

# 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. Rakesh Nagi, Prof. Wen-mei Hwu & 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

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

(\*Equal contribution)

PREPRINT ON ARXIV (ACCEPTED AS POSTER IN PPOPP'23 BUT WITHDREW DUE TO TIME CONFLICTS)

- 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](#)

Nov. 2021

Yen-Hsiang Chang, Jianhao Pu, Wen-mei Hwu, and Jinjun Xiong

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

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### 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

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### 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

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

## Skills

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<b>Languages</b>	C/C++, Python, Go
<b>Libraries/Tools</b>	CUDA, OpenMP, MPI
<b>Other</b>	Git, Docker, $\text{\LaTeX}$

## Leadership

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### Illinois Programming League at UIUC

*Jan. 2019 - Aug. 2021*

CAPTAIN AND COCHAIR

- Holding weekly training contests for competitive programming competitions.