SINONG(SIMON) ZHAN

Github⋄ http://simon-zhan.com/⋄ Google Scholar
L456 Sheridan Road, Evanston, IL
(+1)510-599-4662 ⋄ SinongZhan2028@u.northwestern.edu

EDUCATION

Northwestern University *Sept 2023 - Present*
PhD in Electrical and Computer Engineering, advised by Prof. Qi Zhu
University of California, Berkeley *August 2018 - December 2022*
Bachelor of Arts in Computer Science and Applied Mathematics, advised by Prof. Sanjit Seshia

RESEARCH INTERESTS

My research lies at the intersection of Reinforcement Learning and Formal Methods, developing principled approaches to ensure safety, robustness, and verifiability in embodied cyber-physical systems. I focus on integrating formal verification techniques with learning-based control to provide guarantees while maintaining adaptability and performance. My work spans safe reinforcement learning with constraint satisfaction, delay-aware optimization under uncertainty, model-based approaches for certified learning, and neurosymbolic methods that combine symbolic reasoning with neural computation to achieve interpretable and verifiable intelligent systems. And my research has resulted in publications in some top tier conferences such as ICML, NeurIPS, ICCPS, L4DC, FM, RV, IROS, etc.

RESEARCH EXPERIENCE

IDEAS Lab, Northwestern University Sep 2023 - Present
Graduate Research Assistant *Advised by Prof. Qi Zhu*

- Developed safe and delay-robust reinforcement learning algorithms with formal verification for autonomous driving and safety-critical robotics, resulting in 2 ICML and 1 NeurIPS Spotlight papers.
- Designed novel inverse reinforcement learning frameworks using generative modeling (GANs, score matching) for stable imitation learning in stochastic environments.
- Explored neurosymbolic approaches with large language models to enhance interpretability and formal reasoning capabilities in autonomous systems and robotics applications.
- Built a comprehensive framework to evaluate and improve the safety of embodied AI agents, combining formal safety rules with multi-level testing (semantic, plan, and trajectory) in realistic simulation environments.

University of California, Berkeley Feb 2022 - April 2023
Undergraduate Researcher & Research Assistant *Advised by Prof. Sanjit Seshia*

- Developed automated verification and control synthesis methods for complex robotics systems, specializing in path planning and trajectory optimization for underwater robots.
- Created SMT-based 3D bin-packing solver for design model checking, contributing to structured design automation pipelines and formal verification frameworks for NSF UUV Challenge.

Human Computing Lab, ISCAS & XDiscovery Lab, Dartmouth May 2019 - Sep 2021
Research Assistant *Advised by Prof. Feng Tian, Prof. Teng Han, & Prof. Xing-Dong Yang*

- Designed VR-based interaction models with real-time feedback systems and developed novel microfluidics-based sensing technologies, resulting in CHI and UbiComp publications.
- Implemented self-supervised learning techniques for robust multi-modal sensor fusion in haptic interfaces, exploring fast-prototyping methods for human-computer interaction applications.

INDUSTRY EXPERIENCE

Amazon June 2025 - Sep 2025
Applied Scientist Intern *Store Foundation AI Team*

- Developed multi-turn conversational agents for Rufus Shopping Assistant using state-of-the-art reinforcement learning algorithms and designed logic-based reward machines for human behavior simulation.
- Contributed to large-scale production systems serving millions of Amazon customers, optimizing LLM agent training pipelines for e-commerce applications and customer interaction workflows.

CAS Ruiyi Technology Co., Ltd May 2020 - Aug 2021
Software Developer

- Developed data analysis pipelines for medical device performance evaluation and robustness testing, building WeChat mini-programs for healthcare applications facilitating doctor-patient communication.
- Presented product demonstrations to hospital clients and investors, contributing to business development and conducting live demos for top-tier hospitals and healthcare organizations.

ACADEMIC SERVICE

Conference Reviewer: NeurIPS (2024-), ICML (2024-), ICLR (2024-), AAAI (2024-), L4DC (2024-), ASP-DAC (2024-)

Journal Reviewer: Machine Learning Journal (Springer), IEEE Internet of Things Journal

Program Committee: ICCPS Artifact Evaluation Committee

PUBLICATIONS (* INDICATES EQUAL CONTRIBUTION)

Conference Papers

Directly Forecasting Belief for Reinforcement Learning with Delays. Qingyuan Wu*, **Simon Sinong Zhan***, Yuhui Wang*, Yixuan Wang, Chung-Wei Lin, Chen Lv, Qi Zhu, Jurgen Schmidhuber, Chao Huang. *International Conference on Machine Learning (ICML 2025).*

Variational Delayed Policy Optimization. Qingyuan Wu*, **Simon Sinong Zhan***, Yixuan Wang, Yuhui Wang, Chung-Wei Lin, Chen Lv, Qi Zhu, Chao Huang. *Conference on Neural Information Processing Systems (NeurIPS 2024)* **(Spotlight)**.

Switching Controller Synthesis for Hybrid Systems Against STL Formulas. Han Su, Shenghua Feng, **Simon Sinong Zhan**, Naijun Zhan. *International Symposium on Formal Methods (FM 2024).*

Case Study: Runtime Safety Verification of Neural Network Controlled System. Frank Yang, **Simon Sinong Zhan**, Yixuan Wang, Chao Huang, Qi Zhu. *International Conference on Runtime Verification (RV 2024).*

State-wise safe reinforcement learning with pixel observations. Simon Sinong Zhan, Yixuan Wang, Qingyuan Wu, Ruochen Jiao, Chao Huang, Qi Zhu. *Learning for Dynamics and Control Conference (L4DC 2024).*

Boosting Reinforcement Learning with Strongly Delayed Feedback Through Auxiliary Short Delays. Qingyuan Wu, **Simon Sinong Zhan**, Yixuan Wang, Yuhui Wang, Chung-Wei Lin, Chen Lv, Qi Zhu, Jurgen Schmidhuber, Chao Huang. *International Conference on Machine Learning (ICML 2024).*

Kinematics-aware Trajectory Generation and Prediction with Latent Stochastic Differential Modeling. Ruochen Jiao*, Yixuan Wang*, Xiangguo Liu, **Simon Sinong Zhan**, Chao Huang, Qi Zhu. *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2024).*

Enforcing Hard Constraints with Soft Barriers: Safe Reinforcement Learning in Unknown Stochastic Environments. Yixuan Wang, **Simon Sinong Zhan**, Ruochen Jiao, Zhilu Wang, Wanxin Jin, Zhuoran Yang, Zhaoran Wang, Chao Huang, Qi Zhu. *International Conference on Machine Learning (ICML 2023).*

Joint Differentiable Optimization and Verification for Certified Reinforcement Learning. Yixuan Wang*, **Simon Sinong Zhan***, Zhilu Wang, Chao Huang, Zhaoran Wang, Zhuoran Yang, Qi Zhu. *International Conference on Cyber-Physical Systems (ICCPS 2023).*

MicroFluID - A Reconfigurable RFID Platform for Robust Interaction Sensing Based on Microfluidics. Wei Sun, Yuwen Chen, Yanjun Chen, **Simon Sinong Zhan**, Yixin Li, Jiecheng Wu, Teng Han, Feng Tian, Jingxian Wang, Haipeng Mi, Xing-Dong Yang. *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT/UbiComp 2022).*

RElectrode: A Reconfigurable Electrode For Multi-Purpose Sensing Based on Microfluidics. Wei Sun, Yanjun Chen, **Simon Sinong Zhan**, Teng Han, Feng Tian, Hongan Wang, Xing-Dong Yang. *ACM Conference on Human Factors in Computing Systems (CHI 2021).*

Workshop Papers

Empowering autonomous driving with large language models: A safety perspective. Yixuan Wang, Ruochen Jiao, Chengtian Lang, **Simon Sinong Zhan**, Chao Huang, Zhaoran Wang, Zhuoran Yang, Qi Zhu. *LLMAgent Workshop @ ICLR 2024.*

Shop-R1: Rewarding LLMs to Simulate Human Behavior in Online Shopping via Reinforcement Learning. Yimeng Zhang, Tian Wang, Jiri Gesi, Ziyi Wang, Yuxuan Lu, Jiacheng Lin, **Sinong Zhan**, Vianne Gao, Ruochen Jiao, Junze Liu, Kun Qian, Yuxin Tang, Ran Xue, Houyu Zhang, Qingjun Cui, Yufan Guo, Dakuo Wang. *SEA Workshop @ NeurIPS 2025.*

See, Think, Act: Online Shopper Behavior Simulation with VLM Agents. Yimeng Zhang, Ziyi Wang, Yuxuan Lu, **Sinong Zhan**, Jing Huang, Dakuo Wang. *SEA Workshop @ NeurIPS 2025.*

Under Review

Model-Based Reward Shaping for Adversarial Inverse Reinforcement Learning in Stochastic Environments. Simon Sinong Zhan, Qingyuan Wu, Philip Wang, Yixuan Wang, Ruochen Jiao, Chao Huang, Qi Zhu. *Under Review.*

Inverse Delayed Reinforcement Learning. Simon Sinong Zhan*, Qingyuan Wu*, Aria Ruan, Frank Yang, Philip Wang, Yixuan Wang, Ruochen Jiao, Chao Huang, Qi Zhu. *Under Review.*

Token Buncher: Shielding LLMs from Harmful Reinforcement Learning Fine-Tuning. Weitao Feng, Lixu Wang, Tianyi Wei, Jie Zhang, Chongyang Gao, **Simon Sinong Zhan**, Peizhuo Lv, Wei Dong. *Under Review.*

SENTINEL: **A Multi-Level Formal Framework for Safety Evaluation of LLM-based Embodied Agents. Simon Sinong Zhan**, Yao Liu, Philip Wang, Zinan Wang, Qineng Wang, Zhian Ruan, Xiangyu Shi, Xinyu Cao, Frank Yang, Kangrui Wang, Huajie Shao, Manling Li, Qi Zhu. *Under Review.*

Efficient Multi-Step Reinforcement Learning with Expectation-Maximization Bootstrapping. Qingyuan Wu, Yuhui Wang, **Simon Sinong Zhan**, Qi Zhu, Jurgen Schmidhuber, Chao Huang. *Under Review.*

Adapting Offline Reinforcement Learning with Online Delays. Simon Sinong Zhan, Qingyuan Wu, Frank Yang, Xiangyu Shi, Chao Huang, Qi Zhu. *Under Review.*

TEACHING EXPERIENCE

University of California, Berkeley Fall 2022
Teaching Assistant *Math 128A: Numerical Analysis*

- Conducted weekly discussion sections and office hours for 40+ undergraduate students
- Graded assignments and provided detailed feedback on numerical methods and computational mathematics

HONORS & AWARDS

NeurIPS 2024 Spotlight Paper - Top 3% of accepted papers 2024

First-Year Fellowship, Northwestern University 2023

Dean's List, UC Berkeley 2020-2022

PATENTS

EMG-based Multi-target Control System. Simon Zhan, Junjun Fan, Feng Tian, Wei Sun. Chinese Patent No. CN201710953534.X.

Microfluidic Pipeline Composite Structure and Pattern Deformation System. Wei Sun, Yanjun Chen, Simon Zhan, Teng Han, Feng Tian, Hongan Wang, Xing-Dong Yang. Chinese Patent No. CN202110377915.4.

Fluid Pattern Reconfigurable System Based on Microfluidic Technology. Wei Sun, Yanjun Chen, Simon Zhan, Teng Han, Feng Tian, Hongan Wang, Xing-Dong Yang. Chinese Patent No. CN202110378536.7.

TECHNICAL SKILLS

Programming	Python, C/C++, Lean FRO, CUDA, Java, R, Julia
ML/AI Frameworks	PyTorch, JAX, Hugging Face, Verl
Optimization	Gurobi, CVX, CasADi
Tools	Git, Docker, LaTeX, Linux, Unity3D, MATLAB, Simulink
Languages	English (Native), Chinese (Native), German (Limited-proficiency)