# Di Wang

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## Bio

I am an Assistant Professor at Peking University's School of Computer Science and a member of the PL Lab there. My main interest is in programming languages, and formal verification, program analysis, and probabilistic programming in particular. My mission is to develop *universal and easy-to-use abstractions and paradigms* for programming safe and efficient software, and *programming-language-level integrations* to automatically analyze, optimize, and synthesize programs. Currently, I am working on resource-safe system programming, programmable Bayesian inference, quantitative program analysis, and proof-oriented programming languages.

## Education

**Carnegie Mellon University**                                           **Pittsburgh, PA, USA**
*Ph.D. in Computer Science*                                                   *Aug 2017 – May 2022*
Advisor: Prof. Jan Hoffmann
Thesis: *Static Analysis of Probabilistic Programs: An Algebraic Approach*

**Peking University**                                                             **Beijing, China**
*Bachelor of Science (with Honors) in Computer Science & Technology*           *Sep 2013 – Jun 2017*
Advisor: Prof. Yingfei Xiong
Thesis: *Accelerating Program Analyses by Conditional Summarization with Datalog*

## Research Experiences

**Facebook**                                                                 **Seattle, WA, USA**
*Research intern, supervised by Dr. Herman Venter*                             *May 2020 – Aug 2020*
Topics: Formal Verification of Rust Code, Side Channel Analysis of Blockchain Code

**Massachusetts Institute of Technology**                                    **Boston, MA, USA**
*Research intern, supervised by Prof. Adam Chlipala*                           *Sep 2016 – Jan 2017*
Topics: Type System for Complexity Analysis, Complexity Preserved Compiler

**University of Wisconsin–Madison**                                          **Madison, WI, USA**
*Research intern, supervised by Prof. Thomas Reps*                             *Jun 2016 – Aug 2016*
Topics: Probabilistic Reasoning about Side Channel Attacks, Expectation Invariant Analysis of Probabilistic Programs

**Peking University**                                                             **Beijing, China**
*Research assistant, supervised by Prof. Lu Zhang and Prof. Yingfei Xiong*      *Sep 2015 – Jun 2017*
Topics: Complete Library Summarization for Program Analyses, Pointer Analysis for Java

## Professional Activities

- **Program/Review Committee Member** – ASE'23, OOPSLA'24, PLDI'24
- **Artifact Evaluation Committee Member** – POPL'19, POPL'20, CAV'20
- **External Reviewer** – ICALP'18, LICS'19, LICS'20, LICS'21, LICS'22, ESOP'20, ESOP'21, ESOP'23, POPL'22, FoSSaCS'22, FoSSaCS'23, ICFP'23

# Publications

Refereed Conference Papers..................................................................................................

[1] Ankush Das, **Di Wang**, and Jan Hoffmann. Probabilistic Resource-Aware Session Types. In *50th Symposium on Principles of Programming Languages (POPL'23)*, 2023.

[2] **Di Wang**, Jan Hoffmann, and Thomas Reps. Sound Probabilistic Inference via Guide Types. In *42nd Conference on Programming Language Design and Implementation (PLDI'21)*, 2021.

[3] **Di Wang**, Jan Hoffmann, and Thomas Reps. Central Moment Analysis for Cost Accumulators in Probabilistic Programs. In *42nd Conference on Programming Language Design and Implementation (PLDI'21)*, 2021.

[4] **Di Wang**, David M. Kahn, and Jan Hoffmann. Raising Expectations: Automating Expected Cost Analysis with Types. In *International Conference on Functional Programming (ICFP'20)*, 2020.

[5] Tristan Knoth, **Di Wang**, Adam Reynolds, Jan Hoffmann, and Nadia Polikarpova. Liquid Resource Types. In *International Conference on Functional Programming (ICFP'20)*, 2020.

[6] Tristan Knoth, **Di Wang**, Nadia Polikarpova, and Jan Hoffmann. Resource-Guided Program Synthesis. In *40th Conference on Programming Language Design and Implementation (PLDI'19)*, 2019.

[7] **Di Wang**, Jan Hoffmann, and Thomas Reps. A Denotational Semantics for Low-Level Probabilistic Programs with Nondeterminism. In *Mathematical Foundations of Programming Semantics XXXV (MFPS'19)*, 2019.

[8] **Di Wang** and Jan Hoffmann. Type-Guided Worst-Case Input Generation. In *46th Symposium on Principles of Programming Languages (POPL'19)*, 2019.

[9] **Di Wang**, Jan Hoffmann, and Thomas Reps. PMAF: An Algebraic Framework for Static Analysis of Probabilistic Programs. In *39th Conference on Programming Language Design and Implementation (PLDI'18)*, 2018.

[10] Peng Wang, **Di Wang**, and Adam Chlipala. TiML: A Functional Language for Practical Complexity Analysis with Invariants. In *International Conference on Object-Oriented Programming, Systems, Languages, & Applications (OOPSLA'17)*, 2017.

[11] Hao Tang, **Di Wang**, Yingfei Xiong, Lingming Zhang, Xiaoyin Wang, and Lu Zhang. Conditional Dyck-CFL Reachability Analysis for Complete and Efficient Library Summarization. In *26th European Symposium on Programming (ESOP'17)*, 2017.

Other Publications..................................................................................................

[12] Hongjun Wu and **Di Wang**. Worst-Case Analysis is Maximum-A-Posteriori Estimation. Working paper, 2023.

[13] **Di Wang** and Thomas Reps. Newtonian Program Analysis of Probabilistic Programs. Working paper, 2023.

[14] **Di Wang**, Jan Hoffmann, and Thomas Reps. Expected-Cost Analysis for Probabilistic Programs and Semantics-Level Adaption of Optional Stopping Theorems. Working paper, 2021.

# Teaching and Mentoring Experience

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|---|---|
| ○ **Lecturer** – *Compiler Principles*, Peking University | 2023 |
| ○ **Lecturer** – *Design Principles of Programming Languages*, Peking University | 2023 |
| ○ **Guest Lecturer** – *Foundations of Quantitative Program Analysis*, Carnegie Mellon University | 2019 |
| ○ **Mentor** – Xuanyu Peng, *Rust resource analysis by functional translation* | 2023 |
| ○ **Mentor** – Vanshika Chowdhary, *Programmable Gibbs sampling with linear types* | 2021 |
| ○ **Mentor** – Mohamed Lotfi, *Synthesis of probabilistic programs that generate handwritten digits* | 2021 |

- o **Mentor** – Charles Yuan, *Exact Bayesian inference with distribution transformers*                    2019
- o **Teaching Assistant** – *Bug Catching: Automated Program Verification*, Carnegie Mellon University    2020
- o **Teaching Assistant** – *Programming Language Semantics*, Carnegie Mellon University    2019
- o **Teaching Assistant** – *Introduction to Computer Systems*, Peking University    2015

## Talks

### Conference Presentations
- o Sound Probabilistic Inference via Guide Types, *PLDI'21*.    Jun 2021
- o Central Moment Analysis for Cost Accumulators in Probabilistic Programs, *PLDI'21*.    Jun 2021
- o Raising Expectations: Automating Expected Cost Analysis with Types, *ICFP'20*.    Aug 2020
- o Liquid Resource Types, *ICFP'20*.    Aug 2020
- o A Denotational Semantics for Low-Level Probabilistic Programs with Nondeterminism, *MFPS'19*.    Jun 2019
- o Type-Guided Worst-Case Input Generation, *POPL'19*.    Jan 2019
- o PMAF: An Algebraic Framework for Static Analysis of Probabilistic Programs, *PLDI'18*.    Jun 2018

### Seminar Presentations
- o Algebraic Program Analysis of Probabilistic Programs, *CCF*, Formal Methods Seminar.    Jun 2023
- o Type-Driven Programming Language Design, *Compiler Competition*, Seminar.    Jun 2023
- o Resource-Safe System Programming Language, *PL Lab*, Seminar.    May 2023
- o Intuitionistic Logics and Programing Languages, *Peking University*, Logic Seminar.    Mar 2023
- o Quantitative Program Analysis and Verification, *ZTE*, Seminar.    Dec 2022
- o Semantics of Probabilistic Programs: An Algebraic Approach, *Tsinghua University*, Seminar.    Mar 2022
- o Type-Based Resource-Guided Search, *Imperial College London*, Functional Programming Seminar.    Nov 2021
- o Type-Based Resource-Guided Search, *Peking University*, Programming Language Seminar.    Oct 2020
- o Taint Analysis for Blockchain Code, *Facebook*, Novice Seminar.    Aug 2020
- o Automating Expected Cost Analysis with Types, *Facebook*, Novice Seminar.    Jun 2020

## Scholarships and Awards

- o China National Scholarship    2014, 2016
- o Huawei Scholarship    2015

- o Silver Medal (5$^{th}$ place) in the 39$^{th}$ Annual ACM-ICPC World Finals    2015
- o Gold Medal (1$^{st}$ place) in the 39$^{th}$ ACM-ICPC Asia Regionals Anshan site    2014
- o Gold Medal (9$^{th}$ place) in the 38$^{th}$ ACM-ICPC Asia Regionals Changchun site    2013