

Hao Zhang

PH.D. CANDIDATE @ NANJING UNIVERSITY OF AERONAUTICS AND ASTRONAUTICS

VISITING PH.D. STUDENT @ NANYANG TECHNOLOGICAL UNIVERSITY

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About Me

I am now a last year Ph.D. candidate (EGD: **Mar 2025**) under the supervision of Prof. Fuhui Zhou in **College of Electronic and Information Engineering, Nanjing University of Aeronautics and Astronautics**. I was selected as a member of **Top-notch Postgraduate Innovative Talents Training Yinhang Project of NUAA** in 2022. I have received a Master of Engineering degree, and a Bachelor's degree from **Nanchang University**, majoring in Electrical and Communication Engineering and Internet of Things Engineering in 2020 and 2017. From Jan 1st 2024, I am now a **visiting Ph.D. student** under the supervision of Assoc Prof **Chau Yuen's** group in the **School of Electrical & Electronic Engineering, Nanyang Technological University** supported by Chinese Government Scholarship from China Scholarship Council (CSC). Until now, I have published over 15 papers (Google Scholar citation: **390+**, H index: **11**), including **one ESI highly cited paper**.

Research Interests

My research interests include some sub-fields of Wireless Communication and Signal Processing in the era of Machine Learning/Deep Learning:

- **Deep Convolutional Neural Networks (DCNN)** is a class of artificial neural network with multiple layers between the input and output layers, most commonly applied to analyzing visual imagery.
- **Radio Frequency Machine Learning (RFML)** aims to apply machine learning and deep learning for a multitude of tasks in wireless communications, such as signal classification, spectrum sensing and signal identification and cognitive radio.

Education

Nanyang Technological University

VISITING STUDENT.

under the supervision of Assoc Prof **Chau Yuen's** group

Singapore

Jan 2024-Now

Nanjing University of Aeronautics and Astronautics

PH.D STUDENT.

Majoring in the Information and Communication Engineering. During Jul. 2020-Mar.2021, I served as a research assistant in NUAA.

Nanjing, Jiangsu, China

Apr. 2021-Now

Nanchang University

M.ENG. IN ELECTRICAL AND COMMUNICATION ENGINEERING.

- Outstanding Graduates (4%)

Nanchang, Jiangxi, China

Sep. 2017 - Jun. 2020

Nanchang University

B.S. IN INTERNET OF THINGS ENGINEERING

- Monitor of the class. "Excellent Class" title of Nanchang University (2015-2016).

Nanchang, Jiangxi, China

Sep. 2013 - Jun. 2017

Publications

1. **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, Sept. 2024, doi: 10.1109/TCOMM.2024.3385921.
2. **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 Networking*, vol. 8, no. 1, pp. 97-110, March 2022, doi: 10.1109/TCCN.2021.3091730.
3. **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.
4. **Hao Zhang**, Fuhui Zhou, Qihui Wu, and Chau Yuen. "FSOS-AMC: Few-Shot Open-Set Learning for Automatic Modulation Classification", *16th International Conference on Wireless Communications and Signal Processing (WCSP 2024)*, 2024.
5. **Hao Zhang**, Xianggong Hong. "Recent Progresses on Object Detection: A Brief Review". *Multimedia Tools and Applications*: 78 (19), 27809-27847. (CCF-C)
6. **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)
7. **Hao Zhang**, Xianggong Hong, Li Zhu. "Detecting Small Objects in Thermal Images Using Single-Shot Detector". *Automatic Control and Computer Sciences Aut.* 55, 202-211 (2021).

8. 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*, accepted, doi: 10.1029/2024JH000347. (Co-first author)
9. Jin-Jian Xu, **Hao Zhang**, Chao-Sheng Tang, Qing Cheng, Bo Liu, Bin Shi, "Automatic Soil Desiccation Crack Recognition Using Deep Learning", *Géotechnique* 2022 72:4, 337-349. **Highly Cited Paper & 75th Géotechnique Anniversary Early Career Award (insightful paper on Artificial Intelligence and Statistics in geotechnics published in the decade 2013-2023)**
10. 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*, 2021. <https://doi.org/10.1016/j.enggeo.2021.106495>.
11. 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 June 15, 2022, doi: 10.1109/JIOT.2021.3132652.
12. 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.
13. 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.
14. Qinqin Zhou, **Hao Zhang**, and Suyu Wang. "Artificial Intelligence, Big Data, and Blockchain in Food Safety", *International Journal of Food Engineering*, vol. 18, no. 1, 2022, pp. 1-14.
15. 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 (IOTSMS2022)*, 2022, pp. 1-5, doi: 10.1109/IOTSMS58070.2022.10061867.
16. Ming Xu, Yuhang Wu, **Hao Zhang**, Lu Yuan, Yiyao Wan, Fuhui Zhou, and Qihui 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.
17. 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.
18. 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.
19. 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.

Preprints

1. **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* (minor revision)
2. **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* (under review)
3. **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* (under review)
4. **Hao Zhang**, Fuhui Zhou, Qihui Wu, and Chau Yuen. "Distributed Multi-Task Learning for Joint Wireless Signal Enhancement and Recognition", *IEEE Journal on Selected Topics in Signal Processing* (under review)
5. **Hao Zhang**, Fuhui Zhou, Qihui Wu, and Chau Yuen. "FSOS-AMC: Few-Shot Open-Set Learning for Automatic Modulation Classification under Multipath Fading Channels", *IEEE Transactions on Wireless Communications* (under review)
6. **Hao Zhang**, Fuhui Zhou, Qihui Wu, and Chau Yuen. "Spectrum Cognition: Semantic Situation for Next-Generation Spectrum Management", *IEEE Communications Magazine* (under review)
7. Jin-Jian Xu[†], **Hao Zhang[†]**, Chao-Sheng Tang, Mohamed Ramy El-Maarry, Yao-Wen Yang, Lin Li, Bin Shi. "Drying Induces Mars Intermediate-Sized Cracks: New Evidence and Insight from Geometrical Quantification". (under review) (Co-first author)
8. Jin-Jian Xu[†], **Hao Zhang[†]**, Chaosheng Tang, Lin Li, Dazhan Zhang, Dianlong Wang, and Bin Shi. "XGeoS-AI: An Interpretable Learning Framework for Deciphering Geoscience Image Segmentation". (under review) (Co-first author)
9. Qihui Wu, Shijin Zhao, Fuhui Zhou, **Hao Zhang**, Yang Huang, Kai-Kuang Ma. Cognitive Escape Reinforcement Learning for Complex Decision Making. *Science China: Information Science*, <https://doi.org/10.21203/rs.3.rs-2661516/v1> (under review)

Patents

1. **Hao Zhang**, Fuhui Zhou, Jiaxin Ding, Liang Chang, Shengmei Luo, Zhihong Lu, and Qihui Wu. "Semi-supervised intelligent and accurate identification method for few sample wireless signals", applying for Chinese Invention Patent
2. Fuhui Zhou, Rui Ding, Ming Xu, **Hao Zhang**, Lu Yuan, Qihui Wu and Chao Dong. A data-knowledge dual-driven modulation intelligent identification method. Chinese Invention Patent (Authorize: CN 114157539 B)

Projects

- Few Sample Modulation Identification under High Dynamic Environment**

PI

- **Postgraduate Research and Practice Innovation Program of Jiangsu Province (Grant No. KYCX23_0380).** The goal of this project is the identification of wireless signal under high dynamic environment.

Nanjing, China

2023.06-2024.06
- Research on Comprehensive Mechanical Performance of Coral Concrete Foundation Island and Reef Wind Turbines Based on Interpretable Deep Learning**

Co-PI

- **Interdisciplinary Innovation Fund for Doctoral Students of Nanjing University of Aeronautics and Astronautics (Grant No. KXKCXJJ202302).** The goal of this project is to investigate the interpretable deep learning models.

Nanjing, China

2023.05-2024.06
- Nonconvex Optimization Theory of Multi-domain Resources in Wireless Networks**

MAIN PARTICIPANTS

- **National Outstanding Youth Science Fund.** The goal of this project is to apply machine learning to multi-domain resource optimization, and realize multi-domain resource intelligent management and control.

Nanjing, China

2023.01-2025.12
- Deep spectrum cognition in multi-system complex dynamic environment**

MAIN PARTICIPANTS

- **National Key Research and Development Project.** The goal of this project is to apply deep learning for wireless signal recognition and spectrum sensing.

Nanjing, China

2021.01-2023.12

Honors & Awards

- 2023.11

75th Géotechnique Anniversary Early Career Award, Institute of Civil Engineers (ICE)

Nanjing
- 2023.07

Chinese Government Scholarship, Chinese Scholarship Council (CSC)

Nanjing
- 2022.05

28/year, Graduate Top-notch Innovative Talents Training Program “Yinhang Program”

Nanjing
- 2020.06

4%, Outstanding Graduates of Nanchang University

Nanchang
- 2020.06

1st Prize, Graduate Scholarship of Nanchang University

Nanchang
- 2019.05

1st Prize, Graduate Scholarship of Nanchang University

Nanchang
- 2018.05

2nd Prize, Graduate Scholarship of Nanchang University

Nanchang
- 2017.07

3rd Prize, 12th Graduate Electronics Design Contest (Huazhong Zone)

Changsha
- 2017.05

1st Prize, Scholarship of Nanchang University

Nanchang
- 2016.11

1st Prize, Scholarship of Nanchang University

Nanchang
- 2015.11

Speical Grade, Scholarship of Nanchang University

Nanchang
- 2014.11

1st Prize, Scholarship of Nanchang University

Nanchang
- 2014.05

Excellent League Member, Excellent Students of Nanchang University

Nanchang
- 2014.04

2nd Prize, Scholarship of Nanchang University

Nanchang