Arshavir Ter-Gabrielyan

Curriculum Vitae

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Education

2015–2021 **Doctor of Sciences**, ETH Zurich, Switzerland
Adviser: Prof. Dr. Peter Müller
Thesis: *Compositional Verification of Rich Program Properties in Separation Logic*

2013–2015 **Master of Science in Computer Science, *Red Diploma***
Moscow Institute of Physics and Technology, Russia
Thesis with honors: *A Machine Learning Approach to Static Code Analysis*

2009–2013 **Bachelor of Science in Applied Physics and Mathematics**
Moscow Institute of Physics and Technology, Russia
Thesis with honors: *A Control Flow Optimization for Multi-Strand Architectures*

Employment

Oct 2021–today **Software Engineer**, DFINITY Foundation, Zurich, Switzerland
Broad spectrum of contributions across multiple teams:
- Engineering Lead for *Matched Funding*, an advanced (∼10kloc) smart contract for allocating tokens during decentralization swaps from a fund of more than $10M equivalent.
- Owner of scalability testing framework for the Service Nervous System.
- Driving the code-level verification initiatives; results include the Motoko-san tool.
- Designed and implemented Internet Computer's runtime verification pipeline.
- Co-authored the test driver for distributed system testing of the Internet Computer.

Aug 2015–Dec 2020 **Research Assistant**, Programming Methodology Group, ETH Zurich, Switzerland
Member of the Viper project. Main contributions are in formal verification, SMT-based tools, and tool integration:
- Developed novel techniques for automatic modular verification of rich program properties, e.g. the shape of linked, dynamically allocated data structures, data summaries.
- Created a tool for automatically testing first-order axiomatizations that are commonly used in security-critical applications, e.g. SMT-based verifiers.
- Lead developer of Viper IDE, a distributed verification environment that integrates various verification backends, spec inference engines, and verification debuggers.

Aug 2014–Aug 2015 **Research Scientist**, Strategic CAD Labs, Intel Corporation, Moscow, Russia
Built tools for automatic verification of mobile and embedded systems (Android). Performance and energy analysis automation and bug finding via constraint mining.

Jun 2013–Aug 2014 **Junior Compiler Engineer**, Intel Corporation, Moscow, Russia
Improved loop optimizations of a static binary translator. Used deep neural networks and decision trees to enable precise classification of extremely unevenly distributed data: memory access conflicts, cache misses, and branch mispredictions.

Jun 2011–Jun 2013 **Junior Software Engineer**, Intel Corporation, Moscow, Russia
- Designed novel compiler optimizations of parallel control flow for a binary translator running on an explicitly parallel instruction computing architecture.
- Supported backwards compatibility for a novel post-superscalar computer architecture by applying binary translation technology with x86 machine code as input.
- Reduced overhead caused by limited size of translation units in the compiler.

Publications

2023 D. Basin, D. S. Dietiker, S. Krstic, Y.-A. Pignolet, M. Raszyk, J. Schneider, and A. Ter-Gabrielyan. Monitoring the Internet Computer. *Form. Asp. Comput.* Link

2022 A. Bugariu, A. Ter-Gabrielyan, and P. Müller. Identifying overly restrictive matching patterns in SMT-based program verifiers (extended version). *Form. Asp. Comput.* Link

2021 A. Bugariu, A. Ter-Gabrielyan, and P. Müller. Identifying overly restrictive matching patterns in SMT-based program verifiers. In *Formal Methods (FM)*, LNCS. Link

2019 A. Ter-Gabrielyan, A. J. Summers, and P. Müller. Modular Verification of Heap Reachability Properties in Separation Logic. *Proc. ACM Program. Lang.*, 3(OOPSLA):121:1–121:28. Link

2014 A. Ter-Gabrielyan and S. Scherbinin. Application of machine learning methods for static prediction of conflicts among memory access operations. *Proceedings of the 57th MIPT Scientific Conference*. Link to abstract (Original in Russian)

Open Source Projects

2021–today **Internet Computer** (IC), Blockchain-based public cloud platform (Rust).
Co-authored the framework for distributed system testing of security and scalability aspects of the IC; designed and implemented the IC runtime verification pipeline.

2022–today **Motoko-san**, Code-level automatic verifier for Motoko smart contracts (OCaml).
Managed a team of four compiler engineers and two formal verification researchers.

2016–2021 **Viper IDE**, Interactive IDE for Viper (Akka/Scala, VS Code/Typescript).
Implemented the Viper language server. Supervised three ETH Master's students who wrote most of the client code. Developed the testing infrastructure and CI.

2012–2014 **FusionCopter**, Autonomous multirotor drone with a client-server task manager (C++).
Managed both the software and the hardware teams, synchronizing their efforts. Contributed to the methodology of the safety and stabilization modules.

2014 **Caroline**, Camera-based computer vision system for smart robots (OpenCV).
Managed a team of seven software developers.
letnyayashkola.org, The website of a prominent Russian summer school platform.
Developed the frontend (Python/Django, JavaScript/HTML/CSS).

2013 **RoboMobo**, Multiplayer, GPS-driven hide-and-seek for Android (Java).
Assembled and managed a team of four Android developers. Orchestrated the collaboration with the graphic design team. Responsible for the gameplay.
Pathway to Knowledge, Visualization of the graph of open access data (JavaScript).
Prototyped a guide for readers of academic papers. Joint with Vasily Vasilyev.

2011 **The Problem of N Bodies**, Newtonian dynamics simulator via actors (JavaScript).

Mentorship

Oct 2018–Feb 2019 **Gishor Sivanrupan** interned with me at ETH Zurich, working on formal verification of graph-manipulating algorithms. Currently *Software Engineer*, Snyk.

Dec 2016–Jun 2017 **Ruben Kälin** interned with me at ETH Zurich, working on tool support for the development of formally verified programs. Currently *Associate Engineering Manager*, GetYourGuide.

2012–2017 **Sergei Volodin** was my Summer School mentee whom I taught object-oriented programming and digital hardware design. We collaborated on FusionCopter. I have consulted Sergei on various academic matters while he was applying to graduate schools. Currently *Master Student*, EPFL and *Software Engineering Intern*, Google Brain.

2011–2014 **Alexandr Derbenev** was my Summer School mentee whom I taught object-oriented programming and team management basics. We collaborated on UniSched, Caroline. Currently *Embedded Operating Systems Build and Integration Engineer*, Apple.

2013 **Mark Surnin** was my Summer School mentee whom I taught object-oriented programming and digital hardware design while we collaborated on FusionCopter. Currently ~~*Software Engineer*, Goldman Sachs~~ *Database Reliability Engineer*, Yelp.

Leadership

2022–2023 **Established and coordinated** DFINITY / ETH Zurich's Programming Methodology Group collaboration. Results include the Motoko-san prototype.

2021–2022 **Coordinated** DFINITY / ETH Zurich's Information Security Group collaboration. Results include publishing a case study on Monitoring the Internet Computer [1].

2017–2019 **Treasurer**, VMI, ETH Zurich
VMI is the Scientific Staff Association in the Computer Science Department.

2016–2017 **Vice President**, VMI, ETH Zurich
- Represented the research staff in Department Conferences.
- Organized dozens of networking and social events for staff members.

2010–2015 **Co-Founder & Head**, Technoworks
Technoworks is an annual workshop teaching CS via software & hardware projects.

Continuing Education

2019 **Google Compiler & Programming Languages Summit**, Munich, Germany
Presented a poster on Modular Verification

ACM SIGPLAN Conference on Systems, Programming, Languages, and Applications: Software for Humanity, Athens, Greece
Speaker in the OOPSLA track

2015–2019 **Workshop on Dependable and Secure Software Systems**
Talks on correctness and reliability of software presented by top field experts

2016 **Marktoberdorf Summer School**, Bavaria, Germany
Safety and Security of Software Systems: Logics, Proofs, Applications

Learning to Teach certification from ETH Zurich

2015 **EDIC Open House**, EPFL, Lausanne, Switzerland

2009–2012 **Researcher Summer School**, Dubna, Russia
Attended classes in General Physics and Microcontroller Programming

2010 **MIPT-Intel Student Lab**, Dolgoprudny, Russia
I was the lead developer of a benchmark suite for JavaScript WebWorkers

Academic Service

2019 **31st International Conference on Computer-Aided Verification (CAV)**
Sub-reviewer for the Review Committee

2018 **Formal Methods: Lecture Notes in Computer Science (FM)**
Sub-reviewer for the Review Committee

2018 **Principled Software Development**
Member of the Review Committee

2017 **Selection Committee for Computer Science Faculty at ETH Zurich**
Representative of the Scientific Staff

2015–2018 **Workshop on Dependable and Secure Software Systems**
Member of the Organization Team

Supervised Student Projects

Oct 2020	**Universal Library Components for Verification IDE Development** (BSc thesis), Valentin Racine
May 2019	**SMT Models for Verification Debugging** (MSc thesis, co-supervised with Alexander J. Summers), Cédric Stoll
Oct 2018	**Specification and Automated Reasoning for Datastructure Comprehensions** (BSc thesis, co-supervised with Alexander J. Summers), Tierry Hörmann — currently *President*, VSETH
Sep 2018	**Deductive Verification of Imperative Graph Algorithms** (BSc thesis), Gishor Sivanrupan (continued collaboration via internship)
Mar 2018	**Creating an Advanced Debugger for Symbolic Execution** (MSc thesis), Alessio Aurecchia — currently *Software Developer*, Lykke.
Nov 2017	**Automatic Verification of Closures and Lambda-Functions in Python** (MSc thesis, co-supervised with Marco Eilers), Benjamin Weber — currently *Scientific Software Engineer*, MeteoSwiss
May 2017	**Supporting Sequence Axiomatization on the SMT Solver Level for the Viper Project** (BSc thesis), Lukas Schär
Nov 2016	**Advanced Features for an Integrated Verification Environment** (MSc thesis), Ruben Kälin (continued collaboration via internship)

Teaching

Fall 2020	**Software Engineering Seminar**, assistant
Spring 2020	**Formal Methods and Functional Programming**, remote teaching assistant
Spring 2019	**Formal Methods and Functional Programming**, teaching assistant
Spring 2018	**Software Architecture and Engineering**, teaching assistant
Fall 2017	**Discrete Mathematics**, teaching assistant
	Software Engineering Seminar, assistant
Spring 2017	**Formal Methods and Functional Programming**, teaching assistant
Fall 2016	**Discrete Mathematics**, teaching assistant
Spring 2016	**Formal Methods and Functional Programming**, teaching assistant
Fall 2015	**Informatics for Mathematicians and Physicists (C++)**, teaching assistant
	Research Topics in Software Engineering, assistant
Summer 2015	**Programming for Robotics**, Summer School course instructor
Summer 2014	**Programming for Robotics**, Summer School course instructor
Summer 2013	**Information Theory**, Summer School course instructor

Honors

2015	Awarded the EDIC Fellowship from EPFL (51,100 CHF)
2015	Graduated from the MIPT Master's program with honors (red diploma)
2013–2015	Received Increased Russian State Academic Scholarship
2010–2011	Received Student Scholarship from Intel Corporation
2009–2010	Received Russian State Academic Scholarship

Skills

	Expert	**Knowledgeable**
Programming	Rust, Scala, Python	OCaml, C, TypeScript, Java, Bash
Frameworks	Tokio, Akka, VS Code/Node.js, MATLAB	OpenMP, MPI, Boost
Systems	Linux, Docker	Bazel, Nix
Verification Tools	Viper, Z3, Alloy	Dafny, Boogie, TLA+
Preferred Tools	LaTeX, Git/GitHub, Vim, IntelliJ IDEA	Subversion, Gnuplot, Travis, Jenkins
Soft Skills	Leadership, Mentoring, Team Management, Cross-organizational collaboration	

Languages

English	Native — lived in the U.S. for 4 years
Russian	Native — lived in Russia for 16 years
Armenian	Native — was born and lived in Armenia for 4 years
German	Basic — lived in Zurich, Switzerland for 7 years

Hobbies

Movies, alpine skiing, motorcycle touring, bouldering.