Gao Xinwei

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Personal Profile

I am a highly motivated researcher with a Master's degree in Mechanical Engineering from the National University of Singapore (NUS). My research interests focus on reinforcement learning, safety mechanisms in machine learning, and robotics. I am also a Permanent Resident (PR) in Singapore, reflecting my commitment to contribute to the country's research and innovation ecosystem.

Education

Master of Science in Mechanical Engineering, National University of Singapore *Singapore*

GPA: 4.40/5.00 *July 2021 – June 2022*

Modules: Deep Learning for Robotics, Neural Networks, Computer Vision

Bachelor of Science in Mechanical Engineering, Nanjing University of Science and Technology *Nanjing, China*

GPA: 3.22/4.00 *August 2017 - July 2021*

Modules: Artificial Intelligence; Modern Control System; Electrotechnics; Mechanical Manufacture

Standardized Tests: GRE: 333 IELTS: 6.5

Publications

CRLLK: Constrained Reinforcement Learning for Lane Keeping in Autonomous Driving *Detroit, Michigan, USA*

24th International Conference on Autonomous Agents and Multiagent Systems (Demo Track) *May 2025*

Abstract: Formulated a lane-keeping system as a constrained reinforcement learning problem, maximizing driving distance and setting lane deviations and collisions as constraints. This approach eliminated the need for scenario-specific tuning, with weights automatically learned alongside the policy. Validated in both simulated and real-world scenarios, achieving superior performance over baselines.

Work Experience

Research Associate, CPS Research Group, NTU *Singapore*

Advised by Prof. Arvind Easwaran *Nov 2022 – Jun 2025*

- Designed and implemented safety-aware learning and control components, deployable algorithm modules.
- Built and maintained end-to-end ML experimentation pipelines (data processing, training, evaluation, debugging) to accelerate iteration and improve performance by 37%, reducing training and evaluation overhead.
- Deployed sim-to-real RL policies on resource-constrained embedded hardware (Jetson Nano) with ROS2.
- Developed tooling for automated assessment of AI training programs (ATP), improving evaluation throughput through step-level metrics.

Student Researcher, MARMOT Lab, NUS *Singapore*

Advised by Prof. Guillaume Adrien Sartoretti *Apr 2022 – May 2022*

- Implemented and evaluated multi-agent pathfinding methods for warehouse-scale settings; benchmarked learning-based planners against classical search baselines.
- Built a repeatable experiment and analysis workflow to compare performance across varying fleet sizes and map densities.
- Achieved 70% higher completion rates in large-robot scenarios by improving planner robustness in congestion and dead/livelock cases.

Projects and Experience

Short-Horizon Regret Reinforcement Learning in Trainer-Trainee System *NTU, Singapore*

Advised by Prof. Arvind Easwaran. Founded by AI Singapore. *January 2024 - Present*

- Introduces a theoretical approach that leverages regret minimization within a teacher-student framework to provide a immediate training feedback, fairness evaluation and trustworthiness guarantee. This approach allowing real-time updates with sample efficiency while preserving optimal solution for the long-horizon problem.

Constrained Lane Keeping in Simulation-to-Real Environment *NTU, Singapore*

Advised by Prof. Arvind Easwaran. Founded by AI Singapore. *October 2022 - Dec 2024*

- Formulate a constraint Lane Following problem which is sensitive to the lane deviation for safety consideration. Design a Lane Following algorithm on continuous and discrete space. This approach outperforms various baselines in terms of performance.
- Technical Skills: Embedded System, ROS Development, Docker GPU Training, ML Related Skills

Individual Voting for RL and Search-based Algorithm Combination in Multi-agent Pathfinding *NUS, Singapore*

Advised by Prof. Guillaume SARTORETTI, Mechanical Engineering Project. *Aug 2021 - July 2022*

- Proposed a mechanism optimize the pathfinding algorithm in dead/livelock situations by learning to combine a decentralized RL algorithm and a search-based algorithm. This approach outperforms various baselines in terms of the runtime of planning algorithm and the completion rate of robot path planning tasks.

Reinforcement Learning in Continuous Control Problem *NJUST, China*

Advised by Prof. Chew Chee Meng and Prof. Jian Hu, Final Year Project. *Sept 2020 - May 2021*

- Developed a RL-based algorithm for robust manipulator control using RGB image inputs and Cartesian coordinate outputs. Achieved autonomous grasping for arbitrary workpiece structures.

Skills

Programming Python (Pandas, NumPy, PyTorch, Tensorflow), C++, MATLAB, Origin
Infrastructure Linux, Docker, Distributed Training, GPU Training Pipelines, ROS, Arduino, Raspberry Pi, Jetson Nano
Softskills Teamwork, Model Training & Evaluation, Debugging, Data Analysis, Research Presentation,
Tools AutoCAD, SolidWorks, Latex, Unity, OpenAI Gym

Achievements

2021 **Outstanding Graduate Award in Mechanical Engineering**, NJUST *Nanjing, China*
2020 **School of Mechanical Engineering School-level Scholarship**, NJUST *Nanjing, China*
2019 **Second Prize in Jiangsu Province Mechanics Competition**, Society of Theoretical and Applied Mechanics *Jiangsu, China*
2019 **School of Mechanical Engineering School-level Scholarship**, NJUST *Nanjing, China*
2018 **School of Mechanical Engineering School-level Scholarship**, NJUST *Nanjing, China*

Extracurricular

Sports Love to running, hiking, swimming, sky diving and Scuba diving
Hobbies Watching movies, reading books, playing the violin and the piano

References

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