

# SEONGMIN LEE

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## Research Summary

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The overarching objective of my research is to achieve **practical software testing in real-world scenarios** by addressing the empirical challenges associated with the *scale and complexity of software systems*. To do so, I **utilize statistical methods**, such as *causal inference, biostatistics, and machine learning*, **to analyze the dynamic behavior of software in operational environments**. My research has been published in top-tier software engineering venues, including ICSE, FSE, and JSS, and I served as a program committee member for top-tier conferences, including FSE, ASE, and ISSTA.

## Education and Employment

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Max Planck Institute for Security and Privacy

Germany

**Postdoctoral Researcher, Software Security Research group**

Sep. 2022 – Present

Group head: Dr. Marcel Böhme

Korea Advanced Institute of Science and Technology

Republic of Korea

**Doctor of Philosophy, School of Computing**

Sep. 2016 – Aug. 2022

Advisor: Dr. Shin Yoo

**Bachelor of Science, School of Computing**

Feb. 2012 – Aug. 2016

**Bachelor of Science, Department of Mathematical Sciences**

## Publications

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### Refereed Journal Articles

- SCP'25 **Seongmin Lee**, Dave Binkley, Robert Feldt, Nicolas Gold, and Shin Yoo. Causal program dependence analysis. *Science of Computer Programming*, 240:103208, 2025
- JSS'21 **Seongmin Lee**, David Binkley, Robert Feldt, Nicolas Gold, and Shin Yoo. Observation-based approximate dependency modeling and its use for program slicing. *Journal of Systems and Software*, 179:110988, 2021
- JSS'20 **Seongmin Lee**, David Binkley, Nicolas Gold, Syed Islam, Jens Krinke, and Shin Yoo. Evaluating lexical approximation of program dependence. *Journal of Systems and Software*, 160:110459, 2020

### Refereed Conference Publications

- ICSE'25 **Seongmin Lee**, Shreyas Minocha, and Marcel Böhme. Accounting for missing events in statistical information leakage analysis. In *2025 IEEE/ACM 47th International Conference on Software Engineering (ICSE)*, 2025
- ICSE'24 Danushka Liyanage\*, **Seongmin Lee\***, Chakkrit Tantithamthavorn, and Marcel Böhme. Extrapolating Coverage Rate in Greybox Fuzzing. In *Proceedings of the IEEE/ACM 46th International Conference on Software Engineering*, ICSE '24, pages 1–12. Association for Computing Machinery, 2024  
(\*Co-first authors with equal contribution)
- FSE'23 **Seongmin Lee** and Marcel Böhme. Statistical Reachability Analysis. In *Proceedings of the 31st ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering*, ESEC/FSE 2023, pages 326–337. Association for Computing Machinery, 2023
- SCAM'19 **Seongmin Lee**, David Binkley, Robert Feldt, Nicolas Gold, and Shin Yoo. MOAD: Modeling Observation-Based Approximate Dependency. In *2019 19th International Working Conference on Source Code Analysis and Manipulation (SCAM)*, pages 12–22, 2019
- ICST'19 **Seongmin Lee**, Shin Hong, Jungbae Yi, Taeksu Kim, Chul-Joo Kim, and Shin Yoo. Classifying False Positive Static Checker Alarms in Continuous Integration Using Convolutional Neural Networks. In *2019 12th IEEE Conference on Software Testing, Validation and Verification (ICST)*, pages 391–401, 2019

## Preprints

- Seongmin Lee** and Marcel Böhme. Structure-aware Residual Risk Analysis – *Under review with ISSTA'25*
- Jing Liu\*, **Seongmin Lee**\*, and Marcel Böhme. Can LLM Generate Regression Tests for Software Commits? – *Under review with FSE'25*  
(\*Co-first authors with equal contribution)
- Seongmin Lee** and Marcel Böhme. How Much is Unseen Depends Chiefly on Information About the Seen – *Under review with ICLR'25, Initial review score: 7.33/10 (8:=accept, 8, 6:=weak accept)*

## Invited Articles

- GI'20 William B. Langdon, Westley Weimer, Justyna Petke, Erik Fredericks, **Seongmin Lee**, Emily Winter, Michail Basios, Myra B. Cohen, Aymeric Blot, Markus Wagner, Bobby R. Bruce, Shin Yoo, Simos Gerasimou, Oliver Krauss, Yu Huang, and Michael Gerten. Genetic Improvement @ ICSE 2020. *SIGSOFT Softw. Eng. Notes*, 45(4):24–30, 2020

## Refereed Workshop Publications

- ICST'21 Saeyoon Oh, **Seongmin Lee**, and Shin Yoo. Effectively Sampling Higher Order Mutants Using Causal Effect. In *2021 IEEE International Conference on Software Testing, Verification and Validation Workshops (ICSTW)*, pages 19–24, 2021
- ICSE'20 **Seongmin Lee**. Scalable and approximate program dependence analysis. In *Proceedings of the ACM/IEEE 42nd International Conference on Software Engineering: Companion Proceedings*, ICSE '20, pages 162–165. Association for Computing Machinery, 2020
- KCC'19 Gabin An, Jinhan Kim, **Seongmin Lee**, and Shin Yoo. Pyggi: Python general framework for genetic improvement. In *Korea Computer Congress 2017*, pages 536–538, 2017
- ICSE'18 **Seongmin Lee**, David Binkley, Nicolas Gold, Syed Islam, Jens Krinke, and Shin Yoo. MOBS: Multi-operator observation-based slicing using lexical approximation of program dependence. In *Proceedings of the 40th International Conference on Software Engineering: Companion Proceedings*, ICSE '18, pages 302–303. Association for Computing Machinery
- SBSE'17 **Seongmin Lee** and Shin Yoo. Hyperheuristic Observation Based Slicing of Guava. In Tim Menzies and Justyna Petke, editors, *Search Based Software Engineering*, pages 175–180. Springer International Publishing, 2017
- SBSE'16 Jeongju Sohn, **Seongmin Lee**, and Shin Yoo. Amortised Deep Parameter Optimisation of GPGPU Work Group Size for OpenCV. In Federica Sarro and Kalyanmoy Deb, editors, *Search Based Software Engineering*, pages 211–217. Springer International Publishing, 2016

## Grants and Fellowships

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- Title: *Statistical Security Analysis for Large, Evolving Software*  
Funding Agency: CASA - Cyber Security in the Age of Large-Scale Adversaries  
Grant ID: DFG under Germany's Excellence Strategy - **EXC 2092 CASA - 390781972**  
Amount: Salary according to the remuneration group E 14 TV-L (full time, ~ €136,000)  
Duration: 2024.01.01 – 2025.12.31

## Awards and Honors

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- **Distinguished Artifact Reviewer Award**, 33rd USENIX Security Symposium, 2024
- **PhD Dissertation Award**, School of Computing, KAIST, 2022
  - Title of Dissertation: *Statistical Program Dependence Approximation*
- **2021 Naver Ph.D. Fellowship Award**: Awarded by NAVER Corp. to Ph.D. candidates who have published an outstanding research paper or have excellent publication performance, 2021
- Government-sponsored Scholarship, Ministry of Science and ICT of Korea, 2016 - 2022
- Government-sponsored Scholarship, Ministry of Science and ICT of Korea, 2012 - 2016

## Services

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### Academic Services

- Program committee: (Main Track) ASE'24, ISSTA'24, FUZZING'24, SCAM'24, ASE'23 / (Artifact Evaluation Track) ISSTA'24, ECOOP'24, USENIX Security'24, ICSE'24, ISSTA'23, ICSME'22, ICSME'21 / (Student Research Competition Track) FSE'24 / (Tool Demonstration Track) ASE'24
- Reviewer: TOSEM'24, TSE'24, IST'24, ASE'24, TOSEM'22, JSS'21, JSS'20 / (External) ICSE'24, FSE'24, ECOOP'24, ICSE'23, ISSTA'23

### Institutional Services

- Open Science Ambassador, Max Planck Institute for Security and Privacy 2023 – Present  
As representatives of the institute, Open Science Ambassadors raise awareness and provide valuable information to their colleagues about Open Science practices. They meet annually, in person or online, to discuss strategies, participate in workshops, and evaluate the status of Open Science within and beyond the Society.

## Advising Experience

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### Ph.D. Students

- **Danushka Liyanage** (Monash University, moved on to University of Sydney Postdoc, 2024) Nov. 2022 – Dec. 2023  
Co-advised with Dr. Marcel Böhme on extrapolating the coverage rate of the Greybox Fuzzing using the statistical model. A **full conference paper** where Danushka is the first author has been accepted to ICSE'24.

### Undergraduate Students

- **Jing Liu** (Shanghai University, incoming Ph.D. student in UC Irvine) Apr. 2024 – Present  
Co-advised with Dr. Marcel Böhme on the LLM-based regression test generation for the software testing. A **full conference paper** where Jing is the first author has been submitted to FSE'25.
- **Shreyas Minocha** (Rice University, moved on to Georgia Tech Ph.D. student, 2024) Feb. 2023 – Jul. 2024  
Primary advisor on the statistical information leakage analysis to suggest the accurate and safe information leakage estimator. A **full conference paper** has been accepted to ICSE'25.
- **Saeyoon Oh** (KAIST, moved on to FuriosaAI) Jul. 2020 – Apr. 2021  
Co-advised with Dr. Shin Yoo on the effective sampling of higher-order mutants for mutation testing. A **workshop paper** where Saeyoon is the first author has been accepted to ICST'21.

## Teaching Experience

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### Guest Lecturer

- *Guarantees in Software Security – 2nd part: Extrapolating Software Testing*,  
Fuzzing and Software Security Summer School @ National University of Singapore (NUS) May 2024

### Invited Talks

- *Statistical Program Analysis*, Korea Advanced Institute of Science and Technology (KAIST) Jan. 2024
- *Statistical Program Analysis*, Ulsan National Institute of Science and Technology (UNIST) Jan. 2024
- *Causal Program Dependence Analysis*, Sheffield Causality and Testing Workshop Sep. 2023
- *Statistical program dependence analysis*, Handong Global University Aug. 2022
- *Observation-based approximate dependency modeling and its use for program slicing*,  
Korea Conference on Software Engineering Jan. 2022
- *MOBS: Multi-Operator Observation-Based Slicing using Lexical Approximation of Program Dependence*,  
59th CREST Open Workshop – Multi-language Software Analysis Mar. 2018

### Teaching Assistant

- Automated Software Testing (CS453), School of Computing (SoC), KAIST Spring 2019
- Artificial Intelligence Based Software Engineering (CS454), SoC, KAIST Fall 2018
- Introduction to Logic for Computer Science (CS402), SoC, KAIST Spring 2018
- Artificial Intelligence Based Software Engineering (CS454), SoC, KAIST Fall 2017
- Introduction to Logic for Computer Science (CS402), SoC, KAIST Spring 2017
- Special Topics in Computer Science (Search Based Software Engineering) (CS492), SoC, KAIST Fall 2016

## Research Experience

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### Software Security Group, MPI-SP

Sep. 2022 – Present

*Postdoc*

*Bochum, Germany*

- Researching on unbiased estimation of the missing mass/probability/expected number of discovering new classes of unknown multinomial distribution
- Researched on LLM-based regression test generation for the software security testing – Cleverest
- Researched applying biostatistics for information leakage analysis to suggest the accurate and safe information leakage estimator – Statistical Information Leakage Analysis
- Researched on extrapolating the coverage rate of the Greybox Fuzzing using the statistical model – Greybox Fuzzing Extrapolation
- Researched applying statistical methods for program analysis to overcome the scalability issue of the static analysis – Statistical Reachability Analysis

### Computational Intelligence for Software Engineering Laboratory (COINSE), KAIST

Sep. 2016 – Aug. 2022

*Ph.D. Student*

*Daejeon, Republic of Korea*

- Researched approximating the degree of dependence between program element using causal inference – CPDA
- Researched applying statistical models on the observation data to approximate the program dependence – MOAD
- Researched inferencing the type information in the binary executables using RNN with National Security Research Institute
- Researched classifying the false positive alarms from static checker in continuous integration pipeline using CNN with Samsung Research
- Researched program dependence approximation using the lexical model on the source code – MOBS

### Computational Intelligence for Software Engineering Laboratory (COINSE), KAIST

Mar. 2016 – Aug. 2016

*Undergraduate Research Intern*

*Daejeon, Republic of Korea*

- Researched on the amortised deep parameter optimisation of GPGPU work group size for OpenCV.
- Accelerated the scalability of Observation based slicing (ORBS) by applying a code distance metric during the slicing.

### Programming Language Research Group (PLRG) Lab, KAIST

Jul. 2015 – Feb. 2016

*Undergraduate Research Intern*

*Daejeon, Republic of Korea*

- Developed a source code translator from C# to C++ with F#.
- Developed a frontend of Scalable Analysis Framework for ECMAScript (SAFE), a Javascript static analysis tool.