

# Sergey Mechtaev

Lecturer (Assistant Professor), University College London

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## RESEARCH INTERESTS

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- **Automated Programming:** automated program repair, program synthesis
- **Program Analysis:** symbolic execution, Datalog-based analysis.
- **Artificial Intelligence:** AI4SE, LLM4SE.

## EDUCATION

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- **National University of Singapore, School of Computing** Singapore  
*Doctor of Philosophy*  
August 2012–July 2018  
Thesis: Semantic program repair; Supervisor: Abhik Roychoudhury; GPA: 4.4
- **Saint Petersburg State University, Mathematics & Mechanics Faculty** Saint Petersburg, Russia  
*Specialist*  
September 2006–July 2011  
Thesis: Generic programming library for OCaml; Supervisor: Dmitry Boulytchev; GPA: 4.7

## EMPLOYMENT

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- **University College London** London, United Kingdom  
*Lecturer*  
February 2019–Present  
Software System Engineering group, CREST centre
- **National University of Singapore** Singapore  
*Research Assistant*  
March 2017–January 2019  
TSUNAMi centre
- **Fondazione Bruno Kessler** Trento, Italy  
*Intern*  
February 2016–June 2016  
Research Unit in Embedded Systems
- **Lanit-Tercom, Inc** Saint-Petersburg, Russia  
*Software Developer*  
May 2010–July 2012  
HaSCoL hardware-description language
- **OOO Dvin** Saint-Petersburg, Russia  
*Software Developer*  
June 2009–April 2010  
Video surveillance software startup

## AWARDS

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- **ACM SIGSOFT Distinguished Paper Award** Melbourne, Australia  
*For ICSE paper “Rete: Learning Namespace Representation for Program Repair”*  
2023
- **National University of Singapore IMDA Excellence Prize 2019** Singapore  
*For School of Computing’s best PhD thesis “Semantic Program Repair”*  
2019
- **ACM SIGSOFT Outstanding Doctoral Dissertation Award** Montreal, Canada  
*For PhD thesis “Semantic Program Repair”*  
2019
- **National University of Singapore Research Achievement Award** Singapore  
*For my research on automated program repair.*  
2016

• **ACM ICPC NEERC Northern Subregional Contest Honorable Mention**

Saint Petersburg, Russia

*For my participation in ACM ICPC programming competition.*

2007

PUBLICATIONS

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**Google Scholar:** <https://scholar.google.com.sg/citations?user=XTFR93cAAAAJ&hl=en>

**DBLP:** <https://dblp.uni-trier.de/pers/hd/m/Mechtaev:Sergey>

- **Precise Data-Driven Approximation for Program Analysis via Fuzzing** ASE 2023  
*Nikhil Parasaram, Earl Barr, Sergey Mechtaev, Marcel Boehme*  
International Conference on Automated Software Engineering 2023
- **Program Repair Guided by Datalog-Defined Static Analysis** FSE 2023  
*Liu Yu, Sergey Mechtaev\*, Pavle Subotic, Abhik Roychoudhury*  
Symposium on the Foundations of Software Engineering 2023
- **Continuously Accelerating Research** ICSE'23 NIER  
*Earl Barr, Jonathan Bell, Michael Hilton, Sergey Mechtaev, Christopher Timperley*  
International Conference on Software Engineering 2023, New Ideas and Emerging Results
- **Rete: Learning Namespace Representation for Program Repair** ICSE'23  
*Nikhil Parasaram, Earl Barr, Sergey Mechtaev*  
International Conference on Software Engineering 2023. **ACM SIGSOFT Distinguished Paper Award**
- **Efficient SMT-based Network Fault Tolerance Verification** FM'23  
*Yu Liu, Pavle Subotic, Emmanuel Letier, Sergey Mechtaev, Abhik Roychoudhury*  
International Symposium on Formal Methods 2023
- **Modus: A Datalog Dialect for Building Container Images** FSE'22  
*Chris Tomy, Tingmao Wang, Earl Barr, Sergey Mechtaev*  
Symposium on the Foundations of Software Engineering 2022
- **Fair Decision Making via Automated Repair of Decision Trees** Fairware'22  
*Jiang Zhang, Ivan Beschastnikh, Sergey Mechtaev, Abhik Roychoudhury*  
International Workshop on Equitable Data & Technology 2022
- **Trident: Controlling Side Effects in Automated Program Repair** TSE'21  
*Nikhil Parasaram, Earl Barr, Sergey Mechtaev*  
Transactions on Software Engineering
- **Evaluating Automatic Program Repair Capabilities to Repair API Misuses** TSE'21  
*Maria Kechagia, Sergey Mechtaev, Federica Sarro, Mark Harman*  
Transactions on Software Engineering
- **Re-factoring Based Program Repair Applied to Programming Assignments** ASE'19  
*Yang Hu, Umair Z. Ahmed, Sergey Mechtaev, Ben Leong, Abhik Roychoudhury*  
International Conference on Automated Software Engineering 2019
- **Crash-Avoiding Program Repair** ISSTA'19  
*Xiang Gao, Sergey Mechtaev, Abhik Roychoudhury*  
International Symposium on Software Testing and Analysis 2019
- **Symbolic Execution with Existential Second-Order Constraints** FSE'18  
*Sergey Mechtaev, Alberto Griggio, Alessandro Cimatti, Abhik Roychoudhury*  
Symposium on the Foundations of Software Engineering 2018
- **Test-equivalence Analysis for Automatic Patch Generation** TOSEM'18  
*Sergey Mechtaev, Xiang Gao, Shin Hwei Tan, Abhik Roychoudhury*  
Transactions on Software Engineering and Methodology 2018
- **Semantic Program Repair Using a Reference Implementation** ICSE'18  
*Sergey Mechtaev, Manh-Dung Nguyen, Yannic Noller, Lars Grunske, Abhik Roychoudhury*  
International Conference on Software Engineering 2018, Acceptance: 105/502 = 21%

- **A Correlation Study Between Automated Program Repair and Test-suite Metrics** EMSE'17  
Jooyong Yi, Shin Hwei Tan, Sergey Mechtaev, Marcel Boehme, Abhik Roychoudhury  
Empirical Software Engineering Journal 2017
- **Codeflaws: A Programming Competition Benchmark for Evaluating Automated Program Repair Tools** ICSE'17-Poster  
Shin Hwei Tan, Jooyong Yi, Yulis, Sergey Mechtaev, Abhik Roychoudhury  
International Conference on Software Engineering, Poster track 2017
- **Angelix: Scalable Multiline Program Patch Synthesis via Symbolic Analysis** ICSE'16  
Sergey Mechtaev, Jooyong Yi, Abhik Roychoudhury  
International Conference on Software Engineering 2016, Acceptance: 101/530 = 19%
- **DirectFix: Looking for Simple Program Repairs** ICSE'15  
Sergey Mechtaev, Jooyong Yi, Abhik Roychoudhury  
International Conference on Software Engineering 2015, Acceptance: 84/452 = 18%
- **Eliminating Boilerplate Code in Objective Caml Programs** SysProg'11  
Sergey Mechtaev  
System Programming 2011
- **Efficiently Scrapping Boilerplate Code in OCaml** ML'11  
Dmitri Boulytchev, Sergey Mechtaev  
Workshop on ML 2011

## SELECTED PROJECTS

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**GitHub:** <https://github.com/mechtaev>

- **Modus:** Modus is a language for building Docker/OCI container images. Modus uses logic programming to express interactions among build parameters, specify complex build workflows, automatically parallelise and cache builds, help to reduce image size, and simplify maintenance. Received over 250 stars on GitHub soon after its public release.  
<https://modus-containers.com/>
- **Angelix:** the first constraint-based program repair system that scales to large real-world programs. Angelix generated a patch for the well-known Heartbleed vulnerability; it has been downloaded by researchers from over 60 institutions, and has been used in several projects including an intelligent tutoring system at IIT Kanpur. <http://angelix.io>
- **program-repair.org:** the largest online community dedicated to program repair founded by me in 2016. Has over 120 subscribed program repair researchers from around the world; researchers from over 10 institutions have contributed content to this website; the website has 200-300 unique visitors per month. <http://program-repair.org>

## PHD SUPERVISION

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- **Nikhil Parasaram (PhD)** University College London  
*First supervisor. Second supervisor: Earl T. Barr* September 2019–Present  
Thesis: TBA
- **Liu Yu (PhD)** National University of Singapore/CREST  
*Co-advisor. Other advisors: Abhik Roychoudhury, Emmanuel Letier* September 2020–Present  
Thesis: TBA

## TEACHING

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- **COMP0174 Practical Program Analysis** University College London  
*Module Leader* January 2023–March 2023
- **COMP0010 Software Engineering** University College London  
*Module Leader* September 2022–December 2022
- **COMP0174 Practical Program Analysis** University College London  
*Module Leader* January 2022–March 2022

- **COMP0010 Software Engineering**  
*Module Leader* University College London  
*September 2021–December 2021*
- **COMP0010 Software Engineering**  
*Module Leader* University College London  
*September 2020–December 2020*
- **COMP0010 Software Engineering**  
*Module Leader* University College London  
*September 2019–December 2019*
- **CS4218 Software Testing and Debugging**  
*Teaching Assistant* National University of Singapore  
*January 2015–May 2015*

## TALKS

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- **Modus: A Datalog Dialect for Building Container Images**  
*JetBrains Open Reading Club* Online  
*December 2022*
- **To Build is to Query: Building Container Images with Datalog**  
*Microsoft, MDCS Tech & Science Talks* Online  
*November 2022*
- **To Build is to Query: Building Container Images with Datalog**  
*National University of Singapore, CS Seminar* Singapore  
*August 2022*
- **Semantic Program Repair**  
*NUS Computing Research Week* Singapore (via video conferencing)  
*August 2020*
- **Synthesis of Software Patches Using Symbolic Execution**  
*62<sup>nd</sup> CREST Open Workshop on Program Repair and GI* London, United Kingdom  
*January 2020*
- **Automated Repair of Security Vulnerabilities**  
*Shonan Meeting 160 on Fuzzing and Symbolic Execution* Tokyo, Japan  
*September 2019*
- **Semantic Program Repair**  
*Southern University of Science and Technology* Shenzhen, China  
*July 2019*
- **Semantic Program Repair**  
*Imperial College London* London, United Kingdom  
*May 2019*
- **First-Order and Second-Order Symbolic Execution**  
*JetBrains Research* Saint-Petersburg, Russia  
*April 2019*
- **Semantic Program Repair**  
*University College London* London, United Kingdom  
*July 2018*
- **Semantic Program Repair Using a Reference Implementation**  
*Dagstuhl Seminar 18151 on Program Equivalence* Schloss Dagstuhl, Germany  
*April 2018*
- **Semantics-based Program Repair**  
*School of Computing, National University of Singapore* Singapore  
*April 2017*
- **Efficient Exploration of Patch Spaces for Automated Program Repair**  
*JetBrains Research* Saint-Petersburg, Russia  
*March 2017*
- **Towards a Synergy of Syntax-based and Semantics-based Program Repair**  
*Dagstuhl Seminar 17022 on Automated Program Repair* Schloss Dagstuhl, Germany  
*January 2017*
- **Constraint-based Automated Program Repair**  
*Fondazione Bruno Kessler* Trento, Italy  
*May 2016*

## SERVICE

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- **Organiser:**
  - International Workshop on Automated Program Repair (APR) co-located with ICSE 2024
  - 65<sup>th</sup> CREST Open Workshop (COW) on Automated Program Repair and Genetic Improvement 2023
  - International Workshop on Automated Program Repair (APR) co-located with ICSE 2023

- International Conference on Software Engineering Student Research Competition (ICSE SRC) 2022
- International Workshop on Automated Program Repair (APR) co-located with ICSE 2022
- International Workshop on Automated Program Repair (APR) co-located with ICSE 2021
- 62<sup>nd</sup> CREST Open Workshop (COW) on Automated Program Repair and Genetic Improvement 2020
- International Workshop on Automated Program Repair (APR) co-located with ICSE 2020

• **Program committee:**

- International Conference on Software Engineering (ICSE) 2024
- Symposium on the Foundations of Software Engineering (FSE) 2023
- International Conference on Automated Software Engineering (ASE) 2019, 2020, 2021
- International Conference on Software Engineering Demonstrations (ICSE-Demo) 2022
- Symposium on the Foundations of Software Engineering Doctoral Symposium (FSE-DS) 2022
- International Conference on Automated Software Engineering Student Research Competition (ASE SRC) 2021

• **Reviewer:**

- Transactions on Software Engineering (TSE) 2017, 2018, 2019, 2021, 2022
- Empirical Software Engineering (EMSE) 2017, 2018, 2019, 2020, 2021, 2022
- Transactions on Software Engineering and Methodology (TOSEM) 2018, 2019, 2020, 2021, 2022, 2023
- Journal of Software: Evolution and Process 2022
- Science of Computer Programming 2020
- Formal Method in System Design (FMSD) 2020

• **Subreviewer:**

- International Conference on Automated Software Engineering (ASE) 2013
- International Symposium on Software Testing and Analysis (ISSTA) 2015
- International Conference on Software Testing, Verification, and Validation (ICST) 2017
- Symposium on the Foundations of Software Engineering (FSE) 2017
- International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS) 2019