

# Fan-Keng Sun

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## Research Interests

The intersections across **Machine Learning / Deep Learning, Electronic Design Automation, and Combinatorial Optimization.**

## Education

### National Taiwan University (NTU)

Taipei, Taiwan

B.S. Major in Electrical Engineering, Minor in Computer Science & Information Engineering

09/2014 - PRESENT

- **GPA: 4.17/4.3 (top 5%)**, major GPA: 4.23/4.3, last 60: 4.26/4.3
  - **Machine Learning:** Intro. to Digital Speech Processing, Machine Learning<sup>†</sup>, Machine Learning and Having It Deep and Structured<sup>†</sup>, Advanced Deep Learning<sup>†</sup>, Mathematical Principles of Machine Learning<sup>†</sup>, Topics in Machine Learning<sup>†</sup>
  - **Algorithm:** Algorithm Design & Analysis, ACM-ICPC, Graph Theory<sup>†</sup>, Physical Design for Nanometer ICs<sup>†</sup>
- (<sup>†</sup> denotes graduate-level courses)

## Research Experience

### Research Assistant, Speech Processing and Machine Learning Lab, with Prof. Hung-yi Lee

09/2016 - PRESENT

*Open-Set Multi-Speaker Speech Separation (Ongoing)*

- Proposed to use the phase in complex domain to improve performance.

*Multivariate Time Series (MTS) Forecasting [submitted to ECML/PKDD 19]*

- Proposed the temporal pattern attention for MTS forecasting which use CNNs to extract temporal patterns across multiple time steps, instead of a single time step as in traditional attention mechanisms.
- Verified by toy examples, our attention is able to attend on multiple time steps and handle interdependencies between series.
- Achieved state-of-the-art performance on a wide range of MTS datasets, including polyphonic music notes.

*Natural Language Processing*

- Researched a chat-bot with seq2seq model with deep reinforcement learning on the Cornell movie dialog corpus.
- Researched the CycleGAN paradigm with LSTM to train unpaired machine translation.

### Research Assistant, Electronic Design Automation Lab, with Prof. Yao-Wen Chang

02/2016 - PRESENT

*Bivariate Gradient-based Wirelength Model [submitted to DAC 19]*

- Proposed a novel bivariate gradient-based wirelength model for global placement which combines the advantages of bivariate and multivariate functions.
- Our wirelength model outperforms previous bivariate and state-of-the-art multivariate wirelength models.

*Topology-Matching Bus Routing [submitted to DAC 19]*

- Proposed and implemented the DAG-based topology-matching bus routing engine and won the top 10 at 2018 ICCAD CAD contest.
- Our algorithm outperforms all participants of 2018 ICCAD CAD contest, where the 1st place router result in 145% higher cost than ours.

*Initial Detailed Routing [ICCAD 18]*

- Proposed and implemented the multithreaded initial detailed routing engine that considers global guides and won the 3rd place at the 2018 ISPD contest.
- The multithreaded scheme speeds the engine up almost proportional to the number of threads.
- Our algorithm surpassed the winner of 2018 ISPD contest by 23%.

### Undergraduate Researcher, Speech Processing Lab, with Prof. Lin-shan Lee

09/2017 - 09/2018

*Reinforcing Reinforcement Learning by Rule-based Teacher*

- Applied computer vision technique to guide a rule-based Slither.io agent.
- Researched the combination of a rule-based teacher to guide a Slither.io agent by Asynchronous Advantage Actor Critic (A3C) which surpassed rule-based model.

### Software Engineering Intern, Synopsys, Inc.

07/2016 - 08/2016

*Single Layer Global Routing*

- Researched and implemented a single layer global routing algorithm based on mixture of previous literature and own thoughts.
- The algorithm successfully routed many real industrial cases.

## Publications

1. **Fan-Keng Sun**, Yao-Wen Chang “Anonymous Title”, submitted to DAC, 2019
2. Chen-Hao Hsu, Shao-Chun Hung, Hao Chen, **Fan-Keng Sun**, Yao-Wen Chang “Anonymous Title”, submitted to DAC, 2019
3. Shun-Yao Shih\*, **Fan-Keng Sun\***, Hung-yi Lee, “Temporal Pattern Attention for Multivariate Time Series Forecasting”, submitted to ECML/PKDD, 2020 (\* indicates equal contribution) | 📄 | 🔗
4. **Fan-Keng Sun**, Hao Chen, Ching-Yu Chen, Chen-Hao Hsu, Yao-Wen Chang “A Multithreaded Initial Detailed Routing Algorithm Considering Global Routing Guides”, ICCAD, 2018 | 📄 | 🔗

## Teaching

**Teaching Assistant, Algorithm Design and Analysis**, Prof. Yun-Nung Chen & Hsu-Chun Hsiao  
**Teaching Assistant, Machine Learning and Having It Deep and Structured**, Prof. Hung-yi Lee  
**Teaching Assistant, Machine Learning**, Prof. Hung-yi Lee

09/2018 - PRESENT  
02/2018 - 06/2018  
09/2017 - 01/2018

## Honors & Awards

Ongoing **Semifinalist**, Formosa Speech Grand Challenge - Talk to AI  
2018 **Outstanding Performance Scholarship**, National Taiwan University  
2018 **3rd Place**, Problem A at ICCAD CAD contest  
2018 **Top 10**, Problem B at ICCAD CAD contest  
2018 **Appier Scholarship**, Travel grant for ICCAD 2018  
2018 **3rd Place (first pure-undergraduate team in top 3 in 14 years)**, ISPD Contest  
2017 **Research Project Grant**, Taiwan Ministry of Science and Technology  
2017 **Top 12**, Formosa Speech Grand Challenge - Talk to AI (Warm-Up Match)  
2017 **National Technology and Science Scholarship**, CTCI  
16,17 **3rd Place (2 times)**, NTU ACM ICPC Ranking  
2017 **3rd Place**, National Collegiate Programming Contest  
2017 **Silver**, ACM ICPC Regional Contest  
2016 **1st Place**, ACM ICPC Regional Contest  
2016 **1st Place**, Calculus World Cup  
2016 **6th Place**, Data Structure and Programming Final Project Contest  
2016 **2nd Place**, Newcomers for ACM-ICPC Taiwan Online Programming Contest  
2012 **Silver Medal**, International Geography Olympiad

## Selected Projects

(complete list at [daikon-sun.github.io/#projects](https://daikon-sun.github.io/#projects))

### AI Traffic Control System [CTCI Scholarship] | 📁

11/2017

- Designed and implemented a low-cost and real-time traffic signal system on NVIDIA Jetson TK1 using Fast-RCNN to detect the traffic flow and reinforcement learning to train the traffic signal switching interval model.
- Our system is effective on simple traffic simulation, and thus won the 2017 National Technology and Research Scholarship presented by CTCI Foundation.

### Solving Multi-Armed Bandits by Upper Confidence Bound (UCB) Algorithms | 📁

06/2018

- Surveys several important UCB algorithms, from the original UCB, to improved versions (UCBV, improved-UCB), and end at the state-of-the-art method (EUCBV).
- Introduced the lower bound for the consistent algorithms and showed the optimality of KL-UCB in special case.

### What does Deep CNN learn? Visualization of Popular Deep CNN Models | 📁

03/2017

- Discussed and compared different methods of visualization on various well-known models, in order to gain further insights into the structure and success of CNN.
- Visualization methods include Activity, Deconvolutional Network, Saliency Map, Deep Generator Network (DGN), and Plug-and-Play Generative Networks.

## Extracurricular Activity

### Director, Academic Department of NTUEE Student Association

09/2016 - 06/2017

- Led a team of over 30 students to provide academic services to the 700+ undergraduates, including, but not limited to the followings.
- EExplore: an event where professors introduce every research area in EE department to freshman.
- Lab Intro: a week of continuous lab introduction by the corresponding professor to recruit interested undergraduate researchers.
- Others: online course selection, online textbook bookstore, makerspace, etc.

### Chair, MakeNTU Makeathon, [website], [FB fansite], [Recap video]

08/2016 - 02/2017

- Organized the largest nationwide student makeathon in Taiwan with 200 participants, 70k USD arrangement, and 60 volunteers.
- Collaborated with the Taipei City and 22 international companies, including Google, Microsoft, Dell, TSMC, Intel, ARM, Asus, etc.

### Interviewer, NTUEE+, [Video]

08/2017 - 09/2017

- To promote the NTUEE social network around the globe, I interviewed Dr. Hsiao-Wuen Hon, a NTUEE alumnus, who received Ph.D. in CS from CMU and is currently the corporate vice president of Microsoft.

## Skills

<b>Natural Languages</b>	Chinese (native), English (TOEFL 109, GRE 326/3.5)
<b>Programming Languages</b>	Python, C/C++, Shell, Javascript, Matlab, ㄇㄟㄋ
<b>Deep Learning Libraries</b>	Tensorflow, PyTorch, Keras