity (SPLASH) *2019*
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

SOAP @ PLDI, ACM SIGPLAN Conference on Programming Language Design and Implementation *2019*
ISSTA, International Symposium on Software Testing and Analysis *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

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*
SCP, Science of Computer Programming *2015*

Other

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$30,000

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$60,000

Coarse-Grained Call Graph Analysis of Android Applications *2017–2018*
- Huawei Innovation Research Program (HIRP)
- With: Sole PI
- Amount: USD$46,200

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

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

Students ———————————————————————————————————

CURRENT

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*

Erick Ochoa   *2017–Present*
UNIVERSITY OF ALBERTA, CANADA, (MAIN SUPERVISOR; CO-SUPERVISED WITH JOSÉ NELSON AMARAL) *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

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	*Winter 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

Reverse EXPO Co-Organizer, University of Alberta, Canada *2018–Present*

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*