

# Mr. Hanlin Cai

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## OVERVIEW

As a highly motivated and collaborative engineering student with a strong focus on Intelligent Communication and Cyber-Physical Systems, 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: Semantic-Driven Communication System for Intelligent Healthcare.

### 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)*

- Average Score: 88.72 (Ranking: 1/60)
- **Scholarships:** Innovation Scholarship (highest award in university, \$2500), President's Scholarship (\$1000), First Prize Scholarship (\$1000, five times), Best Bachelor Thesis Award (top 1/300).

## HONOURS

ACM SIGKDD Undergraduate Scholar (\$1000, for outstanding performance in data mining research)	2024
AAAI Undergraduate Scholar (\$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] [Hanlin Cai](#), 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] [Hanlin Cai](#), 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] [Hanlin Cai](#), Ozgur B. Akan. “Semantic Learning for Molecular Communication in Internet of Bio-Nano Things”. *Submitted to IEEE Transactions on Molecular, Biological, and Multi-Scale Communications*, 2025. Preprint: [arxiv.org/abs/2502.08426](https://arxiv.org/abs/2502.08426).

## RESEARCH EXPERIENCE

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

**Supervisor: Prof. Özgür B. Akan**

**June 2024 – Present**

**Outline:**

- Developed an end-to-end semantic learning framework for molecular communication in the IoBNT, enabling efficient and robust transmission of task-relevant information under resource-constrained conditions.

**Key Responsibilities:**

- Implemented the Semantic learning framework based on joint source channel coding, incorporating semantic feature extraction and molecular signal modulation to enable end-to-end training with physical constraints.

**Achievement:**

- Achieved a 32% performance improvement over traditional method; paper was submitted to *IEEE TMBMC*.

**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 based smart IoT devices, quadruped robots and cloud computing.

**Key Responsibilities:**

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

**Achievement:**

- Won the **Best Technology Award** in China National Youth Science Innovation Project Competition (top 1%).

**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 mechanism based on temporal convolutional network, text-CNN and SVM.

**Achievement:**

- Secured a NSF Grant over \$5000; Authored two research paper presented in *MobiSys 2024* and *KDD 2024*.

**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 mixed attacks in wireless sensor networks (WSNs) by designing a learning-based detection framework that integrates reconstruction and classification methodologies.

**Key Responsibilities:**

- Developed a multiple-mix-attacks detection algorithm using graph neural network and random forest models.

**Achievement:**

- Established a state-of-the-art detection benchmark and a large-scale dataset for WSNs security research.

## SKILLS

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**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 China national second-level swimming athlete standard).