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.	**Jiaqi He,** Formal Verification of Neural Networks	*2020–Present*
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	*2018–2020*
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' Rassameemasmuang,** 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 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*

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*