

Fangke Ye

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Education

Georgia Institute of Technology

Ph.D. Candidate in Computer Science

Advisor: Vivek Sarkar

GPA: 4.0/4.0

Atlanta, GA, USA

Aug. 2017 - Present

The University of Texas at Austin

Exchange Student at the Department of Computer Science

GPA: 4.0/4.0

Austin, TX, USA

Aug. 2015 - Dec. 2015

Tsinghua University

B.Eng. in Computer Science and Technology

GPA: 92/100, Ranking: 5/127

Beijing, China

Aug. 2013 - July 2017

Experience

Georgia Institute of Technology

Graduate Research Assistant, Advisor: Vivek Sarkar

Atlanta, GA, USA

Aug. 2017 - Present

- Developed a concrete type inference approach to enable ahead-of-time compiler optimizations for a subset of Python using a combination of machine learning (e.g., large language models) with SMT solving. Published at *OOPSLA 2023*.
- Designed a deep reinforcement learning based type inference system for Python with type-correctness guarantees. The system consists of a pre-trained type inference model, a static type checker, and a type slot selection agent. To train the agent, a distributed reinforcement learning framework was built using PyTorch and Ray.
- Created a graph-based deep learning type inference model for JavaScript/TypeScript. Introduced a type flow graph representation and corresponding graph neural networks.
- Proposed a debugging approach based on partial program symbolic execution to identify usage anomalies in MPI APIs. Implemented the method by modifying the KLEE symbolic execution engine, allowing execution to start from any function and modeling MPI APIs. Published at *SC 2018* and presented at *KLEE Workshop 2021*.

Google

Research Intern, Hosts: Milad Hashemi and Eric Zhang

Sunnyvale, CA, USA

May 2022 - Jan. 2023

- Developed a model to generate structured program test inputs for inducing diverse performance behaviors. The model was based on neural modular networks, trained using reinforcement learning, and implemented in JAX.

Intel Labs

Research Intern, Host: Justin Gottschlich

Santa Clara, CA, USA

May - Aug. 2019, May 2020 - May 2021

- Developed MISIM, a neural code semantic similarity system using a context-aware semantics structure and deep metric learning network architectures based on recurrent neural networks, graph neural networks, and Transformers, implemented using PyTorch.

Lawrence Livermore National Laboratory

Livermore, CA, USA

Research Intern, Host: Markus Schordan

May 2018 - Aug. 2018

- Developed a polyhedral analysis based approach to verify OpenMP parallel affine loop nests are data race free using the ROSE compiler infrastructure. Published at *Correctness 2018*.

Tsinghua University

Beijing, China

Undergraduate Research Assistant, Advisor: Jidong Zhai

Sept. 2014 - June 2017

- Enhanced an MPI communication trace lossless compression method with online intra-process pattern detection and multi-threaded offline inter-process compression.
- Developed an approach to identify scalability bottlenecks in MPI programs by utilizing Clang/LLVM for control structure extraction and static instrumentation for performance data collection.

Tsinghua Student Cluster Competition Team

Beijing, China

Team Member

2016 - 2017

- Designed and trained deep neural networks for CAPTCHA recognition using TensorFlow.
- Optimized FALCON, a genome assembler, to achieve up to $6\times$ speedup by eliminating redundant computation and improving data layout in memory.
- Designed and trained deep neural networks for traffic prediction using the PaddlePaddle deep learning platform.
- Parallelized Graph500's validation phase using OpenMP.

Publications

Concrete Type Inference for Code Optimization Using Machine Learning with SMT Solving

Fangke Ye, Jisheng Zhao, Jun Shirako, Vivek Sarkar

SPLASH/OOPSLA 2023

[[paper](#) | [code](#)]

Detecting MPI Usage Anomalies via Partial Program Symbolic Execution

Fangke Ye, Jisheng Zhao, Vivek Sarkar

International Conference for High Performance Computing, Networking, Storage, and Analysis (SC 2018)

[[paper](#) | [code](#) | [slides](#)]

Using Polyhedral Analysis to Verify OpenMP Applications Are Data Race Free

Fangke Ye, Markus Schordan, Chunhua Liao, Pei-Hung Lin, Ian Karlin, Vivek Sarkar

International Workshop on Software Correctness for HPC Applications (Correctness 2018)

[[paper](#) | [slides](#)]

Preprints

MISIM: A Neural Code Semantics Similarity System Using the Context-Aware Semantics Structure

Fangke Ye*, Shengtian Zhou*, Anand Venkat, Ryan Marcus, Nesime Tatbul, Jesmin Jahan Tithi, Niranjan Hasabnis, Paul Petersen, Timothy Mattson, Tim Kraska, Pradeep Dubey, Vivek Sarkar, Justin Gottschlich (* equal contribution)

[[arXiv](#) | [code](#)]

Advanced Graph-Based Deep Learning for Probabilistic Type Inference

Fangke Ye, Jisheng Zhao, Vivek Sarkar

[[arXiv](#)]

Patents

Methods and Apparatus to Determine Refined Context for Software Bug Detection and Correction

Shengtian Zhou, Justin Gottschlich, [Fangke Ye](#), Celine Lee

Patent No. [US 11,782,813 B2](#)

Methods and Apparatus for Automatic Detection of Software Bugs

[Fangke Ye](#), Justin Gottschlich, Shengtian Zhou, Roshni Iyer, Jesmin Jahan Tithi

US Patent Application No. [17/133,238](#) (Pending)

Methods and Apparatus to Construct Program-Derived Semantic Graphs

Shengtian Zhou, Fangke Ye, Roshni G Iyer, Jesmin Jahan Tithi, Justin Gottschlich

US Patent Application No. [17/133,168](#) (Pending)

Teaching

Graduate Teaching Assistant

Spring 2023

CS 6245: Parallelizing Compilers, Georgia Institute of Technology

Graduate Teaching Assistant

Spring 2019

CS 4240: Compilers & Interpreters, Georgia Institute of Technology

Honors & Awards

First Place in the 6th ISC-HPCAC Student Cluster Competition

2017

Participated as the leader of the Tsinghua Student Cluster Competition Team.

Champion in ASC Student Supercomputer Challenge 2017

2017

Participated as the leader of the Tsinghua Student Cluster Competition Team.

Second Place in the 5th ISC-HPCAC Student Cluster Competition

2016

Participated as a member of the Tsinghua Student Cluster Competition Team.

First Prize in the “Challenge Cup” Tsinghua University Student Science and Technology Works Competition, Tsinghua University

2015

Scholarship of Academic Excellence, Tsinghua University

2014, 2015

First Prize in the National College Student Physics Contest, China

2014

Skills

Programming Languages C/C++, Rust, Java, Python, JavaScript, TypeScript

Parallel Programming MPI, OpenMP, Ray

Program Analysis LLVM, KLEE, ROSE, WALA

Deep Learning PyTorch, TensorFlow, JAX