

JINGYUAN CHEN

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EDUCATION

Princeton University

2022 - 2027 (expected)

Master & PhD in Computer Science

Princeton, US

- Advisor: Amit Levy
- Research Interest: Program Analysis, Verification, Debugging, Agentic AI

University of North Carolina at Chapel Hill

2018 - 2022

Bachelor of Science in Computer Science, Bachelor of Science in Mathematics

Chapel Hill, US

- Graduated with highest honor, GPA: 3.99/4.0

RESEARCH EXPERIENCE

Princeton University

Princeton, NJ

Research Assistant (advised by Amit Levy)

Lightweight Provenance-Guided Automatic Online Debugging

Sep 2022 - Present

Built an *online* debugger that dynamically instruments tracepoints to record data-flow provenances for latent bugs in deployed distributed systems. Designed library-bypassed static analysis algorithms for identifying bug-relevant variables that overcame the *fundamental* precision-scalability trade-off of traditional approaches. Engineered a lightweight, synchronization-free tracing runtime for recording shared-state provenances utilizing the coarse-interleaving hypothesis. Evaluated the system on complex bugs in a realistic distributed system (HDFS) and demonstrated its capability to minimize diagnosis latencies while incurring *practical* runtime overheads ($\leq 10\%$ throughput reduction).

Quantitative Performance Verification of Resource Managers

Apr 2025 - Present

Proposed frameworks for expressing workload-dependent performance dynamics for resource management subsystems (e.g., schedulers, admission controllers) as probabilistic programs. Formulated quantitative performance reasoning for complex systems as probabilistic program verification problems. Proposed methods for automated verification via probabilistic invariant and martingale synthesis. Applied the methodology successfully to the verification of tail latency bounds of simple FCFS schedulers.

Semantic-Aware LLM Agents for Transpilation

Nov 2025 - Present

Proposed a methodology for enabling LLMs to summarize the semantics of complex system code using outputs from external tools, such as symbolic executors and dynamic analyzers. The approach then directs LLMs to perform semantic-aware reasoning steps to faithfully generate code in the transpilation target language. Currently evaluating the methodology in C2Rust transpilation of real-world low-level system code, with a focus on producing idiomatic and safe rust implementations.

Auditing Resource Interference-Freedom of Cloud Platforms

Nov 2024 - Present

Identified a new class of threat in cloud platforms where providers violate resource-isolation guarantees. Designed a mechanism to detect shared-resource side-channel interference using compiler-instrumented auditing operations. Currently developing a *program enhancer* that automatically injects lightweight auditing operations to make victim cloud workloads interference-awareness.

University of North Carolina at Chapel Hill

Chapel Hill, NC

Research Assistant (advised by James H. Anderson and F. Don Smith)

Making Powerful Enemies on NVIDIA GPUs

Aug 2021 - Aug 2022

Empirically evaluated the sensitivity of common GPU workloads to a wide range of interference channels in NVIDIA GPUs. Engineered “enemy” GPU kernels that maximize contention over hardware resources

for approximating the worst-case execution times of real-time GPU kernels. Evaluated the enemies against real-world kernels and showed the effectiveness of the enemies in maximizing resource contention.

PUBLICATIONS

- Lightweight Provenance-Guided Automatic Online Debugging** In submission
Quantitative Performance Verification of Schedulers With Probabilistic Programming SOSp '25 (Poster)
Jingyuan Chen, Amit Levy
- Lumos: Lightweight Provenance-Guided Online Debugging** OSDI '25 (Poster)
Jingyuan Chen, Lei Zhang, Gongqi Huang, Ravi Netravali, Amit Levy
- End-to-End Encrypted Applications with Strong Consistency Under Byzantine Actors** ACSAC '25
Natalie Popescu, Shai Caspin, Leon Schuermann, **Jingyuan Chen**, Amit Levy
- Incentivizing Side-Channel Freedom with Leakage-Aware Computation** WACI '25
Gongqi Huang, **Jingyuan Chen**, Amit Levy
- Making Powerful Enemies on NVIDIA GPUs** IEEE RTSS'22
Tyler Yandrofski, **Jingyuan Chen**, Nathan Otterness, James H. Anderson and F. Donelson Smith
- Minimizing DAG Utilization by Exploiting SMT** IEEE RTAS'22
Sims Hill Osborne, Joshua Bakita, **Jingyuan Chen**, Tyler Yandrofski, and James H. Anderson
- Simultaneous Multithreading in Mixed-Criticality Real-Time Systems** IEEE RTAS'21
Joshua Bakita, Shareef Ahmed, Sims Hill Osborne, Stephen Tang, **Jingyuan Chen**, F. Donelson Smith, and James H. Anderson

TECHNICAL SKILLS

Programming Languages | Proficient: Java, C, Python, Go, Javascript, Datalog; Prior Experience: C++, Rust, Haskell, CLisp, Ocaml, Prolog
Tools | Proficient: Linux, bash, Git, Vim, Spring, Docker, Distributed Tracing (Jaeger, OpenTelemetry), Soot, Doop, Tensorflow, PyTorch, CUDA; Prior Experience: Coq, Dafny