Mr. Hanlin Cai

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OVERVIEW

As a highly motivated and collaborative engineering student with a strong focus on Molecular Communication and the Internet of Nano Things, I have developed expertise in system modeling, data processing and machine learning. My experience spans roles in both industry and research institutions, four peer-reviewed publications, and six international awards from prestigious engineering competitions and conferences.

EDUCATION

University of Cambridge, United Kingdom

Sep. 2024 - Sep. 2025

Master of Philosophy in Engineering, supervised by IEEE Fellow Özgür B. Akan

Research Project: Odor-based Molecular Communication System in Internet of Everything

National University of Ireland, Maynooth (NUIM)

Sep. 2020 - Jun. 2024

Bachelor of Science in Robotics and Intelligent Devices

First Class Honours, Award Mark: 88.1% (Ranking: 1/51, Best Academic Performance Award)

Fuzhou University (FZU, China-Ireland Cooperative Program)

Sep. 2020 - Jun. 2024

Bachelor of Engineering in Automation (Taught in English)

- ➤ GPA: 3.82/4.00, Average Score: 88.72
- **Scholarships:** Innovation Scholarship (Highest Award at NUIM, \$2500), XiamenAir Scholarship (\$1000), First Prize Scholarship (\$1000, Four Times), Best Bachelor Thesis Award of NUIM (Top 1/300).

HONOURS

ACM SIGKDD Undergraduate Scholars (\$1000, for outstanding performance in data mining research)	2024
AAAI Undergraduate Scholars (\$5000, for outstanding performance in machine learning research)	2024
Finalist of China International Internet+ Innovation and Entrepreneurship Competition (Top 3%)	2023
Outstanding Finalist in International Mathematical Contest in Modeling (Top 1% out of 20508 paper)	2023
Best Technology Award in China National Youth Science Innovation Project Competition (Top 1%)	2023
First Prize in China Contemporary Undergraduate Mathematical Contest in Modelling (Top 5%)	2022

PUBLICATIONS

- [1] Hanlin Cai, Yuchen Fang, Jiacheng Huang, Hongling Liao, Meng Yuan, Zhezhuang Xu. "Securing Billion Bluetooth Low Energy Devices Using Cyber-Physical Analysis and Deep Learning Techniques". The 30th ACM SIGKDD Conference on Knowledge Discovery and Data Mining, Undergraduate Consortium. Also presented in the 38th Annual AAAI Conference on Artificial Intelligence, 2024.
- [2] <u>Hanlin Cai</u>, Yuchen Fang, Jiacheng Huang, Meng Yuan, Zhezhuang Xu. "Poster: Hybrid Detection Mechanism for Spoofing Attacks in Bluetooth Low Energy Networks". The 22nd ACM International Conference on Mobile Systems, Applications, and Services (MobiSys), 2024.
- [3] <u>Hanlin Cai</u>, Zheng Li, Jiaqi Hu, Wei Hong Lim, Sew Sun Tiang, Mastaneh Mokayef, Chin Hong Wong. "Optimising Traffic Sign Detection System Using Deep Residual Neural Networks Combined with Analytic Hierarchy Process Model". The 28th International Conference on Artificial Life and Robotics. Recommended for expanding publication in the Journal of Advances in Artificial Life Robotics, 2023.
- [4] <u>Hanlin Cai</u>, Jiacheng Huang, Yuchen Fang, Chen Dan, Zhezhuang Xu. "Detecting Multiple-mix-attack in IoT Networks through Reconstruction and Classification Machine Learning Techniques". *IEEE Sensors Journal. Under Review*, 2024.

RESEARCH EXPERIENCE

Student Researcher, Internet of Everything (IoE) Group, University of Cambridge, UK

Supervisor: Prof. Özgür B. Akan

Outline:

• Exploring novel molecular communication methods to expand the potential of nano-scale networks, focusing on Odor-based systems to enhance information transmission reliability in the Internet of Everything.

July 2024 - Present

Key Responsibilities:

• Developed an efficient and resilient molecular communication system based on Odor intensity and frequency shift keying to encode information; employed RNN and CNN models to enhance odor molecule recognition.

Achievement:

• Achieved a threefold improvement over previous benchmarks; paper submitted to IEEE Trans. on MBMC.

Embedded Development Engineer, HUADING Intelligent Manufacturing Technology Co., Ltd., China Mentor: Dr. Yuxiong Xia Jan. 2023 – June 2023

Outline:

• Effectively tackled the complexities of instrument inspection with intricate industrial environments by devising an intelligent inspection system leveraging IoT devices, quadruped robots and cloud computing.

Key Responsibilities:

• Implemented real-time data collection of sensor modules using ESP32; Integrated machine control with visual algorithms to empower quadruped robots to extract and analyse images of industrial instruments.

Achievement:

• Won the **Best Technology Award** in the 2023 China National Youth Science Innovation Project Competition.

Research Intern, State Key Laboratory of Industrial Automation Control Technology, China Supervisors: Prof. Zhezhuang Xu and Dr. Yuan Meng Oct. 2022 – June 2024 Outline:

Addressed the security vulnerabilities and susceptibility to attacks in Bluetooth Low Energy Networks utilising a hybrid attack detection mechanism based on cyber-physical features and machine learning.
 Key Responsibilities:

• Established a BLE experimental platform, collected datasets using BLE Sniffer, nRF Connect and Wireshark. Developed an attack detection algorithm based on temporal convolutional network, text-CNN and SVM.

Achievement:

• Secured a research grant over \$5000; Authored two research paper and accepted into **AAAI** and **ACM KDD**.

Research Intern, Centre for the Integration of Science, Technology & Culture, University of Cambridge, UK Supervisor: Prof. Pietro Liò June 2022 – Dec. 2022

Outline:

• Resolved the challenge of detecting multiple-mix-attacks within IoT networks by developing a detection framework that integrates reconstruction and classification learning approaches.

Key Responsibilities:

- Developed a multiple-mix-attacks detection algorithm based on LSTM model and random forest algorithm. **Achievement:**
- Research report achieved a ranking within Top 3%; Won an outstanding oversea visiting scholarship (\$2500).

SKILLS

Language Skills: English (Fluent, IELTS 7.5), Mandarin (Native), Hokkien (Native).

Programming: Proficient in MATLAB, Python, LaTeX; experienced in C++, HTML, CSS, JavaScript, Bash.

Hobbies: Swimming (Reached Chinese national second-level swimming athlete standard).