# Wenbin Zhai

## PERSONAL DATA

**ADDRESS:** 29 Jiangjun Road, Nanjing, China, 211106
**EMAIL:** wenbinzhai@nuaa.edu.cn
**RESEARCH INTERESTS:** Routing optimization and cybersecurity in wireless sensor networks
**PHONE:** +86 15094327338

## EDUCATION

**2020 – 2023**   **Master by Research of Computer Science and Technology**
College of Computer Science and Technology, Nanjing University of Aeronautics and Astronautics (NUAA), China (**2023 USNEWS Ranking for Computer Science #161**)
GPA: 85.4/100, Ranking A (Top 15%)
**Thesis Topic: Research on Routing Protocol for Multi-hop Unmanned Aerial Vehicle Ad-hoc Networks**
Supervised by Associate Professor. Liang Liu and Associate Professor. Youwei Ding (Nanjing University of Chinese Medicine)

**2016 – 2020**   **Bachelor of Computer Science and Technology**
School of Artificial Intelligence and Information Technology, Nanjing University of Chinese Medicine (NJUCM), China
GPA: 86/100, Ranking 8/61 (Professional GPA: 90.8/100, Top 5%)
**Thesis Topic: Design and Implementation of a Method for the Safe Storage of Chinese Medicine Data based on Homomorphic Encryption**
Supervised by Associate Professor. Youwei Ding

## SELECTED AWARDS AND HONOURS

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|---|---|
| **Apr. 2023** | Merit Student of Jiangsu Province **(1 postgraduate student in the college each year)** |
| **Apr. 2023** | Outstanding Graduate of NUAA |
| **Dec. 2022** | Merit Student of NUAA (2021-2022) |
| **Dec. 2022** | Advanced Individual in Research and Innovation of NUAA (2021-2022) |
| **Sep. 2020- Sep. 2022** | Second Class Scholarship for Graduate Students of NUAA (2020-2023) (CNY 8,000/year) |
| **Jun. 2020** | Outstanding Graduate of NJUCM |
| **Dec. 2019** | Merit Student of NJUCM (2018-2019) |
| **Dec. 2018- Dec. 2019** | National Encouragement Scholarship in China (2017-2019) (CNY 5,000/year) |
| **Dec. 2018- Dec. 2019** | First Class Scholarship for Undergraduates of NJUCM (2017-2019) (CNY 2,500/year) |
| **Dec. 2018** | Principal's Special Award of NJUCM (2017-2018) (CNY 10,000) **(10 students in the university each year)** |
| **Dec. 2018** | Fei Xiaotong Virtue Scholarship (CNY 6,000) |

## PUBLICATIONS

**Journal Paper:**

- **Wenbin Zhai**, Liang Liu, Youwei Ding, Shanshan Sun, and Ying Gu, "ETD: An Efficient Time Delay Attack Detection Framework for UAV Networks" in **IEEE Transactions on Information Forensics and Security (TIFS)**. [16 double-column pages] [**CORE A**, CCF A, SCI-Q1, IF 7.231] [Publication]

- **Wenbin Zhai**, Shanshan Sun, Liang Liu, Youwei Ding, and Wanying Lu, "HOTD: A Holistic Cross-Layer Time Delay Attack Detection Framework for UAV Networks" in **Journal of Parallel and Distributed Computing (JPDC)**. [14 double-column pages] [**CORE A**, CCF B, SCI-Q1, IF 4.542] [Publication]
- **Wenbin Zhai**, Xin Li, Liang Liu, Youwei Ding, and Wanying Lu, "ESTA: An Efficient Spatial-Temporal Range Aggregation Query Processing Algorithm for UAV Networks" in **Future Generation Computer Systems (FGCS)**. [14 double-column pages] [**CORE A**, CCF C, SCI-Q1, IF 7.307] [Under Review]
- **Wenbin Zhai**, Feng Wang, Liang Liu, Youwei Ding, and Wanying Lu, "Federated Semi-Supervised and Semi-Asynchronous Learning for Anomaly Detection in IoT Networks" in **IEEE Internet of Things Journal (IOTJ)**. [17 double-column pages] [CCF C, SCI-Q1, IF 9.471] [Under Review]
- **Wenbin Zhai**, Liang Liu, Ying Gu, Lingling Hu, Xin Li, and Jianfei Peng, "A Holistic Cross-Layer Routing Optimization Framework for UAV networks" [8 double-column pages] [In Preparation]
- Weichen Ding, **Wenbin Zhai**, Liang Liu, Ying Gu, and Hang Gao, "Detection of packet dropping attack based on evidence fusion in IoT networks" in **Security and Communication Networks (SCN)**. [13 double-column pages] [CCF C, SCI-Q3, IF 1.968] [Publication]
- Gongshun Min, Liang Liu, **Wenbin Zhai**, Zijie Wang, and Wanying Lu "An Efficient Data Collection Algorithm for Partitioned Wireless Sensor Networks" in **Future Generation Computer Systems (FGCS)**. [16 double-column pages] [**CORE A**, CCF C, SCI-Q1, IF 7.307] [Publication]
- Wenjie Zhao, Yu Wang, **Wenbin Zhai**, Liang Liu, and Yulei Liu, "Effcient Time-Delay Attack Detection Based on Node Pruning and Model Fusion in IoT Networks" in **Peer-to-Peer Networking and Applications (PPNA)**. [15 double-column pages] [CCF C, SCI-Q2, IF 3.488] [Publication]
- Yanlin Wang, Liang Liu, Mengqi Li, **Wenbin Zhai**, Weihua Ma, and Hang Gao, "Power Level Aware Charging Schedule in Wireless Rechargeable Sensor Network" in **Peer-to-Peer Networking and Applications (PPNA)**. [15 double-column pages] [CCF C, SCI-Q2, IF 3.488] [Publication]
- Yu Fan, Liang Liu, Xingxing Zhang, Huibin Shi, and **Wenbin Zhai**, "MAPP: An efficient multi-location task allocation framework with personalized location privacy-protecting in spatial crowdsourcing" in I**nformation Sciences**, 2023, 619: 654-678. [23 single-column pages] [**CORE A**, CCF B, SCI Q1, IF 8.233] [Publication]
- Jiancheng Song, Liang Liu, Yulei Liu, Jie Xi, and **Wenbin Zhai**, "Path Planning for Multi-Vehicle-Assisted Multi-UAVs in Mobile Crowdsensing" in **Wireless Communications and Mobile Computing (WCMC)**, vol. 2022, 21 pages, 2022. [12 double-column pages] [CCF C, SCI-Q3, IF 2.146] [Publication]

**Conference Paper:**
- **Wenbin Zhai**, Liang Liu, Jianfei Peng, Youwei Ding, and Wanying Lu, "PAR: A Power-Aware Routing Algorithm for UAV Networks" in **17th International Conference on Wireless Algorithms, Systems, and Applications (WASA 2022)**, Dalian, China, November 24-26, 2022, Proceedings, Part III. Cham: Springer Nature Switzerland, 2022: 333-344. [12 single-column pages] [CCF C] [Publication]
- Yunfeng Cui, **Wenbin Zhai**, Liang Liu, Youwei Ding, and Wanying Lu, "Link Aware Aggregation Query with Privacy-Preserving Capability in Wireless Sensor Networks" in **3rd International Conference on Emerging Information Security and Applications (EISA 2022)**, Wuhan, China, October 29-30, 2022, Proceedings. Cham: Springer Nature Switzerland, 2023: 209-224. [16 single-column pages] [Publication]
- Wanying Lu, Liang Liu, **Wenbin Zhai**, Haoyuan Chen, and Yulei Liu, "HBC: Combining Lossy and Lossless Hybrid Bilayer Compression Framework on Time-Series Data" in **21th IEEE International Symposium on Parallel and Distributed Processing with Applications (ISPA 2023)**, Wuhan, China, December 21-24, 2023. [12 double-column pages] [CCF C] [Accepted]
- Kaibin Zhang, Liang Liu, **Wenbin Zhai**, Youwei Ding, and Jun Hu, "OSIS: Obstacle-Sensitive and Initial-Solution-First Path Planning" in **29th IEEE International Conference on Parallel and Distributed Systems (ICPADS 2023)**, Hainan, China, December 17-21, 2023. [10 double-column pages] [CCF C] [Accepted]
- Kun Guo, Liang Liu, **Wenbin Zhai**, and Youwei Ding, "EKR: An Efficient K-anycast Routing in UAV Networks" in **9th International Conference on Computer and Communications (ICCC 2023)**, Chengdu, China, December 8-11, 2023. [10 double-column pages] [Accepted]

- Zixiao Zhou, Liang Liu, **Wenbin Zhai**, Jiancheng Song, and Yulei Liu, "Power-Aware Path Planning for Vehicle-Assisted Heterogeneous UAVs in Mobile Crowd Sensing" in **2023 International Conference on Data, Information and Computing Science (CDICS 2023)**, Singapore, December 8-10, 2023. [6 double-column pages] [Accepted]
- Lingling Hu, Liang Liu, Yulei Liu, **Wenbin Zhai**, and Xinmeng Wang, "A robust fixed path-based routing scheme for protecting the source location privacy in wsns" in **17th International Conference on Mobility, Sensing and Networking (MSN 2021)**, Exeter, UK, December 13-15, 2021, IEEE, 2021: 48-55. [8 double-column pages] [CCF C] [Publication]

## R E S E A R C H   E X P E R I E N C E

**Sep 2021 – date**

**Master Research**
Aeronautical Computing Laboratory
Institute of Data Management and Knowledge Engineering
Nanjing University of Aeronautics and Astronautics (NUAA)
Supervisor: Associate Professor. Liang Liu and Associate Professor. Youwei Ding

- **Topic: Cybersecurity in Wireless Sensor Networks**
- Proposed a **holistic cross-layer time delay attack detection framework (HOTD)** to detect time delay attack in UAV networks, which is easy to implement and difficult to detect. First, we perform a **holistic selection** of delay-related features at each layer of UAV networks. Then, supervised learning is used to construct a **consistency model** between these selected features and the corresponding forwarding delay, based on which the **consistent degree** of each node can be calculated. Finally, the K-Means clustering method is utilized to distinguish malicious nodes from benign ones according to their consistent degrees. (2021-2022, published in journal **Journal of Parallel and Distributed Computing (JPDC) [CORE A, CCF B, SCI-Q1]**)
- Put forward an **efficient time delay attack detection scheme (ETD)** to detect time delay attack in UAV networks, which is a less explored attack surface. First, we conduct a comprehensive selection of delay-related features from four different dimensions, namely **delay, node, message and connection**, based on which **one-class classification** is used for model training. Then, the forwarding behaviours of all nodes can be evaluated and their trust values can be obtained, based on which benign nodes can be distinguished from malicious ones. (2022, published in journal **IEEE Transactions on Information Forensics and Security (TIFS) [CORE A, CCF A, SCI-Q1]**)
- Working on designing a **federated semi-supervised and semi-asynchronous learning (FedTSA)** for anomaly detection in IoT networks, which considers a more realistic **semi-supervised scenario** for IoT networks. A **semi-asynchronous model update and staleness tolerant distribution scheme** is proposed to achieve the trade-off between the round efficiency and detection performance, and **the staleness of local models and the participation frequency of clients** are considered to balance the contributions to the global model. In addition, a **group-based** aggregation function is conducted to deal with the non-IID data, and the **difference transmission** based on the sparse matrix is adopted to reduce the communication cost. (2022-date, submitted to journal **IEEE Internet of Things Journal (IOTJ) [CCF C, SCI-Q1]**)

**Sep 2020– Sep 2021**

**Master Research**
Aeronautical Computing Laboratory
Institute of Data Management and Knowledge Engineering
Nanjing University of Aeronautics and Astronautics (NUAA)
Supervisor: Associate Professor. Liang Liu and Associate Professor. Youwei Ding

- **Topic: Routing Optimization for UAV Ad-hoc Networks**

- Proposed a **power-aware routing (PAR)** algorithm to optimize energy consumption in delay-constrained UAV networks which takes the **adjustable power** of UAVs into consideration and utilizes the **pre-planned trajectory information** to calculate encounters at different power levels, thereby constructing a **power-aware encounter tree** to find the transmission path with minimum energy consumption from the source to the destination within the delay constraint. (2020-2021, published in conference **WASA 2022 [CCF C]**)
- Designed an efficient **spatial-temporal range aggregation query processing (ESTA)** algorithm for UAV networks. Based on the constructed **topology change graph (TCG)**, an efficient **shortest path algorithm** is proposed to obtain the user query delay. Then ESTA transforms the aggregation processing of query results into recursively solving the **set cover problem**, thus constructing a **spatial-temporal aggregation tree (STAT)** to find an efficient in-network aggregation routing path for query results without sacrificing the user query delay. (2022, submitted to journal **Future Generation Computer Systems (FGCS) [CORE A, CCF C, SCI-Q1]**)

| Jan 2020 – Sep 2020 | **Master Project** |
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**Master Project**
Aeronautical Computing Laboratory
Institute of Data Management and Knowledge Engineering
Nanjing University of Aeronautics and Astronautics (NUAA)
Supervisor: Associate Professor. Liang Liu

- **Topic: Multi-CDN Integration Platform**
- Built a CDN **scheduling** platform, which integrates the resources of different CDN server providers, thus overcoming the shortage of limited resources and scheduling capabilities of a single CDN service provider.
- Integrated and **unified** the interfaces of different CDN service providers (e.g., google, cloudflare). Only one simple configuration through the central control panel can complete the settings of all CDN service providers, saving the operation and maintenance time.
- The distributed data of all CDN service providers are regularly pulled and backed up to the local **time-series database**, based on which we provide users with fast historical queries and real-time queries.

**Jan 2020 – Aug 2020**

**Master Project**
Aeronautical Computing Laboratory
Institute of Data Management and Knowledge Engineering
Nanjing University of Aeronautics and Astronautics (NUAA)
Supervisor: Associate Professor. Liang Liu

- **Topic: Detection of Software Behaviour Baseline**
- Developed a software behaviour baseline **library** to monitor and detect the running behaviour of the software. The library consists of static and dynamic behaviour baseline libraries, in which the **static** one is built by the analysis of the source codes, configuration files, executable programs, etc. through the code analysis tool LLVM and the function granularity control flow graph generator, while the **dynamic** one is formed by using the capture tool strace and Var-grams algorithm to capture the function sequence and system call in the software execution process.
- The software behaviour is judged based on the constructed software behaviour baseline library. If it violates, the software behaviour will be controlled. The control strategies include: stop running, limit execution, and continue execution after alarm.

# ADDITIONAL SKILLS
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- Solid programming skills in J2EE development and Python.

- Full stack development skills: Front-end [HTML, CSS, JavaScript] + Http-Interface Server [Java servlet] + Database [MySQL, SQL Server].