

Wei-Kai Liu

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RESEARCH INTERESTS

Design Automation(DA), Optimization, Algorithms, Computer-Aided Design (CAD) Tools

EDUCATION

National Taiwan University

Bachelor of Science in Electrical Engineering

Cumulative GPA: 3.82/4.3

Last 60 GPA: 4.17/4.3

Taipei, Taiwan

SEP. 2015 - PRESENT

HONORS & AWARDS

Second Place , ACM ISPD Contest

San Francisco, CA, USA, 2019

- One of the most prestigious event in EDA, organized by ACM and Cadence.
- Awarded among 33 competitive teams from Asia, North/South America, Africa, and Europe.
- The first team with exclusive undergraduate participants that won second place in 15 years.

Top4, Honorable Mentions , ICCAD CAD Contest, Problem C

Westminster, CO, USA, 2019

- Awarded among 100+ competitive teams in 10+ regions.
- One of the most prestigious event in EDA, organized by ACM and IEEE.

Outstanding Performance Scholarship, National Taiwan University

Taipei, Taiwan, 2019

- In honor of the academic excellence and outstanding research performance.

Second Place, NTU Undergraduate Innovation Award

Taipei, Taiwan, 2018

- Second place over 300+ projects in Electrical Engineering department.

RESEARCH EXPERIENCE

Electronic Design Automation Lab

Undergraduate Research Student

Advisor: Professor Yao-Wen Chang, NTU

Taipei, Taiwan

JUN. 2018 - PRESENT

- **Initial Detailed Routing**
 - Proposed and implemented the initial detailed routing engine that considers global guides.
 - Completed almost all cases routing in 12 hours and within the 64 GB memory limit.
 - Won the 2nd place at 2019 ISPD contest.
- **LEF/DEF Based Open-Source Global Router**
 - Proposed and implemented the global routing engine that considers detailed routing performance.
 - Contrived a 2D-3D hybrid routing to reduce congestion and wire length in detailed routing result.
 - Won the Top4, Honorable Mentions at 2019 ICCAD contest problem C.
- **System-level FPGA Routing with Timing Division Multiplexing Technique**
 - Implemented the FPGA routing engine and proposed an algorithm to minimize TDM ratio.
 - Outperformed every solutions in public cases at 2019 ICCAD contest problem B.
- **Timing-Aware Fill Insertion**
 - Proposed and implemented the ILP-based fill insertion algorithm that uses corner stitching data structure.

MicroSystem Research Lab

Undergraduate Research Student

Advisor: Professor Tzi-Dar Chiueh, NTU

Taipei, Taiwan

JAN. 2018 - JUN. 2018

- **LED Controller Chip** 📺
 - Designed and implemented a programmable LED cubic displayer using Verilog.
 - Integrated electronic materials with FPGA prototyping to showcase real-world visual effects.
 - Tapped out a controller ASIC based on FPGA design to get proficient in Design Compiler and Innovus.

- **Emotion Recognition by Image**
 - Employed different ways including LBP, HoG features to recognize facial expression.
 - Employed SMOTE, Eigenface, PCA for facial recognition.
 - Applied deep learning(end-to-end CNN model) with facial feactures based on dataset CK+.


PUBLICATIONS

[1] Performance-Driven System-Level FPGA Routing with Time-Division Multiplexing Optimization

Wei-Kai Liu, Ming-Hung Chen, Chia-Ming Chang, Chen-Chia Chang, and Yao-Wen Chang 

- Submitted to ACM/IEEE Design Automation Conference (DAC), 2020.

[2] A Routability-Driven 2D/3D Hybrid Global Routing Algorithm

Chen-Chia Chang*, Chia-Ming Chang*, Ming-Hung Chen*, Wei-Kai Liu*, and Yao-Wen Chang 

- * indicates equal contribution.
- Submitted to ACM/IEEE Design Automation Conference (DAC), 2020.

SELECTED PROJECTS

B* -Floorplan (C++/Python)

EEE 5026 , 2019

- Implemented eda circuit floorplanner based on B*-Tree and fast-SA algorithm within fixed-outline.
- Provided a circuit visualization with Python.

FM-Partition (C/C++/Python)

EEE 5026 , 2019

- Implemented eda circuit partition based on FM algorithm.

Decentralized Car Rental Platform (AngularJS/web3js/Solidity)

EE 3002, 2018

- Developed P2P car rental Dapp on Ethereum with transaction system and immediate updates.
- Established a foundation for future NMLab final Project.

Self-Balancing Robot (C/C++/Python)

EE 3021 , 2018

- Developed a Self-Balancing Robot using RPI, Arduino, and OpenCV.
- Developed an interactive communication app with Robot using bluetooth.

Automatic Sleep Stage Classification (Python/PyTorch)

EE 4057, 2018

- Designed a head-mounted device based on EEG signal to detect sleep stage and wake people up in a proper stage.
- Applied deep learning(end-to-end CNN model), and traditional learning methods in feature extraction and classification.

Pipelined MIPS CPU (Verilog/Design Compiler)

EE 4041, 2018

- Implemented a pipelined based MIPS CPU with L2 Cache and Branch Prediction using Verilog.

Chinese Conversation Prediction (Python/Keras/gensim)

EE 5184, 2018

- Implemented NLP techniques for Chinese conversations prediction.

EDA Tool for Functional Reduced AIG (C++/MiniSat)

EE 3011, 2017

- Developed circuit optimization tool with command-line interface, parallel simulation and SAT solver.

SKILLS

Programming Languages	C/C++, Verilog, Python, Solidity, Matlab
Software	PyTorch, Tensorflow, Keras, OpenCV, \LaTeX
VLSI Technologies	NC-Verilog, Design Compiler, SOC Encounter, Quartus, Innovus
Languages	Chinese/Mandarin(native), English(fluent), Japanese(basic)

LEADERSHIP & EXTRACURRICULAR ACTIVITY

Activity Planning Director, NTUEE Student Association

2017

- Organized and accomplished both campus-wide and departmental events and activies on the annual basis.

Director, the Greatest Show of NTUEE

2017

- Hosted the biggest show in National Taiwan University, more than 700 audience in presence.

Captain, NTUEE Basketball Team

2017

- Led and coached the basketball team to compete in the national college basketball tournaments.