

Deyun Lyu

Fukuoka, Japan

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EDUCATION

Kyushu University

Ph.D. in Advanced Information Technology

Fukuoka, Japan

Sept. 2020 - Present

Dalian University of Technology

B.S. in Software Engineering, M.S. in Software Engineering

Dalian, China

Sept. 2014 - June 2020

RESEARCH INTERESTS

I am a PhD candidate in Intelligent Software Engineering Laboratory, Department of Information Science and Electrical Engineering (ISEE), Kyushu University. My supervisor is Prof. **Jianjun Zhao**, and I am co-advised by Prof. **Paolo Arcaini** and Prof. **Zhenya Zhang**. My research interests mainly focus on quality assurance of AI-enabled cyber-physical systems (AI-enabled CPSs) using software engineering techniques and formal methods.

PUBLICATIONS

- Yipei Yan, **Deyun Lyu**, Zhenya Zhang, Paolo Arcaini and Jianjun Zhao. "Automated Generation of Benchmarks for Falsification of STL Specifications." IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems. (TCAD 2025, under review)
- **Deyun Lyu**, Yi Li, Zhenya Zhang, Paolo Arcaini, Xiao-Yi Zhang, Fuyuki Ishikawa and Jianjun Zhao. "Fault Localization of AI-Enabled Cyber-Physical Systems by Exploiting Temporal Neuron Activation." Journal of Systems and Software. (JSS 2025, under review)
- **Deyun Lyu**, Zhenya Zhang, Paolo Arcaini, Xiao-Yi Zhang, Fuyuki Ishikawa and Jianjun Zhao. "SpectAcle: Fault Localisation of AI-Enabled CPS by Exploiting Sequences of DNN Controller Inferences." ACM Transactions on Software Engineering and Methodology. (TOSEM 2024)
- **Deyun Lyu**, Zhenya Zhang, Paolo Arcaini, Fuyuki Ishikawa, Thomas Laurent and Jianjun Zhao. "Search-Based Repair of DNN Controllers of AI-Enabled CPS Guided by System-Level Specifications." Proceedings of the Genetic and Evolutionary Computation Conference. (GECCO 2024)
- **Deyun Lyu**, Jiayang Song, Zhenya Zhang, Zhijie Wang, Tianyi Zhang, Lei Ma and Jianjun Zhao. "AutoRepair: Automated Repair for AI-Enabled Cyber-Physical Systems under Safety-Critical Conditions." (under submission)
- Jiayang Song, **Deyun Lyu***, Zhenya Zhang, Zhijie Wang, Tianyi Zhang and Lei Ma. "When cyber-physical systems meet AI: a benchmark, an evaluation, and a way forward." 44th International Conference on Software Engineering: Software Engineering in Practice. (ICSE-SEIP 2022, Co-first author)
- Zhenya Zhang, **Deyun Lyu**, Paolo Arcaini, Lei Ma, Ichiro Hasuo and Jianjun Zhao. "FalsifAI: Falsification of AI-Enabled Hybrid Control Systems Guided by Time-Aware Coverage Criteria." IEEE Transactions on Software Engineering. (TSE 2022)
- Huihui Wu, **Deyun Lyu**, Y. Zhang, Gang Hou, Masahiko Watanabe, Jie Wang and Weiqiang Kong. "A verification framework for behavioural safety of self-driving cars." IET Intelligent Transport Systems.
- Zhenya Zhang, **Deyun Lyu**, Paolo Arcaini, Lei Ma, Ichiro Hasuo and Jianjun Zhao. "Effective Hybrid System Falsification Using Monte Carlo Tree Search Guided by QB-Robustness." 33rd

International Conference on Computer-Aided Verification. (CAV 2021)

- Zhenya Zhang, **Deyun Lyu**, Paolo Arcaini, Lei Ma, Ichiro Hasuo and Jianjun Zhao. "On the Effectiveness of Signal Rescaling in Hybrid System Falsification." 13th NASA Formal Methods Symposium. (NFM 2021)
- Huihui Wu, **Deyun Lyu**, TengXiang Cui, Gang Hou, Masahiko Watanabe and Weiqiang Kong. "SDLV: Verification of Steering Angle Safety for Self-Driving Cars." Formal Aspects of Computing. (FAC 2021)

PATENTS

- Weiqiang Kong, **Deyun Lyu**, Zhong Wei, Risheng Liu, Xin Fan and Zhongxuan Luo. "Method For Infrared Small Target Detection Based On Depth Map In Complex Scene." US Patent, No. 12,108,022, Oct. 2024.
- Weiqiang Kong, **Deyun Lyu**, Zhong Wei, Risheng Liu, Xin Fan and Zhongxuan Luo. "Method for Fully Automatically Detecting Chessboard Corner Points." US Patent, No. 12,094,152, Sept. 2024.
- Zhong Wei, **Deyun Lyu**, Weiqiang Kong, Risheng Liu, Xin Fan, Zhongxuan Luo and Shengquan Li. "Method for Adaptively Detecting Chessboard Sub-Pixel Level Corner Points." US Patent, No. 11,900,634, Feb. 2024.

CONFERENCE PRESENTATIONS

- "Search-Based Repair of DNN Controllers of AI-Enabled Cyber-Physical Systems Guided by System-Level Specifications." Top Conference/Journal Special Talk (トップカンファレンス・トップ論文誌特別講演), 日本ソフトウェア科学会第 41 回大会, Osaka, Japan. (JSSST 41)
- "Towards Building Reliable AI-Enabled Cyber-Physical Systems." Doctoral Symposium, 26th International Symposium on Formal Methods. (FM 2023)
- "FalsifAI: Falsification of AI-Enabled Hybrid Control Systems Guided by Time-Aware Coverage Criteria." Demo/Poster Session (デモ・ポスターセッション), 日本ソフトウェア科学会第 39 回大会, Nagoya, Japan. (JSSST 39)

RESEARCH EXPERIENCES

National Institute of Informatics

Visiting Researcher

Tokyo, Japan

Sept. 2023 - Mar. 2024

- **Fault Localisation and Repair of DNN Controllers of AI-Enabled Cyber-Physical Systems.** Proposed a fault localisation approach and a search-based repair approach for AI-enabled CPSs under the guidance of Prof. **Paolo Arcaini** and Prof. **Fuyuki Ishikawa**, as part of the **MIRAI-eAI Project**.

North Automatic Control Technology Institute

Junior Research Engineer

Taiyuan, China

June 2018 - Sept. 2019

- **Chessboard Corner Detection.** Developed an automated method for chessboard sub-pixel corner detection and implemented it as a practical tool.
- **Camera Calibration.** Presented an efficient external parameters optimization approach for binocular stereo vision systems.
- **Infrared Small Object Detection.** Presented a depth map-based method for infrared small object detection in complex scenarios.

TEACHING ASSISTANCE EXPERIENCES

- Python Programming Exercises (Python プログラミング演習) for undergraduate students, Kyushu University, Summer 2024
- Python Programming Exercises (Python プログラミング演習) for undergraduate students, Kyushu University, Summer 2023
- Machine Learning Systems Engineering for graduate students, Kyushu University, Summer 2021

PROFESSIONAL SERVICES

- PC Member: AAAI 2025, AAAI 2024, AAAI 2023
- Reviewer: ICECCS 2024, ICML 2022, ICSE 2021

AWARDS

- GECCO 2024 Student Travel Grant (\$600 USD), The Genetic and Evolutionary Computation Conference, May 2024
- 次世代研究者挑戦的研究プログラム, Japan Science and Technology Agency (JST), Oct. 2021 - Sept. 2023
- 九州大学大学院研究支援奨学金, Kyushu University, Sept. 2021
- First Class Award Scholarship of the Graduate School, Dalian University of Technology, Sept. 2018 - June 2020