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[†], Machine Learning and Having It Deep and Structured[†], Advanced Deep Learning[†], Mathematical Principles of Machine Learning[†], Topics in Machine Learning[†]
- **Algorithm**: Algorithm Design & Analysis, ACM-ICPC, Graph Theory[†], Physical Design for Nanometer ICs[†]

([†] 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 underlined phase in complex domain to improve performance.

Multivariate Time Series (MTS) Forecasting
- 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 Assitant, **Electronic Design Automation Lab**, with Prof. Yao-Wen Chang *02/2016 - PRESENT*
Bivariate Gradient-based Wirelength Model
- 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
- Proposed and implemented the DAG-based topology-matching bus routing engine and won the top 10 at 2018 ICCAD CAD contest.
- Our algorithm outperforms the 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. 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) | 📄 | 🔗
2. **Fan-Keng Sun**, Yao-Wen Chang "Anonymous Title", submitted to DAC, 2019
3. Chen-Hao Hsu, Shao-Chun Hung, Hao Chen, **Fan-Keng Sun**, Yao-Wen Chang "Anonymous Title", submitted to DAC, 2019
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 Analylsis**, Prof. Yun-Nung Chen & Hsu-Chun Hsiao   *09/2018 - PRESENT*
Teaching Assistant, **Machine Learning and Having It Deep and Structured**, Prof. Hung-yi Lee   *02/2018 - 06/2018*
Teaching Assistant, **Machine Learning**, Prof. Hung-yi Lee   *09/2017 - 01/2018*

Honors & Awards

Ongoing	**Semifinalist**, Formosa Speech Grand Challenge - Talk to AI	
2018	**Outstanding Performance Award**, 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	**3rd Place**, ACM ICPC Regional Contest	
2016	**2st 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)

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 detected 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 sights into the structure and success of CNN.
- Visualization methods includes 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*
- Co-organized the largest nationwide student makaethon 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

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