Sergey Mechtaev

Lecturer (Assistant Professor), University College London

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Research interests

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

Education

- **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

- **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

- **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

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

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-continens.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

- **Nikhil Parasaram (PhD)** University College London
  First supervisor. Second supervisor: Earl T. Barr *September 2019–Present*
  Thesis: A Synergy of Program Analysis and Machine Learning for Program Repair
- **Liu Yu (PhD)** National University of Singapore/CREST
  Co-advisor. Other advisors: Abhik Roychoudhury, Emmanuel Letier *September 2020–Present*
  Thesis: A Static Program Repair Framework Based on Symbolic Datalog

Teaching

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

Talks

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

Service

- **Organiser**:
  - International Workshop on Automated Program Repair (APR) co-located with ICSE 2024
  - 65^{nd} 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^{nd} 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

Membership & Certification

- ACM SIGSOFT member
- IEEE member
- UKPSF High Education Academy (HEA) Fellow