Yi-Hua Chung

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EDUCATION

Ph.D. Engineering in Electrical and Computer Engineering, University of Wisconsin-Madison Sep 2023 – Present
GPA: 4.00/4.00 (Fall 23)
Courses: High Performance Computing and Computer-Aided Design for VLSI

Master of Science in Computer Science, Feb 2021 – Aug 2022
Graduate Institute of Networking and Multimedia, National Taiwan University
GPA: 4.25/4.30, Rank: 1/47

Bachelor of Science in Engineering, Biomechatronics Engineering, National Taiwan University Sep 2016 – Jan 2021

PROFESSIONAL EXPERIENCE

Graduate Research Assistant, supervised by Prof. Tsung-Wei Huang, University of Wisconsin-Madison
- Researched GPU-accelerated testing and verification algorithms, especially on fault simulation.
- Accelerated VLSI routing algorithm utilizing GPU that speeds up the state-of-the-art from 2x to 11x.
- Researched parallel and heterogeneous gate-sizing algorithms in timing-driven optimization.

Full-time Research Assistant, supervised by Prof. Bo-Yin Yang, Institute of Information Science, Academia Sinica
- Accelerated big-integer multiplication by adopting the Fast NTT algorithm with warp primitive and inline PTX on GPU.
- Implemented lattice-based cryptosystems, including NTRU and NTRU Prime, on Cortex-A72 and accelerated the program by adopting fast NTT, Toom-Cook algorithm, and Schönhage-Strassen algorithm under the ARMv8-A architecture.

Research Assistant, supervised by Prof. Shih-Hao Hung,
Performance, Applications, and Security Lab, National Taiwan University
- Researched quantum-related topics, including quantum annealing, quantum simulation, and quantum machine learning.
- Led a study group and assisted labmates on large-scale simulated quantum annealing (SQA) on multi-GPU.

Teaching Assistant, Computer Architecture, National Taiwan University
- Designed laboratories for students to implement simple ALU, FPU, CPU (Verilog), and pipelined CPU (RISC-V).
- Mentored 130+ students in class and introduced quantum simulation on a traditional computer architecture.

PUBLICATIONS

Master Thesis
- **Enlarging Quantum Circuit Simulation and Analysis with Non-Volatile Memories**
  - Built a large-scale, cost-effective, high-performance SSD-based **quantum circuit simulator** that utilizes the large capacity offered by non-volatile memory and optimized schemes for contiguous data access and reuse.
  - Designed and implemented a novel **quantum circuit compilation method** to aggregate gates in a quantum circuit and improved the efficiency of the SSD-based simulator by **1.97x** faster than QuEST, a state-of-the-art DRAM-based simulator.
  - **Received the 2022 Future Tech Awards** selected by the Ministry of Science and Technology (MOST) of Taiwan.

Conference and Journal
- **Algorithmic Views of Vectorized Polynomial Multipliers – NTRU (Long Paper Version)**
  - Published in **Indocrypt 2023**. Second author, under the supervision of Prof. Bo-Yin Yang.
  - Explored the design space of vector-optimized polynomial multiplications in NTRU and NTRU Prime.
  - Achieved **7.67x**, **2.48x**, and **1.77x** faster key generation, encapsulation, and decapsulation in *ntruhps2048677*.
  - Achieved **3.00x**, **2.87x**, and **3.25x** faster key generation, encapsulation, and decapsulation in *ntrulpr761*.
  - See repository for implementations.
- **Accelerating Simulated Quantum Annealing with GPU and Tensor Cores**
  - Published in **ISC High Performance 2022**. **First author**, under the supervision of Prof. Shih-Hao Hung.
  - Proposed the "Hierarchical Update " strategy to implement simulated quantum annealing algorithm more parallelly.
  - Accelerated the simulated quantum annealing algorithm by **86.60x** with optimized utilization of GPU and Tensor Cores.
  - Achieved **98.97%** accuracy rate on solving the MAX-CUT benchmark dataset from Stanford University.
  - **2022 NTUEE-1975 Innovation and Entrepreneurship Award.**
- **Development of a Small Intelligent Weather Station for Agricultural Applications**
  - Published in **Advances in Technology Innovation 2021**. **First author**, under the supervision of Prof. Chen-Kang Huang.
  - Constructed a weather box equipped with functions of rainfall prediction, frosting forecast, and lightning detection with wireless connection and built-in decision mode to deliver an early-warning message to users to avoid a decrease in profit.
  - **Best Paper Award** in the 9th international multi-conference on Engineering and Technology Innovation, 2020.

PROJECTS AND AWARDS

Variational Neural Annealing - Recurrent Neural Network Wave Functions
- Reproduced previous works from Waterloo University on solving 1D and 2D Ising problems with 1D and 2D RNN models.
- Compared performance and solution quality between variational neural annealing with classical SQA (Repo , Report).

2D Pattern Matching for DNA sequences, NTU-IBM Q System Q-Camp, 2020.
- Applied 1D and 2D quantum pattern matching algorithms from Politecnico di Torino on genomic sequencing problems.
- Received **Outstanding Performance Award** in a hackathon organized by IBM and National Taiwan University (Repo1 , 2).

2022 Quantum Computing Mentorship Program (QOSF) Cohort-5
- Designed and constructed oracle and diffuse functions of Grover's algorithm for solving quantum tic-tac-toe problems (Repo).

SKILLS

C/C++, CUDA C/C++, OpenMP, ARM Intrinsic, ARM Assembly, Linux, Shell
Expert

Python, C#, Qiskit, JavaScript, WebGL
Experienced