

YUSUKE MATSUSHITA

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<https://shiatsumat.github.io>

I am a software scientist working as a Program-Specific **Assistant Professor** at the **Hakubi Center for Advanced Research** and the **Graduate School of Informatics, Kyoto University**. I specialize in **formal verification** of **stateful programs**, especially those written in Rust (e.g., my work **RustHorn**, **RustHornBelt**, and **Nola**). I am also curious about many other topics, including algorithms and natural language processing (e.g., **SoftMatcha**).

PAPERS

PLDI 2025 — Yusuke Matsushita and Takeshi Tsukada. **Nola: Later-Free Ghost State for Verifying Termination in Iris**. <https://shiatsumat.github.io/papers/pldi2025-nola.pdf>

ICLR 2025 — Hiroyuki Deguchi, Go Kamoda, Yusuke Matsushita, Chihiro Taguchi, Kohei Suenaga, Masaki Waga and Sho Yokoi. **SoftMatcha: A Soft and Fast Pattern Matcher for Billion-Scale Corpus Searches**. <https://softmatcha.github.io/>, <https://openreview.net/forum?id=Q6PAnqYVpo>

VMCAI 2024 — Takashi Nakayama, Yusuke Matsushita, Ken Sakayori, Ryosuke Sato and Naoki Kobayashi. **Borrowable Fractional Ownership Types for Verification**. https://doi.org/10.1007/978-3-031-50521-8_11

ACM PLDI 2022 — Yusuke Matsushita, Xavier Denis, Jacques-Henri Jourdan and Derek Dreyer. **RustHornBelt: A Semantic Foundation for Functional Verification of Rust Programs with Unsafe Code**. **Distinguished Paper Award**. <https://dl.acm.org/doi/10.1145/3519939.3523704>

ACM TOPLAS 2021 — Yusuke Matsushita, Takeshi Tsukada and Naoki Kobayashi. **RustHorn: CHC-based Verification for Rust Programs**. <https://dl.acm.org/doi/10.1145/3462205>

ESOP 2020 — Yusuke Matsushita, Takeshi Tsukada and Naoki Kobayashi. **RustHorn: CHC-based Verification for Rust Programs**. **Selected for the Special Issue of ACM TOPLAS**. https://link.springer.com/chapter/10.1007/978-3-030-44914-8_18

THESES

Ph.D. Dissertation, 2024 — Yusuke Matsushita. **Non-Step-Indexed Separation Logic with Invariants and Rust-Style Borrows**. **University of Tokyo**, 2024. Predecessor of **Nola**. <https://shiatsumat.github.io/papers/phd-thesis.pdf>, <https://shiatsumat.github.io/talks/phd-thesis-talk.pdf>

Master Thesis, 2021 — Yusuke Matsushita. **Extensible Functional-Correctness Verification of Rust Programs by the Technique of Prophecy**. **University of Tokyo**, 2021. Predecessor of **RustHornBelt**. <https://shiatsumat.github.io/papers/masters-thesis.pdf>

Senior Thesis, 2019 — Yusuke Matsushita. **CHC-based Program Verification Exploiting Ownership Types.** University of Tokyo, 2019. Predecessor of **RustHorn**. <https://shiatsumat.github.io/papers/senior-thesis.pdf>

LECTURES

Lecture at Kyoto University in 2024 — Yusuke Matsushita. **The Fun of Rust.** For the Course of CCE, Grad School of Informatics, Kyoto University. <https://shiatsumat.github.io/talks/2024-course-talk.pdf>

PPL Summer School 2024, Invited Lecture — Yusuke Matsushita. **The World of the Separation Logic Iris.** <http://ppl.jssst.or.jp/index.php?ss2024>

UTokyo Open Campus 2023 — Yusuke Matsushita and Takashi Nakayama. **Science of Software, Aspiring to a World Free of Bugs.** Open Campus 2023, the Faculty of Science, the University of Tokyo. <https://www.youtube.com/watch?v=DDdEtX05dZ4>

TALKS

TPSA 2025 & PPlanQC 2025 — Yusuke Matsushita (Presenter at TPSA 2025), Kengo Hirata and Ryo Wakizaka (Presenter at PPlanQC 2025). **Concurrent Quantum Separation Logic for Fine-Grained Parallelism.** Extended abstracts: <https://shiatsumat.github.io/papers/tpsa2025-cqsl.pdf>, <https://shiatsumat.github.io/papers/planqc2025-cqsl.pdf>

PRO-2024-1, Invited Talk — Yusuke Matsushita. **New Perspectives on Program Verification and Testing Spreading from Rust.** <https://shiatsumat.github.io/talks/pro-2024-1-invited-talk.pdf>

ACM PLDI 2022 — Yusuke Matsushita, Xavier Denis (Co-presenter), Jacques-Henri Jourdan and Derek Dreyer. **RustHornBelt: A Semantic Foundation for Functional Verification of Rust Programs with Unsafe Code.** <https://www.youtube.com/watch?v=pOg4dEhr5hI>

ESOP 2020 — Yusuke Matsushita, Takeshi Tsukada and Naoki Kobayashi. **RustHorn: CHC-based Verification for Rust Programs.** <https://www.morressier.com/article/rusthorn-chcbased-verification-rust-programs/604907f41a80aac83ca25d55>

JSSST 2020, Invited Talk — Yusuke Matsushita, Takeshi Tsukada and Naoki Kobayashi. **RustHorn: CHC-based Verification for Rust Programs.** https://www.youtube.com/watch?v=Ah_Bds6I_YI

PPL 2020 — Yusuke Matsushita, Takeshi Tsukada and Naoki Kobayashi. **RustHorn: CHC-based Verification for Rust Programs.**

POSTERS

PPL 2025 — Yusuke Matsushita, Yudai Tanabe, Taro Sekiyama and Atsushi Igarashi. **Pure Realization of Rust-Style Borrows in Linear Haskell.** **Best Poster Award.**

PPL 2019 — **Yusuke Matsushita**, Takeshi Tsukada and Naoki Kobayashi. **CHC-based Program Verification Exploiting Ownership Types**.

ARTICLES

ISPJ 2024 — **Yusuke Matsushita**. **Non-Step-Indexed Separation Logic with Invariants and Rust-Style Borrows**. Bulletin of Ph.D. Dissertations in AY 2023 Recommended by SIGs, Information Processing Society of Japan. Aug 15, 2024. <https://note.com/ipsj/n/nc0ae275045eb>

UTokyo Science News 2022 — **Yusuke Matsushita**. **Breaking Ground in the World of Software**. News from Faculty of Science, the University of Tokyo, Vol. 54, No. 1, 2022. https://dl5s7ayfvssw3.cloudfront.net/WEB_info/p/pub/8311/54-1.pdf#page=7

GRANTS

Apr 2025 – (Mar 2030) — **The Hakubi Project, Kyoto University**. Exploring a New Age of Software Development Springing from Rust.

Apr 2024 – Mar 2027 — **JSPS Research Fellowship for Young Scientists PD**. Foundations and Applications for Robust and High-Performance System Software.

Apr 2021 – Mar 2024 — **JSPS Research Fellowship for Young Scientists DC1**. Theory and Application for Robust and High-Performance Systems Programming Languages.

WORK

Apr 2025 - (Mar 2030) — **Program-Specific Assistant Professor** at **the Hakubi Center for Advanced Research, Kyoto University**

Apr 2024 – Mar 2025 — **JSPS Fellow (PD)** at the Computer Software Group (Igarashi & Suenaga Lab), Graduate School of Informatics, **Kyoto University**

TEACHING

Aug 2024 — Lecturer of S15 **Rust Program Verification Seminar** at **IPA Security Camp 2024** <https://www.ipa.go.jp/jinzai/security-camp/2024/camp/zenkoku/program/kaihatsu.html#s15>

Apr 2022 – Aug 2022, Apr 2019 – Aug 2019 — Teaching assistant of "**Functional and Logic Programming Experiments**" at Dept. of Information Science, School of Science, **University of Tokyo**

Sept 2019 – Feb 2020 — Teaching assistant of "**Processor and Compiler Experiments**" at Dept. of Information Science, School of Science, **University of Tokyo**

Mar 2018 — Lecturer of "**Purely Functional Data Structures**" at the **Japanese Olympiad in Informatics 2017 Spring Training Camp**

Aug 2017 — Tutor on “**Purely Functional Data Structures**” (by Chris Okasaki) at the **Japanese Olympiad in Informatics 2017 Summer Seminar**

SERVICE

Jan 2025 – Mar 2025 — **Program Committee Member** of **PPL 2025**

HONORS & AWARDS

2025 — **Hakubi Researcher** at **the Hakubi Center for Advanced Research, Kyoto University**

2025 — **Best Poster Award** at **PPL 2025**

2024 — **Invited Lecture** at **PPL Summer School 2024**

2022 — **Distinguished Paper Award** at **ACM PLDI 2022**

2020 — Selected for **ACM TOPLAS ESOP 2020 Special Issue**

2018 — **Sub-leader** of Japan’s special team for the **International Olympiad in Informatics 2018**

2013 & 2012 — **Finalist** in the **Japanese Olympiad in Informatics 2013 & 2012**

2013 — **Quarter-finalist** in the **National High School English Debate Tournament 2013**

EDUCATION

Apr 2021 – Mar 2024 — **Ph.D., Computer Science**

Apr 2019 – Mar 2021 — **M.S., Computer Science**

Apr 2015 – Mar 2019 — **B.S., Information Science**

University of Tokyo, Japan. Supervised by **Naoki Kobayashi**.

Apr 2009 – Mar 2015 — **Nada High School, Japan.**

EXPERIENCES

Nov 2022 – Feb 2023 — **Software Engineer Intern** at **ChromeOS Velocity Team, Google Tokyo**

Sept 2020 – July 2021 — **Research Intern** at the **RustBelt** team, led by **Derek Dreyer**, at **Max Planck Institute for Software Systems**

Aug 2019 – Jan 2020 — **Software Engineer Intern** at **CADDi**, a startup in Japan that builds a digital marketplace for manufacturing. Interview article: https://www.wantedly.com/companies/caddi/post_articles/200577

Mar 2017 – Mar 2019 — **Research Intern** at **Morishita Lab** (human genome informatics), in Dept. of Computational Biology and Medical Sciences, Grad School of Frontier Science, University of Tokyo

Dec 2015 – Dec 2016 — **President** of **UTokyo Piano Society**, a piano club of ~200 members

SKILLS

Languages — **Japanese** (Native speaker), **English** (Advanced, EIKEN Grade 1, TOEFL iBT 92)

Programming — C/C++, Rust, Coq, OCaml, Haskell, TypeScript, ...