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

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," *accepted to appear in the IEEE Trans. Signal Process.*, .

[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," *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," *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," *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," *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," *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