

Fan-Keng Sun

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Research Interests

Machine learning and deep learning for sequence modeling, including time series analysis and natural language processing.

Education

Massachusetts Institute of Technology (MIT)

Ph.D. in Electrical Engineering and Computer Science

Cambridge, MA

09/2019 - PRESENT

- Courses: Machine Learning, Algorithms for Inference, Advanced Natural Language Processing, Optimization Methods
- GPA: 5.0/5.0

National Taiwan University (NTU)

B.S. in Electrical Engineering (major) and Computer Science (minor)

Taipei, Taiwan

09/2014 - 06/2019

- GPA: 3.96/4.00, Major GPA: 3.99/4.00

Research Experiences

Research Assistant, Statistical Metrology Group, Prof. Duane Boning

09/2019 - PRESENT

Machine Learning for Time Series

- Proposed a method to adjust for autocorrelated errors in neural networks for time series regression and forecasting.
- Adding our method to existing state-of-the-art models improves performances across a wide range of datasets by 5% on average.

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

09/2016 - 08/2019

Lifelong Language Learning [ICLR-20]

- Proposed a method that trains a GPT-2 model with both question-answering and language model objectives to tackle the lifelong language learning problem.
- Outperformed previous methods by a large margin yet being simple and extensible.

Multivariate Time Series (MTS) Forecasting [Journal track of the 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.
- Achieved state-of-the-art performance on a wide range of MTS datasets, including polyphonic music notes.

Reviewed paper for ICASSP 2019 and TASLP 2019

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

02/2016 - 12/2018

Bivariate Gradient-based Wirelength Model [DAC-19]

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

Topology-Matching Bus Routing [DAC-19]

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

Initial Detailed Routing [ICCAD-18]

- Proposed the multithreaded initial detailed routing engine considering global guides and won the 3rd place at the 2018 ISPD contest.
- Outperformed the winner of 2018 ISPD contest by 23%.

Undergraduate Researcher, Speech Processing Lab, 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 a mixture of previous literature and own design.

Publications

(* indicates equal contribution)

1. **Fan-Keng Sun**, Christopher I. Lang, Duane S. Boning. Adjusting for Autocorrelated Errors in Neural Networks for Time Series Regression and Forecasting. *arXiv preprint arXiv:2101.12578*, 2021.(under review)
2. Kyongmin Yeo, Dylan E. C. Grullon, **Fan-Keng Sun**, Duane S. Boning, Jayant R. Kalagnanam. Variational inference formulation for a model-free simulation of a dynamical system with unknown parameters by a recurrent neural network. *arXiv preprint arXiv:2003.01184*, 2020. (under review)
3. **Fan-Keng Sun***, Cheng-Hao Ho*, Hung-yi Lee. LAMOL: LAnguage MOdeling for Lifelong Language Learning. In *International Conference on Learning Representations (ICLR)*, 2020.

4. Shun-Yao Shih*, **Fan-Keng Sun***, Hung-yi Lee. Temporal Pattern Attention for Multivariate Time Series Forecasting, Journal track of the *European Conference on Machine Learning & Principles and Practice of Knowledge Discovery in Databases (ECML/PKDD)*, 2019.
5. **Fan-Keng Sun**, Yao-Wen Chang. BiG: A Bivariate Gradient-Based Wirelength Model for Analytical Circuit Placement. In *Proc. of ACM/IEEE Design Automation Conference (DAC)*, 2019.
6. Chen-Hao Hsu, Shao-Chun Hung, Hao Chen, **Fan-Keng Sun**, Yao-Wen Chang. A DAG-Based Algorithm for Obstacle-Aware Topology-Matching On-Track Bus Routing. In *Proc. of ACM/IEEE Design Automation Conference (DAC)*, 2019.
7. **Fan-Keng Sun**, Hao Chen, Ching-Yu Chen, Chen-Hao Hsu, Yao-Wen Chang. A Multithreaded Initial Detailed Routing Algorithm Considering Global Routing Guides. In *Proc. of IEEE/ACM International Conference on Computer-Aided Design (ICCAD)*, 2018.

Teachings

Teaching Assistant, Algorithm Design and Analysis (Fall 2018) , Prof. Yun-Nung Chen & Hsu-Chun Hsiao	09/2018 - 01/2019
Teaching Assistant, Machine Learning and Having It Deep and Structured (Spring 2018) , Prof. Hung-yi Lee	02/2018 - 06/2018
Teaching Assistant, Machine Learning (Fall 2017) , Prof. Hung-yi Lee	09/2017 - 01/2018

Honors & Awards

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- 2019 **AI Research Grant (with Prof. Hung-yi Lee)**, Salesforce
 - 2018 **Outstanding Performance Scholarship**, National Taiwan University
 - 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 **National Technology and Science Scholarship**, CTCI Foundation
 - 2017 **Silver Medal**, ACM ICPC Regional Contest
 - 2016 **1st Place**, ACM ICPC Regional Contest
 - 2016 **1st Place out of 2000 participants from 45 countries**, Calculus World Cup
 - 2016 **2nd Place**, Newcomers for ACM-ICPC Taiwan Online Programming Contest
 - 2012 **Silver Medal**, International Geography Olympiad

Selected Projects

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- 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
- Survey several important UCB algorithms: starting 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 consistent algorithms and showed the optimality of KL-UCB in special cases.
- What does Deep CNN learn? Visualization of Popular Deep CNN Models** 03/2017
- Discussed and compared different methods of visualization for various well-known models in order to gain further insights 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 Activities

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- 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 all research areas in EE department to freshmen.
 - Lab Intro: a week of continuous lab introduction by the corresponding professor to recruit interested undergraduate researchers.
- Chair, MakeNTU Makeathon**, [website], [FB fan page], [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.

Skills

Natural Languages	Chinese (Mandarin), English, Taiwanese
Programming Languages	Python, C/C++, Java, R, SQL, Julia, Shell, Matlab, \LaTeX , Git
Deep Learning Libraries	Tensorflow, PyTorch, Keras
Web Scraping Libraries	Beautiful Soup, Selenium, Scrapy