

# YUSUKE MATSUSHITA

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I am a computer scientist working as a Program-Specific **Assistant Professor** at the **Hakubi Center for Advanced Research** and the **Graduate School of Informatics, Kyoto University**.

I study **software science**, especially **formal verification** of **stateful** programs (e.g., my work **RustHorn**, **RustHornBelt**, and **Nola**). I am also curious about many other topics, including quantum computing (e.g., **RapunSL**) and algorithms (e.g., **SoftMatcha**, **SoftMatcha 2**).

## WORK

**Apr 2026 – (Mar 2028)** — **Visiting Scientist** at **MPI-SWS, Germany**. Host: **Derek Dreyer**.

**Apr 2025 – (Mar 2030)** — **Program-Specific Assistant Professor** at the **Hakubi Center for Advanced Research, Kyoto University**. Host: Atsushi Igarashi, the **Computer Software Group**, Graduate School of Informatics, **Kyoto University**.

**Apr 2024 – Mar 2025** — **JSPS Fellow PD**. Host: Atsushi Igarashi, the **Computer Software Group**, Graduate School of Informatics, **Kyoto University**.

## EDUCATION

**Apr 2021 – Mar 2024** — **Ph.D.** in the field of **Information Science and Technology**. Dept. of Computer Science, Grad School of Information Science and Technology, **University of Tokyo**, Japan. Supervisor: **Naoki Kobayashi**.

**Apr 2019 – Mar 2021** — **Master** of **Information Science and Technology**. Dept. of Computer Science, Grad School of Information Science and Technology, **University of Tokyo**, Japan. Supervisor: **Naoki Kobayashi**.

**Apr 2015 – Mar 2019** — **Bachelor of Science**. Dept. of Information Science, School of Science, **University of Tokyo**, Japan. Supervisor: **Naoki Kobayashi**.

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

## PAPERS

**arXiv 2026** — Masataka Yoneda, **Yusuke Matsushita**, Go Kamoda, Kohei Suenaga, Takuya Akiba, Masaki Waga and Sho Yokoi. **SoftMatcha 2: A Fast and Soft Pattern Matcher for Trillion-Scale Corpora**. <https://softmatcha.github.io/v2/>, <https://arxiv.org/abs/2602.10908>.

**POPL 2026** — **Yusuke Matsushita\***, Kengo Hirata\*, Ryo Wakizaka and Emanuele D'Ousualdo (\*: equal contribution). **RapunSL: Untangling Quantum Computing with Separation, Linear Combination and Mixing**. <https://dl.acm.org/doi/10.1145/3776648>.

**PLDI 2025** — **Yusuke Matsushita** and Takeshi Tsukada. **Nola: Later-Free Ghost State for Verifying Termination in Iris**. <https://dl.acm.org/doi/10.1145/3729250>.

**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](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](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. Precursor to **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. Precursor to **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. Precursor to **RustHorn**. <https://shiatsumat.github.io/papers/senior-thesis.pdf>.

## TALKS

**PLDI 2025** — Yusuke Matsushita and Takeshi Tsukada. **Nola: Later-Free Ghost State for Verifying Termination in Iris.** [https://www.youtube.com/watch?v=D7wD5tty\\_FY](https://www.youtube.com/watch?v=D7wD5tty_FY).

**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](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, Naoki Kobayashi and Takeshi Tsukada. **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](https://dl5s7ayfvssw3.cloudfront.net/WEB_info/p/pub/8311/54-1.pdf#page=7).

## LECTURES

**Hakubi Seminar 2025 — Yusuke Matsushita. Science of Software, the Fun of Rust.** Hakubi Seminar. <https://shiatsumat.github.io/talks/2025-hakubi-seminar-talk.pdf>. [https://www.hakubi.kyoto-u.ac.jp/en/sem/sem\\_273/](https://www.hakubi.kyoto-u.ac.jp/en/sem/sem_273/).

**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>.

## GRANTS & FELLOWSHIPS

**Apr 2026 – (Mar 2028) — JSPS Overseas Research Fellowship.** Exploring New Foundations for Software Development in the Age of Rust. Host: **Derek Dreyer, MPI-SWS, Germany**.

**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.

## TEACHING

**Aug 2025 — Lecturer of L1 Rust Verifier Development Seminar at IPA Security Camp 2025** <https://www.ipa.go.jp/jinzai/security-camp/2025/camp/zenkoku/program/l.html#l1>.

**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 2026 – Mar 2026 — Program Committee member of PPL 2026.

Nov 2025 – Apr 2026 — Review Committee member of ACM PLDI 2026.

Feb 2025 – Mar 2025 — External reviewer of ACM PLDI 2025.

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.

## EXPERIENCES

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

Sept 2020 – June 2021 — Visiting Scholar 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](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), English (CEFR B2/C1).

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