Hao Zhang

🏛 Nanjing University of Aeronautics and Astronautics   🎓 Ph.D., IEEE Member

@ haozhangcn@nuaa.edu.cn   🅖 Google Scholar   ⓘ 0000-0003-1923-589X

 haozhangcn   🏠 haozhangcn.com   ♒ May 1994   📍 Nanjing, China

Dr. Hao Zhang is currently an Assistant Researcher/Postdoctoral Fellow at the College of Artificial Intelligence, Nanjing University of Aeronautics and Astronautics (NUAA). In 2022, he was selected as a member of NUAA's Top-notch Postgraduate Innovative Talents Training "Yinhang Project". He obtained the Ph.D. degree in Information and Communication Engineering at Nanjing University of Aeronautics and Astronautics in June 2025.

His research interests include **foundation models, signal classification/processing, and wireless network**. He has published over 30 papers on IEEE top journals and conferences, including **IEEE COMST, IEEE GRSM, IEEE Network, IEEE TIFS, IEEE TCOM, IEEE TCCN, IEEE IOTJ, IEEE WCL**, 🗊citation: **680+**, H index: **15**.

🎓 Education

2025.06	College of Electronic & Information Engineering, ⊛**Nanjing University of Aeronautics and Astronautics**
2021.04	Ph.D. (2020.07-2021.03 serve as a research assistant) in Information and Communication Engineering
2024.12	School of Electrical & Electronic Engineering, 🏫**Nanyang Technological University**
2024.01	Visiting Ph.D. student (Chau Yuen, IEEE Fellow) in Information and Communication Engineering
2020.06	School of Information Engineering, ⊛**Nanchang University**
2017.09	Master of Engineering in Electrical and Communication Engineering
2017.06	School of Information Engineering, ⊛**Nanchang University**
2013.09	Bachelor's degree in Internet of Things Engineering

⚙ Publications

✔ Accepted

1. **Hao Zhang**, Fuhui Zhou, Hongyang Du, Qihui Wu, and Chau Yuen. "Revolution of Wireless Signal Recognition for 6G: Recent Advances, Challenges and Future Directions", *IEEE Communications Surveys & Tutorials*, Early Access, doi:10.1109/COMST.2025.3569427, 2025.

2. **Hao Zhang**, Jin-Jian Xu, Hong-Wei Cui, Lin Li, Yaowen Yang, Chao-Sheng Tang, and Niklas Boers. "When Geoscience Meets Foundation Models: Towards General Geoscience Artificial Intelligence System", *IEEE Geoscience and Remote Sensing Magazine*, Early Access, doi: 10.1109/MGRS.2024.3496478, 2024.

3. **Hao Zhang**, Fuhui Zhou, Qihui Wu, and Chau Yuen. "Spectrum Cognition: Semantic Situation for Next-Generation Spectrum Management", *IEEE Network*, doi: 10.1109/MNET.2025.3604901, 2025.

4. **Hao Zhang**, Fuhui Zhou, Wei Wang, Qihui Wu, and Chau Yuen. "A Federated Learning-based Lightweight Network with Zero Trust for UAV Authentication", *IEEE Transactions on Information Forensics and Security*, doi: 10.1109/TIFS.2025.3587624, 2025.

5. **Hao Zhang**, Fuhui Zhou, Qihui Wu, and Chau Yuen. "Distributed Multi-Task Learning for Joint Wireless Signal Enhancement and Recognition", *IEEE Transactions on Cognitive Communications and Networking*, doi: 10.1109/TCCN.2025.3612750, 2025.

6. **Hao Zhang**, Fuhui Zhou, Qihui Wu, and Naofal Al-Dhahir. "SSwsrNet: A Semi-Supervised Few-Shot Learning Framework for Wireless Signal Recognition". *IEEE Transactions on Communications*, vol. 72, no. 9, pp. 5823-5836, doi: 10.1109/TCOMM.2024.3385921.

7. **Hao Zhang**, Fuhui Zhou, Qihui Wu, Wei Wu, and Rose Qingyang Hu. "A Novel Automatic Modulation Classification Scheme Based on Multi-Scale Networks". *IEEE Transactions on Cognitive Communications and Net-

working, vol. 8, no. 1, pp. 97-110, March 2022, doi: 10.1109/TCCN.2021.3091730.

8. **Hao Zhang**, Fuhui Zhou, Qihui Wu, and Chau Yuen."FSOS-AMC: Few-Shot Open-Set Learning for Automatic Modulation Classification Over Multipath Fading Channels", *IEEE Internet of Things Journal*, vol. 12, no. 12, pp. 18718-18731, doi:10.1109/JIOT.2025.3557973, 2025.

9. **Hao Zhang**, Lu Yuan, Guangyu Wu, Fuhui Zhou, and Qihui Wu. "Efficient Automatic Modulation Classification Using Involution based Residual Networks". *IEEE Wireless Communication Letters*, vol. 10, no. 11, pp. 2417-2420, Nov. 2021, doi: 10.1109/LWC.2021.3102069.

10. **Hao Zhang**, and Xianggong Hong. "Recent Progresses on Object Detection: A Brief Review". *Multimedia Tools and Applications*, vol. 78, pp. 27809-27847, doi: 10.1007/s11042-019-07898-2. (**CCF-C**)

11. **Hao Zhang**, Fuhui Zhou, Qihui Wu, and Chau Yuen. "FSOS-AMC: Few-Shot Open-Set Learning for Automatic Modulation Classification." *2024 16th International Conference on Wireless Communications and Signal Processing (WCSP)*, 2024, pp. 746-751, doi: 10.1109/WCSP62071.2024.10826902.

12. **Hao Zhang**, Xianggong Hong, Shifen Zhou and Qingcai Wang. "Infrared Image Segmentation for Photovoltaic Panels Based on Res-Unet". *In: Lin Z. et al. (eds) Pattern Recognition and Computer Vision. PRCV 2019. Lecture Notes in Computer Science, vol 11857.* Springer, Cham. (**CCF-C**)

13. **Hao Zhang**, Xianggong Hong, Li Zhu. "Detecting Small Objects in Thermal Images Using Single-Shot Detector". *Automatic Control and Computer Sciences*, vol. 55, no. 2, pp. 202–211, doi: 10.3103/S0146411621020097.

14. Jin-Jian Xu[†], **Hao Zhang**[†], Chao-Sheng Tang, Yaowen Yang, Lin Li, Dian-Long Wang, Bo Liu, Bin Shi. "Soil Desiccation Crack Recognition: New Paradigm and Field Application." *Journal of Geophysical Research: Machine Learning and Computation*, 2024, doi: 10.1029/2024JH000347. ([†]Co-first authors)

15. Jin-Jian Xu, **Hao Zhang**, Chao-Sheng Tang, Qing Cheng, Bo Liu, Bin Shi, "Automatic Soil Desiccation Crack Recognition Using Deep Learning", *Géotechnique*, vol. 72, no. 4, pp. 337-349, doi: 10.1680/jgeot.20.P.091. **ESI Highly Cited Paper & 75th Géotechnique Anniversary Early Career Award (insightful paper on Artificial Intelligence and Statistics in geotechnics published in the decade 2013-2023)**

16. Jin-Jian Xu, **Hao Zhang**, Chao-Sheng Tang, Qing Cheng, Ben-gang Tian, Bo Liu, and Bin Shi. "Automatic Soil Crack Recognition Under Uneven Illumination Condition with The Application of Artificial Intelligence", *Engineering Geology*, vol. 296, pp. 106495, doi: 10.1016/j.enggeo.2021.106495.

17. Lu Yuan, **Hao Zhang**, Ming Xu, Fuhui Zhou, and Qihui Wu. "A Multi-Scale CNN Framework for Wireless Technique Classification in Beyond 5G Communications", *IEEE Internet of Things Journal*, vol. 9, no. 12, pp. 10366-10367, 15 June15, 2022, doi: 10.1109/JIOT.2021.3132652.

18. Jin-Jian Xu, **Hao Zhang**, Chao-Sheng Tang, Lin Li, Bin Shi. "XGeoS-AI: An Interpretable Learning Framework for Deciphering Geoscience." *Environmental Earth Sciences*, 2025, doi: 10.1007/s12665-025-12095-6.

19. Qinqin Zhou, **Hao Zhang**, and Suya Wang. "Artificial Intelligence, Big Data, and Blockchain in Food Safety, *International Journal of Food Engineering*, vol. 18, no. 1, 2022, pp. 1-14.

20. Chunyu Liu, **Hao Zhang**, Fuhui Zhou, Wei Wu, Qihui Wu, Derrick Wing Kwan Ng, Tony Q. S. Quek, and Chan-Byoung Chae. "SpectrumFM: Redefining Spectrum Cognition via Foundation Modeling." In 2025 IEEE Global Communications Conference (GLOBECOM), accepted, 2025.

21. Ziheng Tong, **Hao Zhang**, Ming Xu, and Fuhui Zhou. "An Accurate Few-Shot Spectrum Anomaly Detection Method Using the Contrastive Language-Image Pre-training Model." In 2025 International Conference on Ubiquitous Communication (Ucom), accepted, 2025.

22. Rui Ding, **Hao Zhang**, Fuhui Zhou, Qihui Wu, and Zhu Han. "Data-and-Knowledge Dual-Driven Automatic Modulation Recognition for Wireless Communication Networks", *IEEE ICC 2022– IEEE International Conference on Communications*, 2022, pp. 1962-1967, doi: 10.1109/ICC45855.2022.9838977.

23. Qingcai Wang, **Hao Zhang**, Xianggong Hong, and Qinqin Zhou. "Small Object Detection Based on Modified FSSD and Model Compression". *2021 IEEE 6th International Conference on Signal and Image Processing (ICSIP)*, 2021, pp. 88-92, doi: 10.1109/ICSIP52628.2021.9688896.

24. Yifan Wei, Xiaodong Liu, **Hao Zhang**, Fuhui Zhou, and Qihui Wu. "GenSpectraLM: Large Model-Driven Spectrum Map Construction with Electromagnetic Propagation." In 2025 IEEE Global Communications Conference (GLOBECOM), accepted, 2025.

25. Ming Xu, Huixin Ma, **Hao Zhang**, Fuhui Zhou, and Qihui Wu. "PLMSNet: A Pseudo Labeling Multi-Scale Network for Semi-Supervised Spectrum Sensing." In 2025 IEEE Global Communications Conference (GLOBE-COM),accepted, 2025.

26. Linsheng Hu, Yihao Li, **Hao Zhang**, Lu Yuan, Fuhui Zhou, and Qihui Wu, "Robust semantic communications driven by knowledge graph", ***The 9th International Conference on Internet of Things: Systems, Management and Security (IOTSMS 2022)***, 2022, pp. 1-5, doi: 10.1109/IOTSMS58070.2022.10061867.

27. Ming Xu, Yuhang Wu, **Hao Zhang**, Lu Yuan, Yiyao Wan, Fuhui Zhou, and Qqihui Wu, "GAN-enabled robust backdoor attack for UAV recognition", ***2022 International Conference on Communication, Image and Signal Processing (CCISP 2022)***, 2022, pp. 474-478, doi: 10.1109/CCISP55629.2022.9974216.

28. Ruitao Wang, **Hao Zhang**, Ming Xu, Fuhui Zhou, Qihui Wu. "A Novel Lightweight Automatic Modulation Classification Scheme Based on Inverted Residuals", ***2023 International Conference on Ubiquitous Communication (Ucom)***, Xi'an, China, 2023, pp. 259-263.

29. Dongjun Han, **Hao Zhang**, Shujie Wang, Wei Chai, Haonan Zhou, Fuhui Zhou. "Small Objects Recognition by Exploiting an Improved YOLOv5 Algorithm on the UAV Platform", ***2023 International Conference on Ubiquitous Communication (Ucom)***, Xi'an, China, 2023, pp. 193-198.

30. Shijin Zhao, Qihui Wu, Fuhui Zhou, **Hao Zhang**, Yang Huang, and Kai-Kuang Ma. "Cognitive Escape Reinforcement Learning for Complex Decision Making." *IEEE Transactions on Vehicular Technology*, accepted, 2025.

31. Jin-Jian Xu, Chao-Sheng Tang, Yaowen Yang, Lin Li, **Hao Zhang**, Qing Cheng, Xi-Ying Zhang, Bo Liu, and Bin Shi. "Breathing Phenomenon of Soil Desiccation Cracking: Insights From Novel Geophysical Observations". ***Journal of Geophysical Research: Earth Surface*** 129 (2024): e2023JF007318.

32. Xuwei Huang, Xiaopeng Huang, Chunyu Liu, **Hao Zhang**, Fuhui Zhou, and Qihui Wu. "From Survey to Design: Knowledge-Enhanced Multimodal Spectrum Foundation Model for Intelligent Spectrum Management." In 2025 International Conference on Ubiquitous Communication (Ucom), accepted, 2025.

33. Donghui Zhang, Xiaoyu Yan, Huixin Ma, Ming Xu, **Hao Zhang**, and Fuhui Zhou. "YOLOv10-P2: A Robust Detection Scheme for UAV Signals in RF Spectrograms." In 2025 International Conference on Ubiquitous Communication (Ucom), accepted, 2025.

✈ Under Review

1. **Hao Zhang**, Chunyu Liu, Fuhui Zhou, and Qihui Wu. "Spectrum Foundation Model: A New Paradigm Towards General Spectrum Cognition and Decision", ***IEEE Communications Magazine***. (Under Review).

2. Fuhui Zhou, Chunyu Liu, **Hao Zhang**, Wei Wu, Qihui Wu, Derrick Wing Kwan Ng, Tony Q. S. Quek, and Chan-Byoung Chae, "SpectrumFM: A Foundation Model for Intelligent Spectrum Management", ***IEEE Journal on Selected Areas in Communications***. (Under Review)

✇ Patents

1. **Hao Zhang**, Fuhui Zhou, Jiaxin Ding, Liang Chang, Shengmei Luo, Zhihong Lu, Qihui Wu. "A semi-supervised intelligent and accurate recognition method for small sample wireless signals", C.N. Patent (CN 119128666 A)

2. Fuhui Zhou, Rui Ding, Ming Xu, **Hao Zhang**, Lu Yuan, Qihui Wu and Chao Dong. "Intelligent data and knowledge-driven method for modulation recognition". U.S. Patent (Application: 17/901,86)

⬢ Projects

2024.12 2023.06	Few Sample Modulation Identification under High Dynamic Environment ❯ Postgraduate Research & Practice Innovation Program of Jiangsu Province (Grant KYCX23_0380), **Project Leader**
2024.06 2023.06	Research on Comprehensive Mechanical Performance of Coral Concrete Foundation Island and Reef Wind Turbines Based on Interpretable Deep Learning ❯ Interdisciplinary Innovation Fund for Doctoral Students of NUAA (No. KXKCXJJ202302), **Project Co-Leader**
2020.06 2018.06	Research on lightweight convolutional neural network ❯ Innovation Fund for Graduate of Nanchang University (No. CX2018145), **Project Leader**

⚲ Honors

❯ Excellent Graduates, Nanjing University of Aeronautics and Astronautics, Dec. 2024.
❯ Chinese Government Scholarship, Chinese Scholarship Council (CSC), Jul. 2023.
❯ Top-notch Postgraduate Innovative Talents Training "Yinhang Project" of NUAA, May 2022.
❯ Outstanding Graduates of Nanchang University (4%), Jun. 2020.
❯ The First Prize Graduate Scholarship of Nanchang University, May 2020.
❯ The First Prize Graduate Scholarship of Nanchang University, May 2019.
❯ The Second Prize Graduate Scholarship of Nanchang University, May 2018.
❯ The Third Prize of 12th Graduate Electronics Design Contest(Huazhong), Jul. 2017.
❯ The First Prize Scholarship of Nanchang University, May 2017.
❯ The First Prize Scholarship of Nanchang University, Nov. 2016.
❯ The Special Grade Scholarship of Nanchang University, Nov. 2015.
❯ The First Prize Scholarship of Nanchang University, Nov. 2014.
❯ The Second Prize Scholarship of Nanchang University, Apr. 2014.

⚑ Other

❯ **Academic services:** IEEE Member, CCF, IEEE ComSoc, IEEE GRSS, CAAI; IEEE ICC25-SAC TPC Member, IEEE VTC-Spring 2024 Session Chair and Volunteer
❯ **Journal Reviewer:** IEEE JSAC, IEEE TNNLS, IEEE GRSM, IEEE CIM, IEEE TIFS, IEEE TWC, IEEE TCOM, IEEE TCCN, IEEE TVT, IEEE IOTJ, IEEE WCL, IEEE CL, IEEE Network, IEEE Systems Journal, China Communications, Scientific Reports;
❯ **Confrenece Reviewer:** ACM MM 2025, IEEE WCSP 2020, IEEE GLOBECOM 2021/2022/2024, IEEE ICCC 2022, IEEE VTC2022-Fall.