Yen-Hsiang Chang

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Research Interests

Parallel Programming and Algorithms

My research interests lie in the general area of high-performance computing, particularly in parallel programming and algorithms, with the focus on mitigating load imbalance in parallel applications and designing memory-efficient parallel algorithms.

Education

University of Illinois at Urbana-Champaign (UIUC) *Aug. 2018 - May. 2022*

Bachelor of Science in Grainger Engineering

- Major: Computer Engineering, Minor: Mathematics
- Cumulative GPA: 3.99/4.00, Major GPA: 4.00/4.00, Minor GPA: 4.00/4.00
- Graduated with Highest Honors, on completion of an undergraduate thesis of superior quality

Research Experiences

Undergraduate Researcher, instructed by Prof. Wen-mei Hwu, Prof. Rakesh Nagi & Prof. Jinjun Xiong *May. 2021 - Now*

Coordinated Science Laboratory, UIUC

- Researched on graph mining and implemented local k-clique counting kernels on GPUs.
- Researched on maximal clique enumeration, with the focus on implementing variants of Bron-Kerbosch algorithm on GPUs.
- Designed efficient parallel maximal clique enumeration kernels for multi-GPUs, with the characteristics of mitigating load imbalance using a worker list and reducing memory footprint by splitting complicated sets into monotonic sets that can be stored using compact representations.
- Submitted the paper **"Parallelizing Maximal Clique Enumeration on GPUs"** to **PPoPP'23**. Accepted as poster but withdrew due to time conflicts.
- Researched on generalizing the worker list technique to mitigate load imbalance on GPUs for other domains.

Undergraduate Researcher, instructed by Prof. Wen-mei Hwu & Prof. Jinjun Xiong *Jun. 2019 - May. 2022*

IBM-Illinois Center for Cognitive Computing Systems Research (C3SR)

- Researched on MLModelScope, an HW/SW agnostic, extensible, and customizable platform for evaluating and profiling ML models across datasets/frameworks/hardware, and within AI application pipelines.
- Developed MLModelScope Agents in different frameworks, primarily in PyTorch and ONNX Runtime.
- Published the paper **"MLHarness: A Scalable Benchmarking System for MLCommons"** in **BENCH'21**

Publications

Parallelizing Maximal Clique Enumeration on GPUs | Link

Mohammad Almasri*, Yen-Hsiang Chang*, Izzat El Hajj, Rakesh Nagi, Jinjun Xiong, and Wen-mei Hwu *Dec. 2022*

(*Equal contribution)

Preprint on arXiv (Accepted as poster in PPoPP'23 but withdrew due to time conflicts) *Preprint*

- Parallelized the Bron-Kerbosch algorithm for single-GPU and multi-GPUs, with a geometric mean speedup of 4.9× (up to 16.7×) on single GPU and scaled efficiently to multiple GPUs.
- Proposed to parallelize maximal clique enumeration on GPUs by performing depth-first traversal of independent sub-trees in parallel, instead of performing breadth-first traversal to avoid explosion in the number of tree nodes at deep levels.
- Proposed a worker list for dynamic load balancing, as well as partial induced subgraphs and a compact representation of excluded vertex sets to regulate memory consumption.

MLHarness: A Scalable Benchmarking System for MLCommons | Link

Yen-Hsiang Chang, Jianhao Pu, Wen-mei Hwu, and Jinjun Xiong *Nov. 2021*

Published in 2021 BenchCouncil International Symposium on Benchmarking, Measuring and Optimizing (Bench'21) *Virtual*

- Proposed MLHarness, a scalable benchmarking harness system for MLCommons.
- MLHarness codifies the standard benchmark process as defined by MLCommons including models, datasets, DL frameworks, and software and hardware systems.
- MLHarness provides an easy and declarative approach for model developers to contribute their models and datasets to MLCommons.
- MLHarness includes the support of a wide range of models with varying inputs/outputs modalities so that it can scalably benchmark these models across different datasets, frameworks, and hardware systems.

Honors & Awards

International

2022 **17th Place**, 2022 Google Hash Code World Finals
2021 **Bronze Medalist**, 44th Annual World Finals of the International Collegiate Programming Contest
2021 **163rd Place**, 2021 Google Code Jam Round 3
2020 **6th Place**, Microsoft Q# Coding Contest – Summer 2020
2020 **Round 4 Qualifier (top 110)**, 2020 Topcoder Open Algorithm Competition
2020 **132nd Place**, 2020 Google Code Jam Round 3
2019 **112th Place**, 2019 Google Code Jam Round 3

Domestic

2021 **ECE Alumni Association Scholarship**, Outstanding scholastic record in ECE Department, UIUC
2020 **Robert M. Janowiak Scholarship**, Outstanding scholastic record in ECE Department, UIUC
2020 **4th place**, 2020 UIUC & Michigan Correlation One's Terminal Live
2020 **10th place**, 2020 ICPC North America Championship
2020 **Midwest Champion**, 2020 ICPC North America Championship
2020 **2nd place**, 2020 ICPC North America Championship Cyber Challenge
2019 **1st place**, 2019 ICPC Mid-Central USA Programming Contest
2018-22 **Dean's List**, Grainger College of Engineering, UIUC

Selected Projects

Improvements to the Hungarian LAP Solver on GPU *Aug. 2021 - Dec. 2021*

for ECE508 (Manycore Parallel Algorithms)

- Compared two state-of-the-art GPU-accelerated Hungarian LAP solvers of classical and alternating tree variants of the algorithm.
- Optimized CUDA kernels based on the bottlenecks found from profiling tools, including NVIDIA Nsight Systems.

GPU Convolution Kernel Optimizations *Aug. 2020 - Dec. 2020*

for ECE408 (Applied Parallel Programming)

- Designed and developed an optimized neural-network convolutional layer with tensor cores.
- Analyzed and fine-tuned CUDA kernels through the use of profiling tools, including NVIDIA Nsight Compute.

Relevant Courses

Computer Science Algorithms & Models of Computation, Machine Learning, Data Science, Data Structures
Computer Engineering Manycore Parallel Algorithms, Applied Parallel Programming, Computer Systems Engineering
Mathematics Graph Theory, Combinatorics, Linear Programming, Optimization, Statistics and Probability

Skills

Languages C/C++, Python, Go
Libraries/Tools CUDA, OpenMP, MPI
Other Git, Docker, LaTeX

Leadership

Illinois Programming League at UIUC *Jan. 2019 - Aug. 2021*

Captain and Cochair

- Holding weekly training contests for competitive programming competitions.