

Zhan Shi

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Education

Kyoto University

Master of Informatics in Communication and Computer Engineering

Apr, 2022 - Mar, 2024

Kyoto, Japan

Advisor: Atsushi Igarashi

Kumamoto University

B.Eng. in Computer Science

Oct, 2019 - March, 2022

Kumamoto, Japan

Shandong University

B.Eng. in IoT Engineering

Sep, 2017 - June, 2021

Qingdao, Shandong, China

Research Interests

- *Implementation of dependently typed programming languages*, focusing on features such as pattern matching.
 - *Semantic models of type theories*, especially categorical semantics, leveraging categorical perspectives to grasp the essence of new language features quickly.
 - *Semantics-based approaches for programming languages*, such as normalization-by-evaluation and logical relations.
 - *Dependent version of practical type systems*, such as gradual typing and effect systems.
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Research Experience

A Cast Calculus for Implementing Gradual Dependent Types, Master's Thesis

Jan, 2023 - Feb, 2024


Kyoto University, advised by Prof. Atsushi Igarashi and Prof. Taro Sekiyama

Kyoto, Japan

- Proposed a novel approach to the consistent and efficient implementation of gradual dependent types, which introduced modality into the type system and combined static elaboration with runtime pattern unification.
 - Introduced a cast calculus as the core language based on dependent pattern matching and pattern unification.
 - Implemented a prototype of the cast calculus in Haskell.
 - Presented a short paper[1] at SRC@SPLASH 2023, delivering both a talk and a poster presentation.
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Work Experience

Luogu, Shanghai, China

 [luogu.com](https://www.luogu.com)


Backend Team Leader, Remote, Part-Time

Jul, 2017 - Apr, 2023

- Led and participated in the backend development of the biggest online-judge platform in China.
 - Designed and developed a backend framework in PHP with dependency injection and container compilation.
 - Designed and led the development of several curial middlewares, including a distributed asynchronous task worker in Rust, a WebSocket server in Python.
 - Optimized and refactored the existing codebase progressively while continuously introducing new features, enabling scalability from tens of thousands to over a million users, and supporting an annual judgment volume of fifty million.
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OpenSource Contributions


Aya Prover, Practical implementation of a dependent type system

 [aya-dev](https://aya-dev.github.io)

- Overhauled records to support dependent types.
 - Helped with some bugs and refactorings in primitive definitions.
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Personal Projects

yukino, A type-driven and high-performance ORM framework in Rust


 [yukino-dev](https://yukino-dev.github.io)

- Derived SQL operations from simple Rust code based on a monadic structure.
- Developed a functional query builder that delegates its type-checking to the type system of Rust.
- Provided a zero-cost abstraction that ensures both efficiency and type safety.

toy-dt-cpp, A simple dependently typed language implementation in C++

 [toy-dt-cpp](https://toy-dt-cpp.github.io)

quote-data, A tokenization library for procedural macros in Rust

 [quote-data](https://quote-data.github.io)

annotation-rs, Compile-time annotation parser for Rust

 [annotation-rs](https://annotation-rs.github.io)

Skills

- **Programming Languages:** Not limited to any specific language, especially experienced in Agda, C/C++, Haskell, PHP, Python, Rust, comfortable with Coq, Java, JavaScript, OCaml, TypeScript.
 - **Type Theory:** familiar with various dependent type theories and their semantics, and have experience with formal verification.
 - **Compiler:** understand various compiler architectures, familiar with compiler frontend, especially in type checking. Also have experience in parser generator and DSL design.
 - **Web Development: 7 years** of experience in full-stack web development:
 - *Backend:* proficient in various backend frameworks in PHP, Python, and Rust, including Symfony, Laravel, Django, and Actix. Familiar with message queues and asynchronous programming. Also experienced in backend framework design.
 - *Frontend:* experienced with Vue.
 - *Database:* knowledgeable in MySQL, PostgreSQL, Redis, and Elasticsearch with a strong background in database design and optimization.
 - *DevOps:* skilled in Docker, proficient in CI/CD practices, and experienced with cloud services.
 - **Development Tools:** can adapt to any editors/OSs, usually use JetBrains IDEs and VSCode under Ubuntu, familiar with git and docker, and have experience with team collaboration tools like GitHub and Slack.
 - **Languages:** Chinese: native, English: advanced, Japanese: intermediate
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Honors and Awards

National Olympiad in Informatics in Provinces, First Prize

Nov, 2015

Competitive programming contest held by China Computer Federation

Shandong, China

Publications & Talks

- [1] Z. Shi, “Partial Gradual Dependent Type Theory,” in *Companion Proceedings of the 2023 ACM SIGPLAN International Conference on Systems, Programming, Languages, and Applications: Software for Humanity*, in SPLASH 2023. Cascais, Portugal: Association for Computing Machinery, 2023, pp. 22–24. doi: [10.1145/3618305.3623594](https://doi.org/10.1145/3618305.3623594).