Kai-Chieh (Kevin) **Hsu**

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Research Interests

Signal Processing ON ANTENNA ARRAY FOR APPLICATIONS OF 5G MOBILE COMMUNICATIONS AND COGNITIVE RADIO

Machine Learning ON DATA CLASSIFICATION WITH LOW COMPUTATIONAL COMPLEXITY

VLSI design ON DIGITAL SIGNAL PROCESSING

Education

National Taiwan University (NTU) *Taipei, Taiwan*

B.S. IN DEPARTMENT OF ELECTRICAL ENGINEERING SEP. 2014 - PRESENT

- ACHIEVED 4.19/4.3 OVERALL GPA AND 4.2/4.3 MAJOR GPA.
- HARDWARE COURSES: COMPUTER ARCHITECTURE(A+), ADVANCED INTEGRATED CIRCUIT DESIGN(A+) AND DIGITAL CIRCUIT LAB(A+)
- COMMUNICATION COURSES: PRINCIPLES OF COMMUNICATIONS(A), ADVANCED DIGITAL SIGNAL PROCESSING(A+), INTRODUCTION TO WIRELESS AND MOBILE NETWORKING(A+) AND RF MICROWAVE WIRELESS SYSTEMS(A+)
- MACHINE LEARNING COURSES: MACHINE LEARNING(A+) AND MATHEMATICAL PRINCIPLES OF MACHINE LEARNING(A+)

Research Experiences

ECG Real-Time Telemonitoring *Taipei, Taiwan*

UNDER PROF. AN-YEU (ANDY) WU, ACCESS LAB AUG. 2017 - PRESENT

- PROPOSED COMPRESSED ANALYSIS (CA) TO CONDUCT REAL-TIME ECG TELEMONITORING AND CONSIDERED FOLLOWING IMPROVEMENTS
- 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: ...
- HARDWARE DESIGN AND CHIP IMPLEMENTATION: ...

Direction-Of-Arrival Estimation *Taipei, Taiwan*

UNDER PROF. JEAN-FU KIANG, GROUP OF ELECTROMAGNETIC APPLICATIONS FEB. 2017 - PRESENT

- APPLIED DIFFERENT METHODS TO ADDRESS ENTAILED PROBLEMS OF DIRECTION-OF-ARRIVAL (DOA) ESTIMATION
- ANTENNA UNCERTAINTY: UTILIZED SPECIAL MATRIX STRUCTURE WITH KHATRI-RAO SUBSPACE-BASED MULTIPLE SIGNAL CLASSIFICATION ALGORITHM 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 DETECTABLE NUMBER OF 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 KNOWN SOURCES AND THEN JOINT ESTIMATE THE DOA AND CF OF UNKNOWN SOURCES

Publications

Low-Complexity Compressed Analysis in Eigenspace with Limited Labeled Data for Real-Time Electrocardiography Telemonitoring *Anaheim, USA*

K.-C. HSU AND B.-H. CHO, C.-Y. CHOU AND A.-Y. (ANDY) WU NOV. 2018

IEEE GLOBAL CONFERENCE ON SIGNAL AND INFORMATION PROCESSING

Joint Estimation of DOA and Carrier Frequency Based on Coprime Arrays *Toyama, Japan*

K.-C. HSU AND J.-F. KIANG AUG. 2018

PROGRESS IN ELECTROMAGNETICS RESEARCH SYMPOSIUM

DOA Estimation With Triply Primed Arrays Based on Fourth-Order Statistics *Boston, USA*

K.-C. HSU AND J.-F. KIANG JUL. 2018

IEEE AP-S SYMPOSIUM ON ANTENNAS AND PROPAGATION AND USNC-URSI RADIO SCIENCE MEETING

DOA Estimation Using Triply Primed Arrays Based on Fourth-Order Statistics | [PDF] *Cambridge, USA*

K.-C. HSU AND J.-F. KIANG MAR. 2018

PROGRESS IN ELECTROMAGNETICS RESEARCH M, VOL. 67, PP. 55-64

DOA estimation of quasi-stationary signals using a partly-calibrated uniform linear array with fewer sensors than sources | [PDF] *Cambridge, USA*

K.-C. HSU AND J.-F. KIANG JAN. 2018

PROGRESS IN ELECTROMAGNETICS RESEARCH M, VOL. 63, PP. 185-193

Honors & Awards

3rd Prize in Integrated Circuit Design Contest Award — *Ministry of Education, Taiwan*
- Out of about 300 teams

Jul. 2018

2nd Prize in Taiwan Creative Electromagnetic Implementation Competition — *High-speed RF and mm-Wave Tech. Cneter, NTU*
- Implemented an electromagnetic structure longer than 2.5 meters operated at 3 GHz with only materials available in stationery shop to achieve -7.8 dB insertion loss

Aug. 2017

8th place in Data Structure and Programming Contest. — *Cadence, Taiwan*
- Out of about 250 students

Mar. 2017

Professor Chun-Hsiung Chen Scholarship — *Electromagnetic Industry-Academia Consortium, Taiwan*
- Rewarded outstanding performances in electromagnetic fields

Nov. 2017

Presidential Awards $\times 2$ — *Dept. of EE, NTU*
- Given to top ten students of that semester

second semester of 2014 and 2016

Selected Course Projects

Pipelined MIPS CPU | [PDF] — *Computer Architecture*

Verilog, team project — Jun. 2017
- Contribution: served as leader to distribute work, design whole structure and implement basic function of CPU
- Implemented a synthesizable pipelined MIPS CPU overcoming data hazard, lw-use hazard and branch hazard
- Advanced with branch prediction, L2 cache and support multiply and divide instructions

Different Handover Policies in Different Environments | [PDF] — *Intro. to Wireless and Mobile Networking*

Matlab, team project — Jun. 2017
- Contribution: served as project speaker, conducted simulations and analyzed results
- Proposed four different handover policies and compare performances among different environments in both uplink and downlink cases

Drivendata Contest(Pump it Up: Data Mining the Water Table) | [PDF] — *Machine Learning*

Python, team project — Jun. 2017
- Contribution: preprocessed data such as correcting missed or erroneous data and encoding discrete data in one-hot
- Compared performances between random forest, extreme gradient boosting (XGBoost) and dense neural network (DNN)
- Analyzed with heat map, confusion matrix and feature importance

An Analysis of Deep Neural Networks in Hardware Perspective | [PDF] — *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-art very deep CNNs, including AlexNet, VGG net, Inception, ResNet and Xception
- Analyzed with estimation accuracy and resource consumption and provide insight of hardware-friendly designs

Survey of Dictionary Learning | [PDF] — *Mathematical Principles of Machine Learning*

team project — Jun. 2018
- Contribution: served as project speaker and surveyed on predictive dictionary learning and sparse coding optimization
- Studied comprehensively on generalization bound of reconstructive and predictive dictionary learning
- Studied detailedly on optimization algorithm of reconstructive and predictive dictionary learning, including MOD, ODL, K-SVD and TDDL
- Studied informatively on sparse coding optimization algorithm, including sub-gradient descent, ISTA and FISTA

Extracurricular Activity

MV Dance Club of NTU — *Taipei, Taiwan*

Associate Club Leader — Jul. 2015 - Jun. 2016
- Gained expertise in coordination with team members, schools and other clubs.
- Attracted more than hundred club members.
- Held a dance performance attracting more than hundred audiences.

Teaching Assistant — *Taipei, Taiwan*

Digital System Design — Feb. 2018 - Jun. 2018