JIAWEI LIU

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RESEARCH INTEREST

I am generally interested topics related to *correctness*, *programmability* and *performance* in computer systems, esp. deep-learning (DL) systems. My recent research thread (i.e., Ph.D.) is DL compiler validation & debugging.

EDUCATION

University of Illinois at Urbana-Champaign, IL, US — Aug. 2021 - Present
Ph.D. in Computer Science; GPA: 4.0/4.0 — Advisor: Lingming Zhang

Tongji University, Shanghai, China — Sept. 2017 - Jul. 2021
B.Eng. in Computer Science

PAPERS

[1] [**ASPLOS'23**] NNSmith: Generating Diverse and Valid Test Cases for Deep Learning Compilers
Jiawei Liu[*], Jinkun Lin[*], Fabian Ruffy, Cheng Tan, Jinyang Li, Aurojit Panda, Lingming Zhang.
code • artifact • pre-print

[2] [**OOPSLA'22**] Coverage-Guided Tensor Compiler Fuzzing with Joint IR-Pass Mutation
Jiawei Liu, Yuxiang Wei, Sen Yang, Yinlin Deng, Lingming Zhang.
code • artifact • paper

[3] [**ACMMM'21 OSC**] Fast and Flexible Human Pose Estimation with HyperPose
Yixiao Guo[*], **Jiawei Liu**[*], Guo Li[*], Luo Mai, Hao Dong.
code • paper

[†] *New work under submission.* [*] *Joint first authors.*

PROFESSIONAL EXPERIENCES

Intern at OctoML — May. - Aug. 2022
Advised by: Yuchen Jin, Sunghyun Park, Tianqi Chen — *Dataflow Pattern Language*
Designed and implemented a declarative pattern language for simplifying graph optimizations in TVM's Relax IR (PRs: A, B).

Research Assistant at UIUC — Apr. 2021 - Present
Advised by: Lingming Zhang — *Fuzzing*
Doing research in applying PL and formal methods to synthesize Deep-Learning programs for fuzzing and beyond [1] and [2].

Intern at DAMO Academy, Alibaba Cloud — Mar. - Aug. 2021
Advised by: Yuanwei Fang, Yuan Xie (Univ. of California at Santa Barbara) — *GNN Serving*
Implemented multi-core graph sampling algorithms in C++ for GNN pre-processing, improving prior implementation by over 20×.

Research Assistant at NYU Systems Group — Jul. 2020 - Mar. 2021
Advised by: Jinyang Li — *Video Analytics*
Designed a programming model, *Compare-And-Skip*, for doing video analytic with programmable accuracy-efficiency trade-off.

Research Assistant at Peking University — Jan. - Aug. 2020
Advised by: Hao Dong, Luo Mai (Univ. of Edinburgh) — *Fast Pose Estimation*
Implemented a CPU-GPU scheduler for pose estimation and post-processing algorithms, with up-to 7.3× speedup over SOTA [3].

Intern at ByteDance AI Lab — Feb. - Jul. 2020
Advised by: Guanzhe Huang, Chuanxiong Guo — *DNN Model Serving*
Developed a model server with dynamic batching and a monitoring sub-system for debugging health/performance of model services.

NOTABLE ACHIEVEMENTS

Qidi Innovation Scholarship of Tongji University (Top *1%*) — 2020
Selected Entrant for 2020 Google Machine Learning Winter Camp — 2019
Winner of International Data Science Hackathon (Chinese Region), Covestro [news] — 2019
National *2nd* Prize and Province-level *1st* Prize in RoboMaster, DJI Inc. — 2019
National *2nd* Prize (0.75~3.84%) and Province-level *1st* Prize of Chinese Modeling Contest — 2018

OPEN-SOURCE CONTRIBUTIONS

I embrace and grow with the ♥open-source community.

Recently, I lead the NNSmith project, a random DNN synthesizer for testing Deep-Learning (DL) systems. I also have been actively contributed to TVM for bug fixes and the dataflow pattern language of *Relax* IR to simplify graph optimization. Previously, I developed HyperPose (**1200+ stars**) for efficient computer vision.

My research facilitates the correctness of DL systems. Since 2021, we found over 150 new bugs for TVM, PyTorch, TensorFlow, TensorRT, and ONNXRuntime. My work have impacted the testing tooling of real-world systems including nvFuser, TensorRT (privately acknowledged by NVIDIA developers) and TVM Relay.

PROFESSIONAL SERVICES

Reviewer:	AAAI'23@DCAA
Artifact Evaluation Committee:	PLDI'23, OSDI'22, ATC'22.
Co-Reviewer:	ICSE'23, FSE'22, ASE'22.

TALKS

Finding Deep-Learning Compilation Bugs with NNSmith

- Software Engineering Retreat, University of Illinois at Urbana-Champaign — Sept. 2022

Coverage-Guided Tensor Compiler Fuzzing with Joint IR-Pass Mutation

- SPLASH/OOPSLA Conference Talk — Nov 2022
- SAMPL Lunch Talks, University of Washington — May 2022
- Software Engineering Seminar, University of Illinois at Urbana-Champaign — Apr. 2022

MENTORING

Yuxiang Wei (Summer 2021)	Tongji Univ. ↦ UIUC Ph.D. Program
Sen Yang (Summer 2021)	Fudan Univ. ↦ Yale Ph.D. Program

SKILL STACK

My general skill set covers program optimization/analysis, fuzzing, visualization and deep learning. Oftentimes, I code with modern C++ for efficiency with a Python front-end for interoperability.

General: C++, Python, LLVM, Rust, Docker, Git, Grafana, GDB, etc.

Machine Learning & Systems: PyTorch, TensorRT, TensorFlow, TVM, ONNX, Pybind11, etc.

Correctness: Z3, libFuzzer, Sanitizers, Dafny, Spin, etc.

Parallel: C++ Thread Library, CUDA, gRPC, etc.