# 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, CAD, 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 large cache.
- Devised a novel software-controlled cache analytical scheme in order 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 observations 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*

- Integrate 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.
- More than 10x faster than SPICE transient simulation, 100x faster than bi-section simulation, while maintaining more than 0.9 ranking coefficient with SPICE.

## 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 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*

*Teaching Assistant, Dept. of Computer Science and Information Engineering* — *Sep. '19 - Jan. '20 and Sep. '20 - Jan. '21*

- Computer Architecture (undergraduate 3rd grade required course, 3 credits)
- Responsible for introducing and grading verilog projects to build a simple CPU, and answer students' questions about lectures and projects.

### National Taiwan University

*Taipei, Taiwan*

*Part-time worker, Division of Network Management, Computer Information & Network 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 point out 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
- The work is published in a regional conference TANet30, and is online serving at this link (Mandarin only)

## Honors & Awards

2022 **DTP Outstanding Procedure Innovation Award**, Taiwan Semiconductor Manufacturing Company — *Hsinchu, Taiwan*

2015 **Presidential Award**, National Taiwan University — *Taipei, Taiwan*

2014 **Presidential Award**, National Taiwan University — *Taipei, Taiwan*

## Extracurricular Activity

### Equipment Team, NTU Tainan Alumni Association (TAA)

*Taipei, Taiwan*

*Long-term Support and Senior Consultant* — *Jul. 2015 - Mar. 2021*

- This team is responsible for all the hardware including stage lighting, public address (PA) system, photography, and video recording for hosting stage performances. I am the first and only one in the organization who masters all four fields.
- 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 a sustainable lecture and training framework that can be passed down for generations

### NTU Public Address (PA) Team

*Taipei, Taiwan*

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

- Built a server from scratch 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 enhanced the system's ability to handle network security events.
- Managed, maintained, and bought the equipments of the PA Team.

### NTUEE badminton department team

*Taipei, Taiwan*

*Coach* — *Sep. 2017 - Jan. 2021*

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

### Night of NTU Tainan Alumni Association

*Taipei, Taiwan*

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

- Arrange resources to support the performance to be conducted successfully