Pei-Wei (Perry) **Chen**

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Research Interests

Practice and applications of **decision procedures** (SAT, QBF, SSAT...) and **constraint programming**

Electronic Design Automation (verification, synthesis), **formal methods**, **software engineering**

Professional Highlights

Two first-author top-conference paper; **top 5%** in NTUEE; **1st place** in 2020 ICCAD Contest; **2nd place** in 2019 CADathlon

Education

National Taiwan University *Taipei, Taiwan*

B.S. in Electrical Engineering *Sep. 2016 – Jan. 2021*

- Cumulative GPA: 4.21 / 4.3; Major GPA: 4.24 / 4.3; Ranking: 12 / 261 (***top 5%***)

Research Experiences

Applied Logic and Computation Lab, Prof. Jie-Hong Roland Jiang *Taipei, Taiwan*

Undergraduate Research Assistant *Jul. 2019 – Present*

Clause-selection Based Method for Solving Stochastic Boolean Satsifiability (SSAT) [PDF]

- Developed **a general SSAT solver** to solve SSAT formulas **without any constraints**.
- Outperformed previous state-of-the-art SSAT solvers in both solving performance and memory usage.

Circuit Learning for Logic Regression on High Dimensional Boolean Space [PDF]

- Proposed a **decision-tree based algorithm** for **learning compact Boolean expressions** of unknown functions.
- Won **1st place** in 2019 ICCAD CAD Contest and outperformed others by up to **7000X** in circuit size.

Electronic Design Automation Lab, Prof. Yao-Wen Chang *Taipei, Taiwan*

Undergraduate Research Assistant *Jul. 2019 – Present*

Floorplanning for Wafer-scale Deep Learning Accelerators [PDF]

- Proposed a **B*-tree based algorithm** for **simultaneous resource allocation and placement** for deep learning accelerators.
- Won **4th place** in 2020 ISPD Contest and demonstrated robustness and stability under multiple constraints.

Lab for Data Processing Systems, Prof. Yi-Chang Lu *Taipei, Taiwan*

Undergraduate Research Assistant *Sep. 2018 – Jul. 2019*

Dynamic Programming Hardware Accelerator: Genomic Data Processing

- Designed **hardware for genomic sequence alignment** for sequences of **arbitrary lengths**.
- Achieved over **100X speed-up** compared to software with parallel and pipelining schemes.

Speech Processing and Machine Learning Lab, Prof. Hung-Yi Lee *Taipei, Taiwan*

Undergraduate Research Assistant *Sep. 2018 – Jul. 2019*

Deep and Structured Machine Learning [Link]

- Studied and implemented **deep learning models and methods**, including DNN, CNN, RNN, GAN, and RL.
- Applied variants of the above techniques on several tasks, e.g. video captioning and chatbot with RNN, conditioned image generation and transfer learning with GAN, and play atari games with RL models.

Publications

1. **Pei-Wei Chen**, Yu-Ching Huang, Jie-Hong Roland Jiang, "A Sharp Leap from Quantified Boolean Formula to Stochastic Boolean Satisfiability Solving", in *Proc. of AAAI Conference on Artificial Intelligence (AAAI-21)*
2. **Pei-Wei Chen**, Yu-Ching Huang, Cheng-Lin Lee, Jie-Hong Roland Jiang, "Circuit Learning for Logic Regression on High Dimensional Boolean Space", in *Proc. of ACM/IEEE Design Automation Conference (DAC-20)*

Teaching

***Teaching Assistant*, Introduction to Electronic Design Automation (Spring 2019)**, Prof. Jie-Hong R. Jiang *Feb. 2020 – Jun. 2020*

***Teaching Assistant*, Cornerstone EECS Design and Implementation (Spring 2018)**, Prof. Tzi-Dar Chiueh *Feb. 2019 – Jun. 2019*

Honors and Awards

2020 **Dean's List (4 awards out of 8 semesters)**, National Taiwan University
2020 **2nd Prize**, National Taiwan University Innovation Awards
2020 **4th Place**, 2020 ISPD Contest
2019 **1st Place**, 2019 ICCAD CAD Contest Problem A
2019 **2nd Place**, 2019 CADathlon at ICCAD
2019 **TSMC Scholarship**, Taiwan Semiconductor Manufacturing Company
2018 **10th Place**, International Quant Championship (WorldQuant)
2018 **3rd Place**, FRAIG: Functionally Reduced And-Inverter Graph (Cadence, Taiwan)

Selected Projects

Routing with Cell Movement [Link] *Jun. 2020*

- Proposed an iterative re-routing algorithm with limited cell movements to reduce wire length under constraints.
- Adopted the force-directed method to find new locations for cells and applied A* search to re-route cells with largest gains.

Air Hockey on Boards [Link] *Jan. 2020*

- Developed an air hockey game on embedded system with 2 STM32L475 boards and a Raspberry Pi.
- Experimented performances using several network protocols (Wifi, Bluetooth, TCP, UDP).

Bet on Blockchain [Link] *Jun. 2019*

- Deployed a decentralized betting system on blockchain with web service.
- Implemented functionalities such as launching new campaigns, placing bets, and payout return.

Functionally Reduced And-Inverter Graph (FRAIG) [Link] *Mar. 2018*

- Designed algorithms for functional equivalence checking and optimizations (gate sweeping, strashing) on AIGs.
- Outperformed all others (250+) in the contest in terms of gate count and runtime.

Selected Courses (All A+)

(† denotes graduate level courses)

CS related Algorithms / Data Structures and Algorithms / Data Structure and Programming / Computer Architecture / Introduction to Computer Networks / Network and Multimedia Lab / Machine Learning and Having it Deep and Structured†

EDA related Switching Circuit and Logic Design / Introduction to EDA / Physical Design for Nanometer ICs† / SoC Verification† / Logic Synthesis and Verification†

Skills

Natural Languages Mandarin Chinese (native), English (fluent) (TOEFL: 113; GRE: 322, AW 4.0)
Programming Languages C/C++, Python, Verilog, Javascript, Shell scripting, Git, LaTeX
Tools & Libraries Berkeley ABC, Tensorflow

Extracurricular Activity

Leader of Event Planning/Activities Department, NTUEE Camp *Jul. 2019 – Aug. 2019*

- Led a group of 40+ members and organized the activities of a 6-day summer camp for high school students, held by the Electrical Engineering Student Association of National Taiwan University.

Light Dance, NTUEE Night [Video] *Feb. 2019 – Mar. 2019*

- Developed an embedded system consisting of hardware (Linkit 7688, Arduino nano...) and software (Python, C++...) and designed lighting effects and costumes from scratch.