Hao **Zhang**

PH.D CANDIDATE

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About Me

I am now a Ph.D candidate under the supervision of **Prof.Fuhui Zhou** in **College of Electronic and Information Engineering**, **Nanjing University of Aeronautics and Astronautics**. I was selected into the Graduate Top-notch Innovative Talents Training "Yinhang Program" of NUAA. I have just recieved a Master of Engineering degree from **Nanchang University**, majoring in the Electrical and Communication Engineering. Before that, I recieved the B.S. degree in the Internet of Things Engineering from Nanchang University in 2017. Until now, I have published over 10 papers focusing on deep learning for wireless communications, semantic segmentation and object detection, 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

Nanjing University of Aeronautics and Astronautics

Nanjing, Jiangsu, China

PH.D STUDENT. *Apr. 2021-Now*

Majoring in the Information and Communication Engineering.

Nanchang University

Nanchang,Jiangxi, China

M.ENG. IN ELECTRICAL AND COMMUNICATION ENGINEERING. *Sep. 2017 - Jun. 2020*

- Outstanding Graduates (4%)

Nanchang University

Nanchang,Jiangxi, China

B.S. IN INTERNET OF THINGS ENGINEERING *Sep. 2013 - Jun. 2017*

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

Publications

1. **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.

2. **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.

3. **Hao Zhang**, Xianggong Hong. Recent Progresses on Object Detection: A Brief Review. *Multimedia Tools and Applications*: 78 (19), 27809-27847. (**CCF-C**)

4. **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**)

5. **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).

6. 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)**

7. 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.

8. 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.

9. 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.

10. 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.

11. 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)*, to be published, 2022.

12. 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.

13. 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, doi: 10.1109/Ucom59132.2023.10257638.

14. 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, doi: 10.1109/Ucom59132.20

Preprints

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* (Under Review)

2. **Hao Zhang** and Jin-Jian Xu. When Geoscience Meets Foundation Models: Towards General Geoscience Artificial Intelligence System. *arXiv preprint arXiv:2309.06799*. https://arxiv.org/abs/2309.06799

3. Jinjian Xu, **Hao Zhang**, Chaosheng Tang, Lin Li, Dazhan Zhang, Dianlong Wang, and Bin Shi. Interpretable Geoscience Artificial Intelligence (XGeoS-AI): Application to Demystify Image Recognition. 2023. (Under Review)

4. Qihui Wu, Shijin Zhao, Fuhui Zhou, **Hao Zhang**, Yang Huang, Kai-Kuang Ma. Cognitive Escape Reinforcement Learning for Complex Decision Making. *Communications Engineering*, https://doi.org/10.21203/rs.3.rs-2661516/v1 (Under Review)

5. Jin-Jian Xu, Chaosheng Tang, Yao-Wen Yang, Lin Li, **Hao Zhang**, Qing Cheng, Xi Zhang, Bo Liu and Bin Shi. Breathing Phenomenon of Soil Desiccation Cracking: Field Monitoring and Insights. (Under Review)

Patents

1. 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)

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

Few Sample Modulation Identification under High Dynamic Environment

Nanjing, China

PI

2023.06-2024.06

- **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.

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

Nanjing, China

Co-PI

2023.05-2024.06

- **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.

Nonconvex Optimization Theory of Multi-domain Resources in Wireless Networks

Nanjing, China

Main participants

2023.01-2025.12

- **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.

Deep spectrum cognition in multi-system complex dynamic environment

Nanjing, China

Main participants

2021.01-2023.12

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

Honors & Awards

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*