Cheng-Yu (Mike) Tsai

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Education

National Taiwan University _Taipei, Taiwan_

Master of Science in Computer Science and Information Engineering _Feb. 2019 - Jun. 2021_

- Advisor: Chia-Lin Yang, Ph.D.
- Thesis: A Performance Analytical Model for DNN Training with Focus on Memory Subsystem
- Key words: Deep Neural Network, training, bandwidth, cache capacity, analytical model, data reuse

National Taiwan University _Taipei, Taiwan_

Double degree of B.S.E in Electrical Engineering & B.S. in Computer Science and Information Engineering _Sep. 2014 - Jan. 2019_

- GPA: 3.96/4.3 (3.84/4.0)
- Rank: 49/190 (26%)
- Awarded Presidential Award (semester GPA within top 5%) twice

Research Interests

Primary Computer architecture, Soft/Hardware co-design, Software performance analysis and improvement
Secondary Quantum Computing, Scientific Computing, Distributed Computing, Silicon Photonics, Emerging Memory

Research Projects

A Performance Analytical Model for DNN Training with Focus on Memory Subsystem _MS Thesis_

Exploring the tradeoffs between cache capacity and memory bandwidth in DNN workloads _Feb '19 - Jun '21_

- The first work to consider inter-layer data reuse in DNN workloads for 100+ MB cache (AMD has products with this scale already).
- Devised a novel software-controlled cache analytical scheme to approximate an optimal hardware design so that the architecture problem can be decoupled from low-level design issues.
- Analyzed tradeoffs between cache capacity and bandwidth in ResNet, MobileNet, GNMT, and Transformer and drew some insights from the experiment results.

Standard Cell Delay Calculator _Internal Project at TSMC_

An in-house model to quickly estimate the propagation delay of a standard cell _Jun '22 - Jul '23_

- More than 10x faster than SPICE transient simulation, 100x faster than bi-section setup time simulation, while maintaining more than 0.9 of correlation coefficient with SPICE.
- Integrated graph theory, transient pre-characterization, layout dependent effect (LDE) estimation, asymptotic waveform evaluation, etc., into a single program to estimate propagation delay from a detailed standard parasitic format (DSPF) file.
- Leveraged parallel programming, scientific computing, inter-process communication and binding between C++ and Python, and various techniques to assure swift efficiency and ease of use.
- Inquired into influential factors while striking a balance between the model's simplicity and accuracy.

Working Experience

Taiwan Semiconductor Manufacturing Company (TSMC) _Hsinchu, Taiwan_

Engineer, Custom Design Flow Development Department, Design Technology Platform (DTP), R&D _Jul. 2021 - present_

- Built a **delay calculator**, which takes DSPF as input and calculates the propagation delay of standard cells and setup time or clock to Q of combinational cells. This in-house method is more than 10x faster for delay or 100x faster for setup time than conventional spice simulation without commercial licenses while maintaining more than 0.9 of the ranking correlation coefficient.
- Built a **fully automated flow** for the quality checking of silicon photonics process design kit (PDK). With the help of my programming expertise and computer system knowledge, the speed of the whole process is 10x faster than a record-and-replay method using GUI.
- Designed and maintained an **Automatic Quality Checking (QC) system** that runs specified scripts and generates an easy-to-read HTML report. This system provides assurance to developers and managers that the latest code can function as expected without them having to run their own tests.
- Wrote miscellaneous parsers including spice, verilog, lef, etc., and am acquainted with regular expression.

National Taiwan University
Part-time worker, Division of Network Management, Computer & Information Networking Center

Taipei, Taiwan

Apr. 2018 - Jan. 2021

- Built and maintained **VisQWL**: a Visualization framework for monitoring the Quality of campus-wide WireLess service. The heat map can easily pinpoint the hot spot of Wi-Fi usage, guide the system administrators about resource arrangement, and provide a tool to deal with user complaints.
- Skills: SNMP, Kibana, Elasticsearch, data visualization, wireless network, map data processing
- The work is published in a regional conference TANet30, and is online serving at https://ccnet.ntu.edu.tw/wireless/ (Chinese only)

Teaching Experience

Computer Architecture
Three-credit mandatory course for third-year undergraduate students

National Taiwan University

Fall '19 and Fall '20

- Offering a Verilog training lecture for students to be capable of working on their projects
- Introducing Verilog projects, clarifying students' confusion throughout the process, and grading their projects upon submission
- Drafting midterm and final exams and grading them
- Offering office hours for students to ask questions
- Setting up presentation and video recording devices for the lecturer

Honors & Awards

2022	**DTP Outstanding Procedure Innovation Award**, TSMC	*Hsinchu, Taiwan*
2016	**Presidential Award**, National Taiwan University	*Taipei, Taiwan*
2015	**Presidential Award**, National Taiwan University	*Taipei, Taiwan*

Extracurricular Activities & Leadership & Teaching

Equipment Team, NTU Tainan Alumni Association (TAA)
Long-term Support and Senior Consultant/Leader

Taipei, Taiwan

Jul. 2015 - Apr. 2021

- This team is responsible for all the hardware for hosting stage performances. The equipment comes in four major fields: stage lighting, public address (PA) system, photography, and video recording.
- Having mastered all four fields, I coordinated the crew assigned with various responsibilities and made sure they could 1) have smooth communication with performers before the event, 2) set up the equipment within often tight time budget, and 3) correctly operate the devices to meet the performers' requirements.
- Led and trained the staff of this team whose personnel is replenished on a yearly basis. My apprentices span over 6 years (cycles).
- Designed technical lectures and hands-on training to teach newcomers so that they can work independently during real events. I have taught at least 10+ lectures in this group.
- Built up a sustainable lecture and training framework that can be passed down for generations even after I left NTU
- I have a series of documentary videos on this team in my YouTube channel

NTU Public Address (PA) Team
Network Administrator and Director of Equipment

Taipei, Taiwan

Sep. 2017 - Aug. 2018

- Built a radius server so that the shared Wi-Fi could be more secure and easier to manage
- Enhanced the logging system to better handle network security events.
- Managed, maintained, and bought the equipment of the PA Team.
- Taught 7 lectures, including: Decibel and Phase ($\times 3$), Introduction to the Systems in the Auditorium, Introduction to the Network System of PA Team, Introduction to X32 (a digital mixer), Introduction to Photography

NTUEE badminton department team
Coach

Taipei, Taiwan

Sep. 2017 - Jan. 2021

- Taught new members badminton skills and served balls to them.
- Taught experienced members tactics about the plays and pointed out their weaknesses and possible ways of improvement.

Night of NTU Tainan Alumni Association
Event General Coordinator

Taipei, Taiwan

Oct. 2015 - Mar. 2016

- TAA Night is ranked as one of the top three nights in NTU, famous for its high-quality drama. This event consists of about 80 drama performers, 20 dancers, and 70 workers. I was one of the three highest leaders of this event.
- The main responsibility was to arrange resources and the schedule to ensure the stage performance could be conducted successfully