Zhihao Tao

Email: taozh@smail.nju.edu.cn Cell: (+86) 18349287595
Address: 163 Xianlin Road, Qixia District, Nanjing, Jiangsu Province, China, 210023

RESEARCH INTERESTS

- **Wireless Communications and Networks**
  - Multiple-antenna technology, massive MIMO
  - Wireless channels
- **Machine Learning and Optimization Theory**
  - Application of ML toward communications and networking
  - Application of optimization theory in telecommunications
- **Signal Processing for Communications**

EDUCATION

- **Nanjing University, Nanjing, China** **September 2018 – June 2021**

School of Electronic Science and Engineering Research Master in Communication and Information Systems

  - Advisor: Prof. Shaowei Wang
  - Outstanding Graduate (Class of 2021)
  - Core courses include Matrix Theory, Modern Digital Signal Processing, Digital Communication, and etc.
- **Sichuan University, Chengdu, China** **September 2014 – June 2018**

College of Electronics and Information Engineering Bachelor in Electronics and Information Engineering

  - GPA: 3.67/4.0 Overall Score: 88.8/100 Ranking: 4/51 (Honors class)
  - Outstanding Graduate (Class of 2018)
  - Core courses include Modern Communication Technology, Antenna Theory and Design, RF Communication Circuit, Computer Communication and Networks, Digital Signal Processing, Signals and Systems, Programming Language, Mathematics, Physics, and etc.

PUBLICATIONS AND PATENTS

[1] **Zhihao Tao** and Shaowei Wang, "Improved Downlink Rates for FDD Massive MIMO Systems through Bayesian Neural Networks-Based Channel Prediction", *IEEE Transactions on Wireless Communications*, DOI 10.1109/TWC.2021.3109908, Sep. 2021. [PDF]

[2] **Zhihao Tao** and Shaowei Wang, "How Often Do We Need to Estimate Wireless Channels in Massive MIMO with Channel Aging?", in *Proceedings of the IEEE Global Communications Conference 2021 (GLOBECOM'21)*, accepted, Aug. 2021. [PDF]

[3] **Zhihao Tao**, Tianyu Wang, and Shaowei Wang, "Improve Downlink Rates of FDD Massive MIMO Systems by Exploiting CSI Feedback Waiting Phase", in *Proceedings of the IEEE Global Communications Conference 2019 (GLOBECOM'19)*, Waikoloa, HI, USA, Dec. 2019. [PDF]

[4] Shaowei Wang and **Zhihao Tao**, "Channel Prediction-Aided FDD Massive MIMO Systems Based on Bayesian Neural Networks", Nanjing University, China Patent, No. 2020112065996, 2021.

[5] Shaowei Wang, **Zhihao Tao**, Tianyu Wang, Linzhi Shen, and Siqi Liu, "A High Rate Downlink Data Precoding and Transmission Method for FDD Massive MIMO Systems", Nanjing University, China Patent, No. 2020100501693, 2020.

RESEARCH EXPERIENCES

- **Massive MIMO for Maximal Spectral Efficiency: How Often Do We Need to Estimate Wireless Channels with Channel Aging?** **November 2020 – April 2021**

Advisor: Prof. Shaowei Wang School of Electronic Science and Engineering, Nanjing University

- Proposed a novel channel estimation scheme for time-division-duplex massive MIMO systems, which could fully exploit the redundancy among actual user coherence times by exploring temporal channel correlations underlying the channel aging effect.
- Derived closed-form expressions for the achievable spectral efficiency under channel estimation and aging, and formulated a combinatorial optimization problem to determine the optimal time interval of channel estimation in the proposed scheme.
- Numerical simulations demonstrated that the proposed estimation scheme could offer great spectral efficiency gains over the conventional one, and provided insights on how to put into practice the proposed scheme.
- This work has been accepted for publication in IEEE GLOBECOM 2021.

➢ **Improved Downlink Rates for FDD Massive MIMO Systems through Bayesian Neural Networks-Based Channel Prediction** **May 2019 – September 2020**

Advisor: Prof. Shaowei Wang School of Electronic Science and Engineering, Nanjing University

- Proposed a channel prediction-aided FDD scheme to exploit the channel state information (CSI) feedback waiting phase in downlink transmission of FDD massive MIMO systems.
- Investigated the existing channel prediction methods for SISO, MIMO and massive MIMO systems extensively.
- Proposed a novel channel prediction approach based on Bayesian neural networks, which could yield better predictions by handling the uncertainty in a natural manner and learn regularization from data.
- Numerical simulations demonstrated that our proposed channel prediction approach outperformed the state-of-the-art prediction techniques such as the AR model and the LSTM network from the viewpoint of both prediction quality and system performance, and our proposed channel prediction-aided FDD scheme can achieve significant performance gains as compared to the one without prediction.
- This work has been published in IEEE Transactions on Wireless Communications.

➢ **Improve Downlink Rates of FDD Massive MIMO Systems by Exploiting CSI Feedback Waiting Phase** **December 2018 – April 2019**

Advisor 1: Prof. Shaowei Wang School of Electronic Science and Engineering, Nanjing University

Advisor 2: Prof. Tianyu Wang School of Electronic Science and Engineering, Nanjing University

- Investigated the effects of the channel state information (CSI) feedback waiting phase on downlink rates when deploying a large number of antennas at base stations in FDD massive MIMO systems.
- Studied how previous researches reduced prohibitively heavy signaling overhead in FDD massive MIMO systems.
- Proposed two novel downlink precoding and transmission schemes for FDD massive MIMO systems, which can improve available downlink rates by exploiting the CSI feedback waiting phase.
- This work has been published in IEEE GLOBECOM 2019.

➢ **Face Recognition Research** **March 2017 – May 2018**

Advisor: Prof. Yinjie Lei Institute of Intelligent Control, Sichuan University

- Studied face recognition algorithms and implemented an integrated face recognition Windows application using C++ and OpenCV framework.
- Used machine learning and deep learning approaches to improve the traditional face recognition algorithms.
- This work won the second prize in "JINDIAN cup" the 14th science and technology innovation competition at Sichuan University and was selected into the innovation training program for college students in Sichuan province.

WORK EXPERIENCES

➢ **February 2019 – June 2019** **Nanjing, China**

Teaching Assistant in Nanjing University: Served as a teaching assistant for the undergraduate course “Mobile Communications”; Prepared course materials, interacted with students to clear their doubts in the class, and etc.

➢ **February 2018 – May 2018** **Chengdu, China**

Intern in Wanjiang Technology: Designed and developed a cross-platform mobile application using C#, SQL Server, WebAPI, Ionic, and etc.

- **October 2017 – December 2017** **Chengdu, China**
  Intern in Hwadee Technology: Designed and developed Web applications using Java, JavaScript, HTML, Microservices, and etc.

SELECTED HONORS AND AWARDS

11/2020	The First-Class Academic Scholarship for Postgraduate Students at Nanjing University
12/2019	Outstanding Graduate Student Award at Nanjing University
12/2019	The Third Prize in "HUAWEI Cup" the 16th China Post-Graduate Mathematical Contest in Modeling
12/2019	The Second-Class Academic Scholarship for Postgraduate Students at Nanjing University
12/2018	The First-Class Postgraduate Admission Scholarship at Nanjing University
06/2018	The Third Prize for Outstanding Undergraduate Thesis (Design) at Sichuan University (top 10%)
12/2016	National Encouragement Scholarship (top 5%)
11/2015	National Scholarship Award Issued by Ministry of Education of China (top 2%)
10/2015	The Second Prize in the Mathematical Modeling Contest at Sichuan University
10/2015	The Second Prize in the 7th National Mathematics Competition for College Students (Non-mathematics major)

TECHNICAL SKILLS

Programming Languages:	Matlab, Python, C, C++, Java, etc.
Machine Learning:	TensorFlow, Pytorch, Sklearn, etc.
Software Development:	Android, Web application, Ionic, OpenCV, etc.
Languages:	Chinese (Native), English (TOEFL iBT score: 108/120)