Wentao Yu

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https://wyuaq.github.io/

Research Interests

My research spans the intersection of **signal processing** and **machine learning** to develop advanced transceiver algorithms for **next-generation wireless systems**. I am particularly interested in application domains such as millimeter-wave and terahertz systems, near-field communications and sensing, and ultra-massive MIMO systems.

Education

The Hong Kong University of Science and Technology *Sept 2021 – Aug 2025*
Ph.D. in Electronic and Computer Engineering

- Advisor: Prof. Khaled B. Letaief
- Awarded Hong Kong Ph.D. Fellowship Scheme (HKPFS)

Massachusetts Institute of Technology *Sept 2024 – Aug 2025*
Visiting Ph.D. Student in Electronic Engineering and Computer Science

- Advisor: Prof. Lizhong Zheng
- Supported by HKUST Overseas Research Award

Nanjing University *Sept 2017 – Jun 2021*
B.Eng. in Electronic Science and Engineering

- Advisor: Prof. Shaowei Wang
- Outstanding Graduate, Ranking: 3/193, Awarded China National Scholarship

Experience

Massachusetts Institute of Technology *Cambridge, MA, USA*
Visiting Researcher *Sept 2024 – Aug 2025*

- Gained understanding of the information-theoretic feature learning framework – "H-score networks".
- Conducted research on its applications to (i) direction-of-arrival (DoA) estimation using sparse arrays, and (ii) massive MIMO beamforming with implicit channel estimation.
- Led the drafting of the first tutorial paper on "AI for THz ultra-massive MIMO systems", in collaboration with scholars from HKUST, MIT, and Tsinghua University.

The Hong Kong University of Science and Technology *Hong Kong SAR, China*
Graduate Research Assistant *Sept 2021 – Aug 2025*

- Designed an adaptive and robust deep learning framework for THz ultra-massive MIMO channel estimation with convergence guarantees and flexible performance-complexity trade-offs.
- Designed a Bayes-optimal unsupervised learning algorithm for channel estimation in near-field holographic MIMO systems and studied its uncertainty quantification.
- Proposed two deep learning frameworks for iterative and non-iterative transceiver algorithms in ultra-massive MIMO systems and investigated their applications in beam-focusing, channel estimation, and CSI feedback.
- Proposed the concept of physical layer foundation models, a unified deep learning model that can be applied across a wide range of tasks in intelligent transceiver design, and studied its practical applications.
- Studied out-of-distribution detection in task-oriented semantic communications with information bottleneck.

Nanjing University *Nanjing, China*
Undergraduate Research Assistant *Oct 2019 – Jun 2021*

- Proposed a multi-label learning algorithm for antenna selection in massive MIMO systems.
- Designed a learning-based branch-and-bound algorithm for quantized precoding in multi-user massive MIMO.

Honors and Awards

- **2024 IEEE Signal Processing Society's Annual Top 25 Downloaded Article** Paper
- **2024 HKUST ECE Senior Teaching Assistant Fellowship**
- 2024 HKUST Overseas Research Award
- 2021 HKUST Redbird Ph.D. Scholarship
- **2021 Hong Kong Ph.D. Fellowship Scheme (HKPFS)**
- 2021 Outstanding Graduate of Nanjing University
- 2019 The Interdisciplinary Contest in Modeling (ICM), Outstanding Winner (Top 0.14%)
- 2019 Outstanding Student Leaders of Jiangsu Province (Only 10 awardees among all UGs at NJU)
- 2019 Baosteel Scholarship (Only 6 awardees among all UGs at NJU)
- **2018 China National Scholarship**

Teaching

I am honored to receive the **HKUST ECE Senior Teaching Assistant Fellowship**, which *"recognizes RPg students who have demonstrated excellent performance and dedication in serving as a teaching assistant."*

The Hong Kong University of Science and Technology *Hong Kong SAR, China*
Teaching Assistant *Sept 2021 – Aug 2024*

- EESM 5536 Digital Communications (2023 Spring, 2022 Fall)
- ELEC 4901 Final Year Undergraduate Thesis (2023 Fall)
- ELEC 3100 Signal Processing and Communications (2022 Spring)
- ELEC 2600 Probability and Random Processes in Engineering (2023 Fall, 2022 Fall)

Nanjing University *Nanjing, China*
Peer Mentorship *Sept 2018 – Jun 2021*

- Provided support for freshmen both academically and socially
- Coordinated peer mentors in the School of Electronic Science and Engineering

Publications

Journal

[J7] **Wentao Yu**, Xiangxiang Xu, Lizhong Zheng, Khaled B. Letaief, "A neural feature learning framework for direction-of-arrival estimation," *IEEE Transactions on Signal Processing*, in preparation, 2025.

[J6] **Wentao Yu**, Hengtao He, Shenghui Song, Jun Zhang, Lizhong Zheng, Khaled B. Letaief, "Physical layer foundation models for ultra-massive MIMO systems," *IEEE Transactions on Wireless Communications*, in preparation, 2025.

[J5] **Wentao Yu**, Hengtao He, Shenghui Song, Jun Zhang, Linglong Dai, Lizhong Zheng, Khaled B. Letaief, "AI and deep learning for THz ultra-massive MIMO: From model-driven approaches to foundation models," *Engineering*, under review, Dec. 2024. **(Invited paper)**

[J4] **Wentao Yu**, Yifan Ma, Hengtao He, Shenghui Song, Jun Zhang, Khaled B. Letaief, "Deep learning for near-field XL-MIMO transceiver design: Principles and techniques," *IEEE Communications Magazine*, vol. 63, no. 1, pp. 52-58, Jan. 2025.

[J3] **Wentao Yu**, Hengtao He, Xianghao Yu, Shenghui Song, Jun Zhang, Ross Murch, Khaled B. Letaief, "Bayes-optimal unsupervised learning for channel estimation in near-field holographic MIMO," *IEEE Journal of Selected Topics in Signal Processing*, vol. 18, no. 4, pp. 714-729, May 2024. **(Popular article in IEEE JSTSP)**

[J2] **Wentao Yu**, Yifei Shen, Hengtao He, Xianghao Yu, Shenghui Song, Jun Zhang, Khaled B. Letaief, "An adaptive and robust deep learning framework for THz ultra-massive MIMO channel estimation," *IEEE Journal of Selected Topics in Signal Processing*, vol. 17, no. 4, pp. 761-776, Jul. 2023. **(IEEE Signal Processing Society's annual top 25 downloaded article from Sept. 2023 to Sept. 2024)**

[J1] **Wentao Yu**, Tianyu Wang, Shaowei Wang, "Multi-label learning based antenna selection in massive MIMO systems," *IEEE Transactions on Vehicular Technology*, vol. 70, no. 7, pp. 7255-7260, Jul. 2021.

Conference

[C7] **Wentao Yu**, Hengtao He, Xianghao Yu, Shenghui Song, Jun Zhang, Ross Murch, Khaled B. Letaief, "Learning Bayes-optimal channel estimation for holographic MIMO in unknown EM environments," in *Proc. IEEE International Conference on Communications (ICC)*, Denver, CO, USA, Jun. 2024.

[C6] Yifan Ma, **Wentao Yu**, Xianghao Yu, Jun Zhang, Shenghui Song, Khaled B. Letaief, "Lightweight and flexible Deep equilibrium learning for CSI feedback in FDD massive MIMO," in *Proc. IEEE International Conference on Machine Learning for Communication and Networking (ICMLCN)*, Stockholm, Sweden, May 2024.

[C5] Ruoxiao Cao, **Wentao Yu**, Hengtao He, Xianghao Yu, Shenghui Song, Jun Zhang, Yi Gong, Khaled B. Letaief, "Newtonized near-field channel estimation for ultra-massive MIMO systems," in *Proc. IEEE Wireless Communications and Networking Conference (WCNC)*, Dubai, UAE, Apr. 2024.

[C4] Hongru Li, **Wentao Yu**, Hengtao He, Jiawei Shao, Shenghui Song, Jun Zhang, Khaled B. Letaief, "Task-oriented communication with out-of-distribution detection: An information bottleneck framework," in *Proc. IEEE Global Communications Conference (Globecom)*, Kuala Lumpur, Malaysia, Dec. 2023.

[C3] **Wentao Yu**, Hengtao He, Xianghao Yu, Shenghui Song, Jun Zhang, Khaled B. Letaief, "Blind performance prediction for deep learning based ultra-massive MIMO channel estimation," in *Proc. IEEE International Conference on Communications (ICC)*, Rome, Italy, May-Jun. 2023.

[C2] **Wentao Yu**, Hengtao He, Xianghao Yu, Shenghui Song, Jun Zhang, Khaled B. Letaief, "Hybrid far- and near-field channel estimation for THz ultra-massive MIMO via fixed point networks," in *Proc. IEEE Global Communications Conference (Globecom)*, Rio de Janeiro, Brazil, Dec. 2022.

[C1] Tianyu Wang, **Wentao Yu**, Shaowei Wang, "Inter-slice radio resource management via online convex optimization," in *Proc. IEEE International Conference on Communications (ICC)*, Montreal, Canada, Jun. 2021.

Presentations

"AI for THz UM-MIMO: From model-driven deep learning to foundation models"

- IEEE Signal Processing Society's invited webinar, Virtual, Feb. 25, 2025.

"Blind performance prediction for deep learning based ultra-massive MIMO channel estimation"

- IEEE International Conference on Communications (ICC), Rome, Italy, May 30, 2023.

"Learning Bayes-optimal channel estimation for holographic MIMO in unknown EM environments"

- Monthly faculty meeting of the Hong Kong 6G area of excellence scheme, Hong Kong, May 23, 2024.
- IEEE International Conference on Communications (ICC), Denver, CO, USA, Jun. 11, 2024.

"An adaptive and robust deep learning framework for THz ultra-massive MIMO channel estimation"

- IEEE Global Communications Conference (Globecom), Virtual, Dec. 5, 2022.
- IEEE Hong Kong 6G Wireless Summit, Hong Kong, Sept. 13, 2023.
- Monthly faculty meeting of the Hong Kong 6G area of excellence scheme, Hong Kong, Nov. 14, 2023.

Academic Services

Journal Reviewer for

- IEEE Journal on Selected Areas in Communications (JSAC)
- IEEE Transactions on Wireless Communications (TWC)
- IEEE Transactions on Communications (TCOMM)
- IEEE Transactions on Machine Learning for Communications and Networking (TMLCN)

- IEEE Transactions on Vehicular Technology (TVT)
- IEEE Transactions on Cognitive Communications and Networking (TCCN)
- IEEE Transactions on Intelligent Transportation Systems (T-ITS)
- IEEE Transactions on Circuits and Systems II – Express Briefs (TCAS-II)
- IEEE Communications Magazine (MCOM)
- IEEE Open Journal of Vehicular Technology (OJVT)
- IEEE Wireless Communications Letters (WCL)
- IEEE Communications Letters (CL)
- Physical Communications

Conference Reviewer for

- IEEE Global Communications Conference (Globecom)
- IEEE Wireless Communications and Networking Conference (WCNC)
- IEEE Vehicular Technology Conference (VTC)
- International Symposium on Wireless Communication Systems (ISWCS)

Conference TPC Member for

- 2024 IEEE WCNC Workshop on Model-Driven Deep Learning for 6G

Miscellaneous

Languages: Chinese (Native), English (Full Professional Proficiency, TOEFL Speaking: 28/30)

Volunteer Work: Served as the leader of the Youth Volunteer Organization of the School of Electronic Science and Engineering, Nanjing University, regularly organizing volunteer projects for the community.

Hobbies: Table Tennis, Photography, Basketball, Erhu (Chinese violin, 10+ years of practice)