

# Yen-Hsiang Chang

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## Research Interests

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### 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

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### University of California at Berkeley

DOCTOR OF PHILOSOPHY

- Major: Computer Science

Aug. 2023 - Now

Berkeley, California

### University of Illinois at Urbana-Champaign (UIUC)

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

Aug. 2018 - May. 2022

Champaign, Illinois

## Research Experiences

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### Undergraduate Researcher, instructed by Prof. Wen-mei Hwu, Prof. Rakesh Nagi & Prof. Jinjun Xiong

May. 2021 - May. 2022

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.
- Researched on generalizing the worker list technique to mitigate load imbalance on GPUs for other domains.
- Published the paper "Parallelizing Maximal Clique Enumeration on GPUs" in PACT'23

### 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

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### Parallelizing Maximal Clique Enumeration on GPUs | [Link](#) | [Code](#)

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

Oct. 2023

(\*Equal contribution)

PUBLISHED IN 32ND INTERNATIONAL CONFERENCE ON PARALLEL ARCHITECTURES AND COMPILATION TECHNIQUES (PACT'23)

Vienna, Austria

- Parallelized the Bron-Kerbosch algorithm for single-GPU and multi-GPUs, with a geometric mean speedup of 4.9x (up to 16.7x) 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](#) | [Code](#)

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) AT UIUC

- 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) AT UIUC

- 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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**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

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**Languages** C/C++, Python, Go

**Libraries/Tools** CUDA, OpenMP, MPI

**Other** Git, Docker,  $\LaTeX$

## 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.