Yudi Huang

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Short Bio

I am a 4-th year Ph.D. student at Pennsylvania State University (PSU). Before joining PSU, I received my M.S. in Communication and Information Systems and B.S. in Communication and Information Engineering from the University of Electronic Science and Technology of China (UESTC). My research interests lie in applying optimization theory and machine learning tools to make networked systems faster and more robust.

Education

Pennsylvania State University (PSU) 2019 - present
Ph.D. Candidate in Department of Computer Science and Engineering (CSE) Advisor: Ting He

University of Electronic Science and Technology of China (UESTC) 2016 - 2019
M.S. in Communication and Information Systems Advisor: Ying-Chang Liang

University of Electronic Science and Technology of China (UESTC) 2012 - 2016
B.S. in Communication and Information Engineering Advisor: Ying-Chang Liang

Research Experience

- **Inference and Control in Overlay Networks** 2022 - present
  - *Topology Inference for Overlay Routing (undergoing)*
    - Proposed a polynomial-time algorithm to detect the latent sharing between overlay tunnels with the finest granularity
    - Developed a simulation platform based on the 5G-LENA simulator in NS3
- **Prevention and Recovery of Cascading Failure in Smart Grid** 2019 - 2022
  - *Preventing Outages under Coordinated Cyber-Physical Attack with Secured PMU*
    - Studied a novel trade-off for PMU placement through a tri-level mixed-integer programming modeling, which avoids bilinear terms in existing works.
    - Developed a Bender's decomposition-based algorithm to solve the problem to its optimality.
    - Proposed a heuristic algorithms to approximate the problem in polynomial time.
    - **Published** in (i) SmartGridComm'21, and (ii) IEEE Transactions on Smart Grid
  - *Link State Estimation Under Cyber-Physical Attacks: Theory and Algorithms*
    - Developed an algorithm to estimate grid topology after a cyber-physical attack through linear programming-based approximation
    - Established theoretical conditions for the proposed approximation algorithm to have no errors
    - The first attempt at algorithm design to verify the fidelity of the topology estimation results
    - **Published** in (i) SmartGridComm'20 (**Best Paper Runner-up**), and (ii) IEEE Transactions on Smart Grid
- **Apply Machine Learning Tools to Wireless Communication Networks** 2016 - 2019
  - *Dictionary Learning for Channel Estimation in FDD Massive MIMO Systems*
    - Designed a dictionary-based channel model to represent the cell-specific geographical properties
    - Proposed a learning algorithm to obtain the dictionaries with the expected structure
    - Improved MSE performance in dictionary learning-based channel estimation methods

    - ∗ **Published** in IEEE GLOBECOM'19
  - *Clustering-based Wireless Transceiver Design*
    - ∗ Developed a Gaussian mixture model-based clustering framework for wireless transceiver design
    - ∗ Designed a variant of the EM algorithm to reduce the complexity from exponential to linear in antenna array size
    - ∗ Achieved near-optimal symbol error rate in MIMO detection problem
    - ∗ **Published** in (i) IEEE ICC'18, and (ii) IEEE Transaction on Vehicular Technology
  - *Support Vector Machine-based Cooperative Spectrum Sensing*
    - ∗ Developed a support vector machine-based algorithm for cooperative spectrum sensing in cognitive radio
    - ∗ **Published** in IEEE GLOBECOM'16
  - *Undergraduate research: Flowvisor-Based SDN Controller Development*
    - ∗ Developed an experimental platform for testing Flowvisor based on Open vSwitch

Honor and Award

- Best Paper Finalist, IEEE SmartGridComm — Oct. 2020
- Travel Grant, IEEE SmartGridComm — Oct. 2020
- National Scholarships (top 2%) — Sept. 2017
- Enrollment Scholarship for Master Student — Sept. 2016
- Outstanding Bachelor's Thesis Award of UESTC — June 2016
- National Scholarships (top 2%) — Sept. 2015
- 1^{st} prize in National Mathematics Olympiad in Senior (Chongqing Division) — Oct. 2011

Service

- Reviewer:
  - IEEE Transactions on Wireless Communications (TWC)
  - IEEE Transactions on Network Science and Engineering (TNSE)
  - IEEE Access
  - Elsevier Digital Signal Processing
- EasyChair-master (Assistant) for ICCCN 2022

Programming Skills

- Experience with Matlab and Python
  - Orchestrate research simulations
  - Gurobi
  - Graduate course project on developing a GNN-based anomaly detection method in PyTorch
- Experience with C/C++
  - Network simulation in NS3
  - Experience with TCP/IP protocol suite and socket programming
  - Graduate course project on a distributed key-value store based on AWS-EC2
  - Graduate course project on a simple MapReduce framework based on AWS-EC2

Coursework

- Theory: Machine Learning, Distributed Algorithms, Convex Optimization, Large-Scale Machine Learning, Probabilistic Algorithm, Algorithm Analysis
- Wireless communication: Signal Detection and Estimation, Digital Communications, Information Theory, Fundamental Mathematics in Communication Networks, Mobile Communication System, MIMO Signal Processing
- System: Network Software Programming, Operating System, Distributed Systems, Computer Networks

Publication

1. **Y. Huang**, T. He, N. R. Chaudhuri, and T. La Porta, "Preventing Outages under Coordinated Cyber-Physical Attack with Secured PMUs," IEEE Transactions on Smart Grid, 2022.
2. **Y. Huang**, T. He, N. R. Chaudhuri, and T. La Porta, "Link State Estimation under Cyber-Physical Attacks: Theory and Algorithms," IEEE Transactions on Smart Grid, 2022.
3. **Y. Huang**, T. He, N. R. Chaudhuri, and T. La Porta, "Preventing Outages under Coordinated Cyber-Physical Attack with Secured PMUs," IEEE SmartGridComm, 2021.
4. **Y. Huang**, T. He, N. R. Chaudhuri, and T. La Porta, "Power grid state estimation under general cyber-physical attacks," IEEE SmartGridComm, 2020. (**Best Paper Runner-up**)
5. **Y. Huang**, Y.-C. Liang, Feifei Gao, "Channel estimation in FDD massive MIMO systems based on block-structured dictionary learning", IEEE GLOBECOM, 2019.
6. J. Tian, Y. Pei, **Y. Huang**, Y.-C. Liang, "A Machine Learning Approach to Blind Modulation Classification for MIMO Systems", IEEE ICC, 2018.
7. Q. Zhang, P. Liang, **Y. Huang**, Y.-C. Liang, "Label-Assisted Transmission for Short Packet Communications: A Machine Learning Approach", IEEE Transaction On Vehicular Technology, 2018.
8. **Y. Huang**, P. Liang, Q. Zhang, Y.-C. Liang, "A Machine Learning Approach to MIMO Communications", IEEE ICC, 2018.
9. **Y. Huang**, J. Tan, Y.-C. Liang, "Wireless Big Data: Transforming Heterogeneous Networks to Smart Networks", Journal of Communications and Information Networks, 2017.
10. **Y. Huang**, G. Yang, Y.-C. Liang, "A Fuzzy Support Vector Machine Algorithm for Cooperative Spectrum Sensing with Noise Uncertainty", IEEE GLOBECOM, 2016.