

# Xiaojia Rao

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Imperial College London • London, UK | Updated: February 24, 2026  
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## Current Position

### PhD Student

Imperial College London

London, UK

Oct. 2020 - Present

- Research Interests: Proof Assistants, Mechanised Verification, Type Theory, Programming Languages
- Advisor: Philippa Gardner
- External Advisor: Conrad Watt

## Education

### Imperial College London

MSc Advanced Computing

- Average Grade: 84.58/100 (Distinction, top of cohort)

London, UK

2019-2020

### University of Cambridge

Mathematics (Master of Mathematics, Bachelor of Art), St. Johns College

- Class I, Part IA/IB/II
- College Wright Prize (Top 1/3 of Class I), Part IA/IB

Cambridge, UK

2015-2019

## Active Projects

- *WasmCert-Coq*: A mechanisation of the W3C WebAssembly specification in the Coq (Rocq) proof assistant. Maintained since the pre-1.0 draft and updated to W3C 2.0 editor's draft, with the subtyping system from upcoming feature proposals. The extracted runtime has been tested and passed 100% of the official WebAssembly 2.0 test suite.

## Selected Publications

1. Xiaojia Rao, Stefan Radziuk, Conrad Watt, and Philippa Gardner. Progressful interpreters for efficient webassembly mechanisation. *Proc. ACM Program. Lang.*, 9(POPL), 2025

Despite WebAssembly in its name, this paper mainly investigates the theoretical relationship between the type soundness property and properties of executable semantics. The paper proposes a new design of a dependently-typed progressful interpreter which consolidates various desirable properties into one function. All methods discussed are then applied to WebAssembly to demonstrate their feasibility.

2. Xiaojia Rao\*, Aina Linn Georges\*, Maxime Legoupil, Conrad Watt, Jean Pichon-Pharabod, Philippa Gardner, and Lars Birkedal. Iris-wasm: Robust and modular verification of webassembly programs. *Proc. ACM Program. Lang.*, 7(PLDI), 2023

This paper designs and implements a higher-order program logic for WebAssembly based on the Iris separation logic framework in the Coq proof assistant. Some higher-order examples are verified to demonstrate the expressiveness of this program logic instantiated in Iris.

3. Conrad Watt, Xiaojia Rao, Jean Pichon-Pharabod, Martin Bodin, and Philippa Gardner. Two mechanisations of webassembly 1.0. In Marieke Huisman, Corina S. Pasareanu, and Naijun Zhan, editors, *Proceedings of the 24<sup>th</sup> international symposium of Formal Methods (FM21), Beijing, China; November 20-25, 2021*, volume 13047 of *Lecture Notes in Computer Science*, pages 61–79. Springer, 2021

This paper describes the two Wasm 1.0 mechanisations designed and implemented in the Isabelle/HOL and Coq theorem provers separately. The paper also describes the various soundness results proved in the mechanisation, including type soundness, type checker correctness, and other properties.

## Teaching

### Teaching Assistant

London, UK

*Imperial College London*

- Scalable Software Verification (Philippa Gardner, 2020-2023)
- Models of Computation (Azalea Raad, Herbert Wiklicky, Sophia Drossopoulou, 2020-2022)
- Probability and Statistics (Giuliano Casale, 2021-2022)
- Graphs and Algorithms (Iain Philipps, 2021)
- Reasoning about Programs (Sophia Drossopoulou, 2021)

### Master Project/Undergraduate Final Year Project Technical Supervisor

London, UK

*Imperial College London*

- Diego Cupello (Wasm-SpecTec Generation of Coq Mechanisation, 2024, CPP Department Award)
- Henit Mandaliya (Type Soundness of WebAssembly 2.0, 2023)
- Stefan Radziuk (Sound and Progressful Interpreter for WebAssembly, 2023, Distinguished Project Prize)
- Liqing Yang (Soundness of WebAssembly Module Instantiation, 2022)

## Work Experience

### Softwire

London, UK

*Software Engineer Intern*

*Jun. 2017 - Sep. 2017*

### Jane Street Capital

London, UK

*Quantitative Trading Intern*

*Jun. 2016 - Sep. 2016*

## Prizes and Awards

### CPP Award for Academic Excellence

London, UK

*Top of cohort at Imperial College, MSc Advanced Computing*

*2019-2020*

### Wright Prize

Cambridge, UK

*Top 1/3 of Class I at University of Cambridge, Mathematics Tripos*

*2015-2016, 2016-2017*

## **Other Prizes**

- Singapore Mathematics Olympiad:  
Open Category: Gold (2011-2014, rank 17/12/14 in 2012/13/14)  
Senior Category: Gold, rank 3 (2011)
- Singapore National Olympiad in Informatics: Gold, rank 1 (2011)

## **Skills and Qualifications**

### **Programming Languages**

- Proficient: Rocq(Coq), WebAssembly, C/C++, OCaml, Python
- Knowledgeable: JavaScript

### **Natural Languages**

- Native: Mandarin Chinese
- Proficient: English

### **Other Qualifications**

- GRE Mathematics: 970 (99th percentile)