Siyuan Chen

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EDUCATION

PEKING UNIVERSITY Beijing, China 09/2019–present

School of Electronic Engineering and Computer Science

- Major in Computer Science (Turning Class), Overall GPA: **3.82/** 4.0 (Ranking **7**/200);
- Programming & Framework: Expert in C++, Python; TVM, Dynet, CUDA, MPI, OpenMP
- Research Interest: Machine Learning System, Compiler Optimizations
- English Proficiency: TOEFL 109 (Speaking 23), GRE Verbal 160**,** Quantitative 169, Writing 3.0

Awards and Honors

1st Prize in ASC22, 2022
Jiukun Scholarship (Academic Excellence Scholarship), 2021
Shenzhen Stock Exchange Scholarship (Academic Excellence Scholarship), 2020
Merit Student, Peking University, twice
1st Prize in Chinese University Mathematical Competition, 2021

PUBLICATION

Size Zheng*, **Siyuan Chen***, Pedi Song, Renze Chen, Xiuhong Li, Shengen Yan, Dahua Lin, Jingwen Leng, Yun Liang. "Chimera: An Analytical Optimizing Framework for Effective Compute-intensive Operators Fusion"*, in Proceedings of the 29th international symposium on High Performance Computer Architecture (HPCA-29), February 2023. (*Equal Contribution)*

PREPRINT

Siyuan Chen, Pratik Fegade, Tianqi Chen, Phillip B. Gibbons, Todd C. Mowry. "ED-Batch: Efficient Automatic Batching of Dynamic Deep Neural Networks via Finite State Machine". arXiv preprint.

RESEARCH

Mapping Heterogeneous Neural Networks onto Heterogeneous SoC 10/2022-11/2022

Cooperated Research, Supervised by Prof. Yun (Eric) Liang, Depart. of EECS, Peking University

- Observed current mapping framework does not consider the time sharing within one accelerator and treats communication between accelerators of SoC equally.
- Proposed a mapping framework to map heterogeneous neural network onto heterogeneous SoC that considers both DNN operators' time sharing, resource sharing, and SoC's heterogeneity in computation and communication.
- Designed and implemented a genetic algorithm to explore the combinational search space.
- Achieved 30% speedup and 25% reduction in energy consumption compared to state-of-the-art mappers.
- Submitted to DAC'23.

Efficient Automatic Batching of Dynamic Neural Networks via Learned Finite State Machines and batching-aware memory planning 07/2022-1/2023

Individual Research, Supervised by Prof. Phillip B. Gibbons, Todd C. Mowry and Tianqi Chen, Depart. of EECS, CMU

- Observed current techniques to exploit batched parallelism for dynamic neural networks is suboptimal.
- Proposed a reinforcement learning based dynamic batching algorithm to minimize kernel launches and memory transfer.
- Proposed a memory allocation algorithm based on PQ-Tree to alleviate the memory transfer overhead.
- Achieved 1.15x, 1.39x, 2.45x end2end speedup for chain-based, tree-based, and lattice-based DNNs across CPU/GPU compared to SOTA frameworks.
- Submitted to ICML' 23 as the first author.

Analytical Model on Kernel Fusion for Compute-intensive Operators on CPU and GPU 10/2021-6/2022

Cooperated Research, Supervised by Prof. Yun (Eric) Liang, Depart. of EECS, Peking University

- Observed that compute-intensive operators chains (GEMM, CONV chains) become memory intensive in DNN workloads due to the gap between computing performance and memory bandwidth.
- Applied kernel fusion, loop tiling, loop reorder to improve the memory locality for compute-intensive operators chains.
- Formulate an analytical model to select best cache-level for kernel fusion, tile-sizes and loop permutation.
- Designed and implemented low complexity solver to solve for the best loop transformation configuration with minimized data movement volume under the memory capacity constraint.
- Implemented an end2end auto-scheduler and solver and achieve 1.5~2x speedup on CPU and GPU compared to vendor libraries and state-of-the-art tensor compilers.
- Accepted to HPCA' 23 as the co-first author with a PhD student.

SELECTED COURSE PROJECT

Optimization of Gauss Seidel algorithm on GPU | HPC

- Coded in CUDA to accelerate the 3D stencil operator.
- Customized with GPU optimization techniques like kernel fusion and avoiding warp divergence.
- Achieved 40x speedup (36s to 0.9s)

ClaviCode | Online IDE

- An online website served as a replacement for offline IDE like VScode.
- Led the team through the design, develop, and testing of the website.
- Assisted computer courses at PKU.

C to RISC-V Compiler | Compiler

- Design and implement a end2end compiler from subset of C to RISC-V.