

Kai-Chieh Hsu

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Research Interests

Machine Learning Reinforcement Learning, Robotics and Healthcare applications

Signal Processing Compressed sensing and VLSI implementation

Education

Princeton University (PU)

Princeton, NJ

Ph.D. in Electrical Engineering

Sept. 2019 - PRESENT

- Achieved 4.0/4.0 GPA

National Taiwan University (NTU)

Taipei, Taiwan

B.S. in Electrical Engineering

Sept. 2014 - Jan. 2019

- Achieved 4.19/4.30 overall GPA and 4.19/4.30 major GPA
- Ranked in top 5% by cumulative GPA
- Research Advisors: Prof. An-Yeu (Andy) Wu and Prof. Jean-Fu Kiang

Research Projects

Inverse System Design

PU, NJ, USA

Prof. Jaime Fernández Fisac

July 2020 - PRESENT

ECG Real-Time Telemonitoring

NTU, Taiwan

Access IC Lab (Prof. An-Yeu (Andy) Wu, IEEE Fellow)

Aug. 2017 - Mar. 2019

- **Edge Classification:** Incorporated compressed sensing (CS), task-driven dictionary learning (predictive sparse coding) and PCA to render light-weighted classifier and overcome limited labeled data challenge
- **On-Demand Recovery:** Designed a two-stage algorithm that classifies and reconstructs only problematic signals. This algorithm utilizes the information from classification stage to speed up the reconstruction algorithm
- **Hardware Design and Chip Implementation:** Proposed a hardware architecture for on-demand recovery to allow hardware sharing between classification and reconstruction algorithms

Direction-of-Arrival (DOA) Estimation





NTU, Taiwan



Group of Electromagnetic Applications (Prof. Jean-Fu Kiang)

Feb. 2017 - Mar. 2019


- **Antenna Uncertainty:** Utilized special matrix structure with Khatri-Rao subspace-based Multiple Signal Classification (MUSIC) to improve immunity to uncertainties and detect DOAs with sensors half the number of sources
- **More Sources Than Sensors:** Proposed a new antenna array structure to increase the number of detectable sources based on fourth-order statistics and compressive sensing approach
- **Mixed Carrier Frequency (CF) Known and Unknown Sources:** Proposed a two-step algorithm to first estimate DOA of CF-known sources and then joint estimate the DOA and CF of CF-unknown sources

Publications

- [6] C.-Y. Chou, **K.-C. Hsu**, B.-H. Cho, K.-C. Chen and A.-Y. (Andy) Wu, "Low-Complexity On-demand Reconstruction for Compressively Sensed Problematic Signals," in *IEEE Trans. Signal Process.*, vol. 68, pp. 4094-4107, July 2020. | 
- [5] **K.-C. Hsu** and J.-F. Kiang, "Joint Estimation of DOA and Frequency From A Mixture of Frequency Known and Unknown Sources with Orthogonal Coprime Arrays," in *Sensors*, 19(2), 335, Jan. 2019. | 
- [4] **K.-C. Hsu**, B.-H. Cho, C.-Y. Chou and A.-Y. (Andy) Wu, "Low-Complexity Compressed Analysis in Eigenspace with Limited Labeled Data for Real-Time Electrocardiography Telemonitoring," in *IEEE Global Conference on Signal and Information Processing (GlobalSIP)*, Anaheim, USA, Nov. 2018. | 
- [3] **K.-C. Hsu** and J.-F. Kiang, "DOA Estimation With Triply Primed Arrays Based on Fourth-Order Statistics," in *IEEE AP-S Symposium on Antennas and Propagation and USNC-URSI Radio Science Meeting*, Boston, USA, July 2018. | 

- [2] **K.-C. Hsu** and J.-F. Kiang, "DOA Estimation Using Triply Primed Arrays Based on Fourth-Order Statistics," in *Progress In Electromagnetics Research M*, Vol. 67, pp. 55-64, Mar. 2018. | 
- [1] **K.-C. Hsu** and J.-F. Kiang, "DOA Estimation of Quasi-Stationary Signals Using a Partly-Calibrated Uniform Linear Array with Fewer Sensors Than Sources," in *Progress In Electromagnetics Research M*, Vol. 63, pp. 185-193, Jan. 2018. | 

Honors & Awards

3rd Prize in Integrated Circuit Design Contest	Ministry of Education, Taiwan
• Out of about 300 teams	July 2018
2nd Prize in Taiwan Creative Electromagnetic Implementation Competition	High-speed RF and mm-Wave Tech. Center, Taiwan
• Under the supervision of Prof. Tzong-Lin Wu, IEEE Fellow 	Aug. 2017
8th place in Data Structure and Programming Contest	Cadence, Taiwan
• Out of about 250 students	Mar. 2017
Digital IC Design Certificate	National Chip Implementation Center, Taiwan
• Familiar with Verilog, logic synthesis, simulation and STA	Nov. 2018
Graduate Representative in NTUEE graduate ceremony	Dept. of EE, NTU, Taiwan
• Given to top ten students of four years	June 2018
Professor Chun-Hsiung Chen Scholarship	Electromagnetic Industry-Academia Consortium, Taiwan
• Rewarded outstanding performances in electromagnetic fields	Jan. 2018
Presidential Awards	Dept. of EE, NTU, Taiwan
• Given to top ten students of that semester	second semester of 2014 and 2016




Research & Teaching Experiences

Research Assistant	NTU, Taiwan
Access IC Lab (Prof. An-Yeu (Andy) Wu, IEEE Fellow)	Feb. 2018 - Mar. 2019
Undergraduate Researcher	NTU, Taiwan
Group of Electromagnetic Applications (Prof. Jean-Fu Kiang)	Feb. 2017 - Mar. 2019
Teaching Assistant	NTU, Taiwan
Digital System Design	Feb. 2018 - June 2018

Professional Activities

Reviewer IEEE Transactions on Vehicular Technology, IETE Technical Review

Selected Course Projects

Survey of Dictionary Learning 	Mathematical Principles of Machine Learning
team project	June 2018
• Contribution: served as project speaker and surveyed predictive dictionary learning and sparse coding optimization	
• Studied generalization bound of reconstructive and predictive dictionary learning	
• Studied optimization algorithm of dictionary learning, including MOD, ODL, K-SVD and TDD	
• Studied sparse coding optimization algorithm, including sub-gradient descent, ISTA and FISTA	
An Analysis of Deep Neural Networks in Hardware Perspective 	Advanced Integrated Circuit Design
Python, team project	Jan. 2018
• Contribution: served as leader to distribute work and surveyed the structure of residual net, Inception v4 and Xception	
• Reviewed many state-of-the-art very deep CNNs, including AlexNet, VGG net, Inception, ResNet and Xception	
• Analyzed with estimation accuracy and resource consumption and provided insight of hardware-friendly designs	
Pipelined MIPS CPU 	Computer Architecture
Verilog, team project	June 2017
• Contribution: served as leader to distribute work, design whole structure and implement basic function of CPU	
• Implemented a pipelined MIPS CPU with support of multiplication and division and overcame data and branch hazard	