YUSUKE MATSUSHITA

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https://shiatsumat.github.io

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

PUBLICATIONS

ICLR 2025 — Hiroyuki Deguchi, Go Kamoda, **Yusuke Matsushita**, Chihiro Taguchi, Kohei Suenaga, Masaki Waga and Sho Yokoi. **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. 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 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. Precursor of RustHorn. https://shiatsumat.github.io/papers/senior-thesis.pdf

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

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

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.

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 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

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

TALKS

TPSA 2025 & **PLanQC 2025** — **Yusuke Matsushita** (Presenter at TPSA 2025), Kengo Hirata and Ryo Wakizaka (Presenter at PLanQC 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**.

SERVICE

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

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

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.

SKILLS

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

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

EXPERIENCE

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