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👤 About Myself

Computer scientist located in Budapest, Hungary, currently pursuing PhD studies in the field of formal verification. Feeling the most comfortable at the intersection of theory and practice, where the latest research results come to life in real-world solutions.

🎓 Education and Degrees

- 2016– **PhD student/candidate**, *Budapest University of Technology and Economics*.
Advisor: Zoltán Micskei
Dissertation: Effective Domain-Specific Formal Verification Techniques (expected to defend Nov. 2020)
- 2014–2016 **Computer Engineering MSc**, *Budapest University of Technology and Economics*.
Thesis: A Survey on CEGAR-based Model Checking (advisors: T. Tóth, A. Vörös) 📄
Specialization: dependable system design
- 2010–2014 **Computer Engineering BSc**, *Budapest University of Technology and Economics*.
Thesis: Extensions to the CEGAR Approach on Petri Nets (advisors: T. Bartha, A. Vörös) 📄
Specialization: information technologies / system design







💡 Interests and Skills

- Research Formal methods, model checking, static analysis, SAT/SMT, compilers
Verification and analysis of software, smart contracts and system models
Tool and framework development
Experimental evaluation and data analysis
- Development Java, C#, C, C++, R, Python, Git, CI





🌐 Internships and Research Visits

- 2019 **SRI International**, *New York City, USA*, Internship, 12 weeks.
Formalizing and verifying advanced data structures in Solidity. 🔄 📄 🗨️
- 2018 **SRI International**, *New York City, USA*, Internship, 12 weeks.
Developing solc-verify, a formal verification tool for Solidity smart contracts. 🔄 📄 🗨️
- 2017 **McGill University**, *Montréal, Canada*, Research visit, 8 weeks.
Working on functional verification for cyber-physical systems. 🗨️
- 2015 **CERN**, *Geneva, Switzerland*, Summer student programme, 10 weeks.
Developing code generation in ROOT, a data analysis framework for the experiments. 🔄 📄
- 2013 **evopro Innovation**, *Budapest, Hungary*, Internship, 6 weeks.
Modeling and analyzing public transportation networks using Petri nets. 📄

Tools


- 2018– **solc-verify**,  github.com/SRI-CSL/solidity.
Automated tool for modular specification and verification of Solidity smart contracts. I co-started the project, advised by D. Jovanović, and I am one of the main developers to date.
- 2016– **Theta**,  github.com/ftsrg/theta.
Generic, modular and configurable verification framework with various formalisms and algorithms. I co-started the project with T. Tóth, currently I am the lead developer, also managing a group of students working on it.
- 2018– **Gazer**,  github.com/ftsrg/gazer.
LLVM-based C program analysis frontend for Theta. I advised Gy. Sallai who started the project, and I am currently managing a group of students working on it.
- 2017–2018 **PLCverif**,  gitlab.com/plcverif-oss.
PLC verification framework, supporting Theta as a backend. I was working on the integration of Theta, and its experimental evaluation.
- 2012–2016 **PetriDotNet**,  inf.mit.bme.hu/en/research/tools/petridotnet.
Petri net modeling and analysis framework. I was developing CEGAR-based analysis plug-ins.
- 2015 **ROOT**,  root.cern.ch.
Data analysis framework of CERN for high energy physics. I was working on generating analysis script skeletons.

Participation in Research Projects


- 2019– **MCaaS**, with *IncQuery Labs and NASA JPL*.
Model Checking as a Service: cloud-based, push-button model checking for SysML statecharts.
- 2019– **ADVANCE** .
Addressing Verification and Validation Challenges in Future Cyber-Physical Systems.
- 2019– **Arrowhead Tools** .
Automated tool chain for verification and validation of systems under development.
- 2016–2020 **MTA-BME Lendület**  , *Hungarian Academy of Sciences*.
Functional verification for cyber-physical systems.
- 2017–2018 **CERN-BME Collaboration** .
Application of formal methods to verify industrial PLC code at CERN.

Publication Highlights

23 publications in total, with **4 journal** articles, **8 conference** papers, **5 workshop** papers, **4 local** event papers, **1 technical report**, and **1 patent application**

Full list: hajduakos.github.io/publications.html 

Number of citations: 99 (as of October 21st 2020)

 scholar.google.hu/citations?user=7z74iO8AAAAJ

Awards

- 2019 **Included in BME best 100 professors**, based on student feedback (fall semester).
- 2019 **Scholarship of the New National Excellence Program**, Ministry for Innov. and Technology.
- 2019 **Included in BME best 100 professors**, based on student feedback (spring semester).
- 2018 **National Scholarship for Young Talents**, National Talent Programme.
- 2016 **National Scholarship for Young Talents**, National Talent Programme.
- 2016 **Pro Progressio Thesis Award**, Outstanding MSc thesis of the faculty (BME VIK).

- 2015 **Scholarship of the Republic of Hungary.**
- 2014 **Pro Progressio Thesis Award**, *Outstanding BSc thesis of the faculty (BME VIK).*
- 2014 **Scholarship of the Republic of Hungary.**
- 2013 **Scholarship of the Republic of Hungary.**
- 2013 **First Prize at National Scientific Students' Association Conference (OTDK).**
- 2012 **First Prize at BME Scientific Students' Association Conference (TDK).**

Professional Activities and Services

- PC member TAP'20-AE, VMCAI'20-AE, OpenMBEE@MODELS'20
- Webmaster DISC'19
- Subreviewer MODELS'20, VSTTE'19, HASE'19, LADC'18, SRDS'17
- Volunteer DISC'19, AVM'17, SRDS'16, ICACON'15, DSN'13

Summer Schools and Seminars

- 2018 **Winter School on Blockchains and Cryptocurrencies**,
Jerusalem, Israel, IIAS.
- 2016 **Dependable Software Systems Engineering Summer School**,
Marktobendorf, Germany, NATO Advanced Study Institute.
- 2016 **SAT/SMT/AR Summer School**,
Lisbon, Portugal, Instituto Superior Técnico.
- 2016 **Spring School on Logic and Verification**,
Vienna, Austria, TU Wien.
- 2015 **Automatic Verification and Analysis of Complex Systems**,
Oldenburg, Germany, Carl von Ossietzky University.
- 2014 **Verification Technology, Systems and Applications**,
Luxembourg, Luxembourg, University of Luxembourg.
- 2014 **Huawei Telecom Seeds for the Future**,
Beijing/Shenzhen, China.
- 2013 **Mathematics for Scientific Programming**,
Oberwolfach, Germany, Mathematisches Forschungsinstitut Oberwolfach.

Teaching

Current

- 2019– Blockchain Technologies and Applications
- 2017– Systems Engineering Laboratory 1-2 (BSc)
- 2017– Software Development Laboratory 2 (BSc)
- 2017– Integration and Verification Techniques (BSc)
- 2015– Software Verification and Validation (PhD)
- 2015– Software and Systems Verification (MSc)
- 2013– Formal Methods (MSc)

Former


- 2014–2016 IT Engineering Laboratory 2 (BSc)
- 2014–2016 Intelligent Systems Supervision (BSc)

- 2011–2014 Basics of Programming 1-2 (BSc)
- 2013–2013 Databases (BSc)
- 2011–2012 Software Laboratory 1-2 (BSc)

Tutoring

MSc students (co-)advised: 2

BSc students (co-)advised: 7

diplomaterv.vik.bme.hu/en/Supervisors/Hajdu-Akos 

Languages

- Hungarian Native language
- English Advanced level
- German Intermediate level

Publications

Journal Articles

- Access'20 Ákos Hajdu, Naghmeh Ivaki, Imre Kocsis, Attila Klenik, László Gönczy, Nuno Laranjeiro, Henrique Madeira, and András Pataricza. Using fault injection to assess blockchain systems in presence of faulty smart contracts. *IEEE Access*, 2020. (Accepted, in press, early access available)
- JAR'20 Ákos Hajdu and Zoltán Micskei. Efficient strategies for CEGAR-based model checking. *Journal of Automated Reasoning*, 64(6):1051–1091, 2020
- SCP'18 András Vörös, Dániel Darvas, Ákos Hajdu, Attila Klenik, Kristóf Marussy, Vince Molnár, Tamás Bartha, and István Majzik. Industrial applications of the PetriDotNet modelling and analysis tool. *Science of Computer Programming*, 157:17–40, 2018
- Acta'14 Ákos Hajdu, András Vörös, Tamás Bartha, and Zoltán Mártonka. Extensions to the CEGAR approach on Petri nets. *Acta Cybernetica*, 21(3):401–417, 2014

Conference Papers

- ESOP'20 Ákos Hajdu and Dejan Jovanović. SMT-friendly formalization of the Solidity memory model. In *Programming Languages and Systems*, volume 12075 of *Lecture Notes in Computer Science*, pages 224–250. Springer, 2020
- VSTTE'19 Ákos Hajdu and Dejan Jovanović. solc-verify: A modular verifier for Solidity smart contracts. In *Verified Software. Theories, Tools, and Experiments*, volume 12301 of *Lecture Notes in Computer Science*, pages 161–179. Springer, 2020
- FMCAD'17 Tamás Tóth, Ákos Hajdu, András Vörös, Zoltán Micskei, and István Majzik. Theta: a framework for abstraction refinement-based model checking. In *Proceedings of the 17th Conference on Formal Methods in Computer-Aided Design*, pages 176–179, 2017
- PN'16 András Vörös, Dániel Darvas, Vince Molnár, Attila Klenik, Ákos Hajdu, Attila Jámbor, Tamás Bartha, and István Majzik. PetriDotNet 1.5: Extensible Petri net editor and analyser for education and research. In *Application and Theory of Petri Nets and Concurrency*, volume 9698 of *Lecture Notes in Computer Science*, pages 123–132. Springer, 2016
- FORTE'16 Ákos Hajdu, Tamás Tóth, András Vörös, and István Majzik. A configurable CEGAR framework with interpolation-based refinements. In *Formal Techniques for Distributed Objects, Components and Systems*, volume 9688 of *Lecture Notes in Computer Science*, pages 158–174. Springer, 2016

- PN'15 Ákos Hajdu, András Vörös, and Tamás Bartha. New search strategies for the Petri net CEGAR approach. In *Application and Theory of Petri Nets and Concurrency*, volume 9115 of *Lecture Notes in Computer Science*, pages 309–328. Springer, 2015
- ASCO'14 Ákos Hajdu, Róbert Németh, Szilvia Varró-Gyapay, and András Vörös. Petri net based trajectory optimization. In *ASCONIKK 2014: Extended Abstracts. Future Internet Services*, pages 11–19. University of Pannonia, 2014
- SPLST'13 Ákos Hajdu, András Vörös, Tamás Bartha, and Zoltán Mártonka. Extensions to the CEGAR approach on Petri nets. In *Proceedings of the 13th Symposium on Programming Languages and Software Tools*, pages 274–288. University of Szeged, 2013

Workshop Papers

- OMBEE'20 Benedek Horváth, Bence Graics, Ákos Hajdu, Zoltán Micskei, Vince Molnár, István Ráth, Luigi Andolfato, Ivan Gomes, and Robert Karban. Model checking as a service: Towards pragmatic hidden formal methods. In *Proceedings of the ACM/IEEE 23rd International Conference on Model Driven Engineering Languages and Systems (MODELS '20 Companion)*, 2020. (Accepted)
- FMBC'20 Ákos Hajdu, Dejan Jovanović, and Gabriela Ciocarlie. Formal specification and verification of Solidity contracts with events (short paper). In *2nd Workshop on Formal Methods for Blockchains*, volume 84 of *OpenAccess Series in Informatics (OASIS)*. Schloss Dagstuhl–Leibniz-Zentrum für Informatik, 2020. (In press)
- AVOCS'18 Rebeka Farkas, Tamás Tóth, Ákos Hajdu, and András Vörös. Backward reachability analysis for timed automata with data variables. In *Proceedings of the 18th International Workshop on Automated Verification of Critical Systems*, volume 76 of *Electronic Communications of the EASST*, pages 1–20. EASST, 2018
- VPT'17 Gyula Sallai, Ákos Hajdu, Tamás Tóth, and Zoltán Micskei. Towards evaluating size reduction techniques for software model checking. In *Proceedings of the Fifth International Workshop on Verification and Program Transformation*, volume 253 of *Electronic Proceedings in Theoretical Computer Science*, pages 75–91. Open Publishing Association, 2017
- FESCA'17 Bence Czipó, Ákos Hajdu, Tamás Tóth, and István Majzik. Exploiting hierarchy in the abstraction-based verification of statecharts using SMT solvers. In *Proceedings of the 14th International Workshop on Formal Engineering Approaches to Software Components and Architectures*, volume 245 of *Electronic Proceedings in Theoretical Computer Science*, pages 31–45. Open Publishing Association, 2017

Technical Reports

- CERN'15 Ákos Hajdu. Making the TTreeReader interface more accessible. Tech. rep. CERN-STUDENTS-Note-2015-039, European Organization for Nuclear Research (CERN), Aug 2015

Local Events

- MS'19 Viktória Dorina Bajkai and Ákos Hajdu. Software model checking with a combination of explicit values and predicates. In *Proceedings of the 26th PhD Mini-Symposium*, pages 4–7. Budapest University of Technology and Economics, Department of Measurement and Information Systems, 2019
- MS'18 Ákos Hajdu and Zoltán Micskei. A preliminary analysis on the effect of randomness in a CEGAR framework. In *Proceedings of the 25th PhD Mini-Symposium*, pages 32–35. Budapest University of Technology and Economics, Department of Measurement and Information Systems, 2018
- MS'17 Rebeka Farkas and Ákos Hajdu. Activity-based abstraction refinement for timed systems. In *Proceedings of the 24th PhD Mini-Symposium*, pages 18–21. Budapest University of Technology and Economics, Department of Measurement and Information Systems, 2017

MS'17 Ákos Hajdu and Zoltán Micskei. Exploratory analysis of the performance of a configurable CEGAR framework. In *Proceedings of the 24th PhD Mini-Symposium*, pages 34–37. Budapest University of Technology and Economics, Department of Measurement and Information Systems, 2017

Patents and Applications

2020 Gabriela Ciocarlie, Karim Eldefrawy, Tancrede Lepoint, Jorge Navas, Ákos Hajdu, and Dejan Jovanović. Middleware to automatically verify smart contracts on blockchains, June 2020. US Patent App. 16/227,728

Talks



Conference Talks

2020 FMBC@CAV: Formal Specification and Verification of Solidity Contracts with Events
2020 WoSCA@ISSTA (invited): SMT-based effective formalization of reference types in Solidity
2020 SMT@IJCAR: SMT-Friendly Formalization of the Solidity Memory Model
2020 Solidity Summit: solc-verify, a source-level formal verification tool for Solidity smart contracts
2019 VSTTE@CAV: solc-verify: A Modular Verifier for Solidity Smart Contracts
2017 FMCAD: Theta: a Framework for Abstraction Refinement-Based Model Checking
2017 FMCAD Student Forum: Towards Using Multiple Counterexamples for Abstraction Refinement
2017 VPT@ETAPS: Towards Evaluating Size Reduction Techniques for Software Model Checking
2017 FESCA@ETAPS: Exploiting Hierarchy in the Abstraction-Based Verification of Statecharts Using SMT Solvers
2016 FORTE: A Configurable CEGAR Framework with Interpolation-Based Refinements
2015 ICATPN: New search strategies for the Petri net CEGAR approach
2014 VOCAL/ASCONIKK: Petri Net Based Trajectory Optimization
2013 SPLST: Extensions to the CEGAR approach on Petri Nets

Other Talks

2020 SMT-Friendly Formalization of the Solidity Memory Model, at IRIF Verification Seminar
2019 Solc-verify: a Modular Verifier for Solidity Smart Contracts, at SRI International
2019 Smart Contract Verification, at the Scientific Association for Infocommunications
2018 Automated Verification of Solidity Smart Contracts, at the Winter School on Blockchains and Cryptocurrencies
2018 Automated Formal Verification of Smart Contracts, at SRI International
2017 Software Verification with Abstraction-Based Methods, at McGill University
2016 Generating C++ skeletons for particle physics data analysis, at I C what you did last summer
2015 Making the TTreeReader interface more accessible, at CERN
2015 CEGAR-based model checking, at CERN
2014 Extending the iteration strategy of the CEGAR approach on Petri Nets, at VTSA

Other

I like traveling and exploring places, taking photos ( flickr.com/photos/sonic182) and trying local cuisine. I enjoy working out and doing extreme sports like skateboarding, skiing and snowboarding ( youtube.com/user/skatersonic182). I'm married and I have a pet rabbit.