Hailong Gong

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Research Interests

Computer architecture, Reconfigurable computing, FPGA-based acceleration, Large Language Models, AI Infrastructure.

Education

The University of Sydney (QS TOP 30) Mar.2026 - Sep.2029 (expected)

Doctor of Philosophy (Engineering), Advisor: Prof. Philip Leong

Australian National University (QS TOP 30) Feb.2024 - Dec.2025

M.S. Computing (Advanced), GPA:6.67 / 7.0 Advisor: Prof. Amanda S. Barnard AM, Dr. Haibo Zhang

Beijing Institute of Technology (Project 985) Sep.2018 - Jun.2022

B.S. Computer Science and Technology

Industry Experience

Shenzhen Yimeizhi Technology Co., Ltd Shenzhen, China Mar.2023 - Dec.2023

Computer Vision Algorithm Engineer HR Manager: *Wenxian Gan*

• Designed and developed the front-end interface using QT according to the design document, including control layout and window response, improving the operability and practicality of the software.
• Optimized Automatic Optical Inspection module performance through debugging, tuning, and introducing advanced algorithms, achieving a 10% reduction in missed detection rate and 12% in false detection rate.
• Researched and developed parallel computing solutions using CUDA Programming, leading to a 40% reduction in detection efficiency and significantly improving software performance.

ByteDance, Quality Lab Beijing, China Oct.2021 - Feb.2022

Algorithm Engineer Intern Supervisior: Zhao Zhang

• Optimized reinforcement learning algorithms in the software testing tool *Fastbot*.
• Enhanced test coverage and problem interception rate, significantly improving efficiency and quality.

Publications

- **LightMat-HP: A Photonic-Electronic System for Accelerating General Matrix Multiplication With Configurable Precision *(under review)***
- **Leveraging Multi-Stream Information Fusion for Trajectory Prediction in Low Illumination Scenarios: A Multi-channel Graph Convolutional Approach *HaiLong Gong***, ZiRui Li, Chao Lu, GuoDong Du, JianWei Gong, IEEE Transactions on Intelligent Transportation Systems (T-ITS).
- **Towards Online Risk Assessment for Human-robot Interaction: A Data-driven Hamilton-Jacobi-Isaacs Reachability Approach**, ***HaiLong Gong***, ZiRui Li, Chao Lu, JianWei Gong, 26th IEEE International Conference on Intelligent Transportation Systems (ITSC2023).
- **Towards Safe, efficient and Co-operative Decision-making for CAVs in Mixed Autonomy: An Attention-Enhanced Graphic Reinforcement Learning Approach *HaiLong Gong***, ZiRui Li, RunHao Zhou, Qi Liu, Chao Lu, JianWei Gong, The 4th Symposium on Management of Future Motorway and Urban Traffic Systems 2022 (MFTS 2022).
- **Fast and Accurate: Perception System of a Formula Student Driverless Car *HaiLong Gong***, Yunji Feng, TaiRan Chen, ZuoOu Li, YunWei Li, 2022 6th International Conference on Robotics, Control and Automation (ICRCA 2022).

Academic Service

- **Reviewer**, *IEEE Transactions on Intelligent Transportation Systems (T-ITS)*
- **Reviewer**, *IEEE Internet of Things Journal (IEEE IoT-J)*

Research Experience

Ultra-fast Photonic Computing for Deep Learning Acceleration on FPGA Jan. 2025 - Jan. 2026

Supervisor: Prof. Haibo Zhang, Prof. Amanda Barnard, AM

• Conducting research on a novel computing paradigm that integrates photonic computing with FPGA-based electronic systems to achieve high-throughput and low-power neural network acceleration.
• Designed a hybrid photonic-electronic architecture based on the ZCU111 RFSoC platform, leveraging multi-channel DACs and ADCs for high-bandwidth analog signal modulation and acquisition.
• Successfully implemented and verified the electrical data path (DMA → DAC → ADC → DMA) using AXI-DMA and RFDC interfaces, establishing the foundation for integrating the photonic computing module.
• Employed Vivado, PYNQ, and Verilog to configure FPGA logic, manage data streams, and control DDS, DAC, and ADC blocks for system-level prototyping.
• Currently in the system integration and testing phase, with planned evaluations of throughput and latency; targeting publication in top-tier journals in computer architecture or optoelectronic systems.

Parallelized Advection Solver on GPU and Multicore CPU Feb. 2025 – May. 2025

Course Project | ANU COMP8300 Parallel Computing, Instructor: Prof. John Taylor

• Developed a high-performance 2D advection solver using CUDA and OpenMP, effectively targeting both shared-memory and GPU-based parallelism architectures for fluid dynamics simulation.
• Designed optimized GPU kernels with shared-memory tiling, warp-level parallelism, and loop unrolling, significantly reducing latency and improving overall computational throughput on CUDA-enabled devices.
• Applied spatial decomposition with OpenMP and evaluated scheduling strategies (static/dynamic/guided) on the Gadi supercomputer to maximize thread utilization and reduce synchronization overhead.
• Analyzed performance bottlenecks using NVIDIA Nsight and Linux perf tools, guiding refinements in memory alignment, load balancing, and thread-level parallel efficiency.
• Compared 1D vs 2D decomposition strategies and tuned thread-block and grid configurations, adapting implementations for varying cache behavior and memory hierarchy depths.
• Additionally implemented and thoroughly analyzed a distributed-memory version using MPI, integrating deadlock-free, halo exchange techniques, wide-halo buffering, and communication-computation overlap schemes.

Skills

- **Programming Languages**: Python, C/C++, Java, Verilog, CUDA
- **Hardware & Tools:** Vivado, Vitis, PYNQ, Intel Advisor, Roofline Model
- **Parallel Computing:** MPI, OpenMP, AVX/SSE, CUDA programming, Roofline
- **Tools for AI & ML**: Pytorch, TensorFlow, Keras, OpenCV, Scikit-learn
- **Languages**: English - Fluent (PTE 81), Mandarin - Native speaker

Honors and Awards

PhD Teaching Fellowship, The University of Sydney 2026
Research Training Program (RTP) Scholarship (Fully Funded PhD), The University of Sydney 2026
Champion, Formula Student Autonomous China (FSAC), National Level 2020
1st Prize, ByteDance Summer Camp, National Level 2021
1st Prize, "Century Cup" Extracurricular Academic Competition, School Level 2021
Excellent Oral Presentation, 2022 6th International Conference on Robotics and Machine Vision 2022
2nd Class Scholarship, Beijing Institute of Technology, School Level 2022
3rd Class Scholarship, Beijing Institute of Technology, School Level 2019