

Zhan Shi

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Education

Kyoto University

Master of Informatics in Commucation and Computer Engineering

Advisor: Atsushi Igarashi

Apr, 2022 - Mar, 2024

Kyoto, Japan

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

- **Implementing dependently typed programming languages**, focusing on elaboration and pattern matching.
- Investigating **semantic models and methods of dependent type theories**, including categorical semantics, normalization-by-evaluation, and logical relations.
- Exploring the **integration of dependent types with other type systems**, such as gradual typing and effect systems.

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 implementing gradual dependent types soundly and efficiently for introducing dependent types into general-purpose programming languages.
- Introduced a cast calculus as the core language base 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, giving a talk and a poster presentation.

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 back-end framework in PHP with dependency injection and container compilation.
- While continuously introducing new features, progressively optimized and refactored the existing codebase, enabling scalability from tens of thousands to over a million users, and supported an annual judgment volume of fifty million.

OpenSource Contributions

Aya Prover, Practical implementation of a dependent type system

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

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

Personal Projects

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

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

- Derives SQL operations from simple Rust code based on a monadic structure.
- Provides a functional query builder that delegates its type-checking to the type system of Rust.
- The abstraction is type-safe but zero-cost, ensures both efficiency and type safety.

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

[top-dt-cpp](https://github.com/top-dt-cpp)

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

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

annotation-rs, Compile-time annotation parser for Rust

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

derivation-resolver, Derivation tree resolver for STLC and System F in Rust

[derivation-resolver](https://github.com/derivation-resolver)

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, proficient in backend development, databases, and DevOps practices.
- **Languages:** Chinese: native, English: advanced, Japanese: intermediate

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).