Haoren Guo

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Research Interests

machine learning, neural network and deep learning, time series prediction, predictive maintenance, domain adaptation, self-supervised learning, large language model

Education

National University of Singapore — **Singapore**

Ph.D in Electrical and Computer Engineering — *Aug 2021 – May 2025 (Expected)*

NUS Research Scholarship (Industrial ring-fenced with Hexagon)

Main supervisor: Prof. Prahlad Vadakkepat

Co-supervisors: Prof. Ho Weng Khuen, Dr.Bruce Engelmann (Hexagon CTO)

National University of Singapore — **Singapore**

B.Eng in Electrical Engineering, Honors (with Distinction) — *Aug 2017 – May 2021*

Second Major in Data Science and Analytics

Science and Technology Full Scholarship Program (Singapore Ministry of Education)

University of Wisconsin-Madison — **United States**

Student Exchange Program **CAP:** 3.81/4 — *Jan 2020 – May 2020*

Hanyang University — **Korea**

Hanyang International Summer School Program — *July 2019*

Research Experience

Mechatronics and Automation Lab, National University of Singapore — **Singapore**

Advisor: Prof. Prahlad Vadakkepat, Prof. Ho Weng Khuen — *Aug 2021 – Present*

- Conducted extensive research and developed a robust, accurate, and efficient deep learning model for time-series prediction and domain adaptation.
- Researched deep learning algorithms to address predictive maintenance challenges for industrial machinery, focusing on scenarios with **low data** availability and **data scarcity**. The pioneering initiative to introduce cross-domain open-source datasets, significantly enhancing prediction accuracy in low-data scenarios. Achieved **state-of-the-art** performances on the machinery remaining useful time prediction benchmark datasets. (*Published to INDIN 2022, IECON 2023, IEEE TAI*)
- The first to design large language models (LLMs) as a powerful auxiliary module, significantly boosting classification and prediction performance in multivariate time-series domain adaptation. (*Under review by AAAI 2025*)

Vision Lab, National University of Singapore — **Singapore**

Advisor: Prof. Feng Jiashi — *June 2020 – May 2021*

- Final year project to complete bachelor's degree (Grade: A).
- Developed a unified model for simultaneous traffic sign detection and lane detection with high accuracy and efficiency. Trained the model on two disjoint datasets (lane detection and traffic sign detection) using coordination convolution to incorporate positional information for optimization.
- Applied the FCOS model to the traffic sign detection branch to improve efficiency while maintaining average precision.
- Integrated the Ultra-Fast model for lane detection and used CycleGAN to enhance night-time image detection by synthesizing realistic night images for dataset augmentation.

Publication

Haoren Guo, Haiyue Zhu, Jiahui Wang, Vadakkepat Prahlad, Weng Khuen Ho, Tong Heng Lee. "Enhancing Multivariate Time-Series Domain Adaptation via Contrastive Frequency Graph Discovery and Language-Guided Adversary Alignment". 2024 (Under review).

Jiahui Wang, Haiyue Zhu, **Haoren Guo**, Abdullah Al Mamun, Cheng Xiang, Tong Heng Lee. "Efficient Point Cloud Semantic Segmenter for Few- and Zero-Shot Scenarios with Language Guidance". 2024 (Under review).

Haoren Guo, Haiyue Zhu, Jiahui Wang, Vadakkepat Prahlad, Weng Khuen Ho, Clarence W de Silva, Tong Heng Lee. "Remaining Useful Life Prediction via Frequency Emphasizing Mix-Up and Masked Reconstruction". Published to IEEE Transactions on Artificial Intelligence, vol. 5, no. 9, pp. 4686-4695, Sept. 2024.

Haoren Guo, Haiyue Zhu, Jiahui Wang, Vadakkepat Prahlad, Weng Khuen Ho, Clarence W de Silva, Tong Heng Lee. "Lightweight Compressed Temporal and Compressed Spatial Attention with Augmentation Fusion in Remaining Useful Life Prediction". Published to IECON 2023- 49th Annual Conference of the IEEE Industrial Electronics Society, Singapore, Singapore, 2023, pp. 1-6.

Jiahui Wang, Haiyue Zhu, **Haoren Guo,** Abdullah Al Mamun, Clarence W De Silva, Tong Heng Lee. "Few-Shot Point Cloud Semantic Segmentation for CAM/CAD via Feature Enhancement and Efficient Dual Attention". Published to IECON 2023- 49th Annual Conference of the IEEE Industrial Electronics Society, Singapore, Singapore, 2023, pp. 1-6.

Jiahui Wang, Haiyue Zhu, **Haoren Guo**, Abdullah Al Mamun, Cheng Xiang, Tong Heng Lee. "Few-Shot Point Cloud Semantic Segmentation via Contrastive Self-Supervision and Multi-Resolution Attention". Published to IEEE International Conference on Robotics and Automation (ICRA), London, United Kingdom, 2023, pp. 2811-2817.

Haoren Guo, Haiyue Zhu, Jiahui Wang, Prahlad Vadakkepat, Weng Khuen Ho, Tong Heng Lee. "Masked Self-Supervision for Remaining Useful Lifetime Prediction in Machine Tools". Published to IEEE 20th International Conference on Industrial Informatics (INDIN). IEEE, 2022: 353-358.

Jiahui Wang, Haiyue Zhu, **Haoren Guo**, Abdullah Al Mamun, Prahlad Vadakkepat, Tong Heng Lee. "CAM/CAD Point Cloud Part Segmentation via Few-Shot Learning". Published to IEEE 20th International Conference on Industrial Informatics (INDIN). IEEE, 2022: 359-365.

Work and Teaching Experience

National University of Singapore   **Singapore**
  Graduate Teaching Assistant

CG 2023 Signal and System	**EE 4308** Autonomous Robot Systems
EE 4705 Human Robot and Interaction	**EE 5104** Adaptive Control
EE 4302 Advanced Control Systems	**EE 5103** Computer Control System
EE 3305 Robotic System Design	**EE 6104** Adaptive Control (Advanced)

  Served as a teaching assistant for **undergraduate, masters, and PhD students,** and **summer school programs**, more than **450 hours** and **11 times.** Assisted professors in guiding over **300 students**, including lab instructing, course and lab project design, and tutorials.

Micron Technology   **Singapore**
  Autonomous Vehicle Team Research Intern   *July 2019 – Dec 2019*

- Implemented autonomous ground buggy for human mobility at Micron's Singapore factory.
- Developed a buggy behavior planner using the Robot Operating System (ROS) and C++.
- Applied deep learning techniques for computer vision, focusing on obstacle detection visualization.
- Enhanced the robustness of the buggy's electrical system to optimize buggy's overall performance and safety.

NUS ECE Department   **Singapore**
  Peer Tutor of the ECE Peer Tutoring Scheme   2018/19 Semester 2

- Volunteered to provide one-on-one calculus tutoring for a first-year Electrical and Computer Engineering (ECE) student.

Co-curricular Activities

IEEE-HKN, National University of Singapore   **Singapore**
  Vice President   *June 2020 – May 2021*

- Honor student society of IEEE. Joined from Jan 2019.
- Conducted secretary role from June 2019 to June 2020.
- Organized and directed a post-graduate sharing session which opens to all students in NUS on Nov 2019

Skills & Interest

Languages: Mandarin (Native), English (Fluent in speaking reading and writing), Southwestern Mandarin (Native)

Skills: Python, Pytorch, TensorFlow, C, Java, C++, Pandas, R, SQL, MATLAB, SIMULINK, LaTex, Linux, ROS, Swift, SwiftUI, Isaac sim.

Interests: Soprano Bel Canto (10 years), Piano (10 years), Table Tennis (represents my undergraduates CCA to join inter hall games), Musical Composition (performed original songs with full band in some NUS concerts), guitar.