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 in the thesis: 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, Hardware-software co-design, Software performance analysis and improvement

Secondary Scientific computing, Distributed computing, EDA, Wireless network, Silicon photonics

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 — *Jan '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 propagation delay in a standard cell — *Jun '22 - Jul '23*

- More than 10x faster than SPICE transient simulation, 100x faster than bi-section simulation, while maintaining more than 0.9 ranking 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 and decided whether to be added to the model to strike a balance between 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 and maintained an **Automatic Quality Checking (QC) system**, which executes specified scripts and organizes the results into an easily readable HTML report. This system assures developers and managers that the latest code can work as expected without specifically running their tests.
- 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 than conventional spice simulation without commercial licenses while keeping more than 0.9 of ranking correlation coefficient.
- Built a **fully automated quality checking flow** for 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.
- Wrote miscellaneous parsers including spice, verilog, lef, etc., and am acquainted with regular expression.

National Taiwan University

Taipei, Taiwan

Part-time worker, Division of Network Management, Computer & Information Networking Center — *Apr. 2018 - Jan. 2021*

- Built and maintained a framework for monitoring campus-wide wireless Internet service quality with visualized data. 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/ (Mandarin only)

Teaching Experience

Computer Architecture

National Taiwan University

Sep. '19 - Jan. '20 and Sep. '20 - Jan. '21

Three-credit mandatory course for third-year undergraduate students

- 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.
- Setting up presentation and video recording devices for the lecturer
- Offering office hours for students to ask questions

Honors & Awards

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

Extracurricular Activity & Leadership

Equipment Team, NTU Tainan Alumni Association (TAA)

Taipei, Taiwan

Long-term Support and Senior Consultant/Leader — *Jul. 2015 - Mar. 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 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.
- 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

Taipei, Taiwan

Network Administrator and Director of Equipment — *Sep. 2017 - Aug. 2018*

- Built a server for members to exploit WPA2 enterprise-grade Wi-Fi, so that the shared network is more secure and easier to manage. The same server also records more logs than before, which enhances the system's ability to handle network security events.
- Managed, maintained, and bought the equipment of the PA Team.

NTUEE badminton department team

Taipei, Taiwan

Coach — *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

Taipei, Taiwan

Event General Coordinator — *Oct. 2015 - Mar. 2016*

- Arrange resources to ensure the stage performance can be conducted successfully