Sinong (Simon) Zhan

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Education

Northwestern University — Evanston, IL
PhD in Electrical and Computer Engineering — *Sept. 2023 – Present*

University of California, Berkeley — Berkeley, CA
Bachelor of Arts in Computer Science and Applied Mathematics — *Aug. 2018 – Dec. 2022*

Experience

Applied Scientist Intern — June 2025 – Sep 2025
Amazon — *Store Foundation AI Team*
- Developed multi-turn conversational agents for Rufus Shopping Assistant using reinforcement learning algorithms.
- Designed logic-based reward machines for human behavior simulation in LLM agent training pipelines.
- Contributed to large-scale and customer-facing services, leveraging AWS (EC2/EKS, S3, CloudWatch, etc.).

Graduate Research Assistant — Sep 2023 – Present
Northwestern University — *Advisor: Prof. Qi Zhu*
- Designed delay-aware, state-wise safe RL algorithms and constraint-satisfaction toolchains for various embodied Cyber-Physical Systems; publications include L4DC, NeurIPS(Spotlight), and ICML.
- Designed inverse RL frameworks using generative modeling (GANs, score matching) for stable imitation learning.
- 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.
- Explored *Lean FRO* as a verification back-end for LLM outputs, turning natural-language constraints into theorems and emitting machine-checked certificates for safety and security.

Undergraduate Researcher — Feb 2022 – April 2023
University of California, Berkeley — *Advisor: Prof. Sanjit Seshia*
- Developed automated design verification and control synthesis tool-chains for Unmanned Underwater Vehicle.
- Created SMT-based 3D bin-packing solver for design model checking and automated the whole pipelines.

Projects

Safe Reinforcement Learning with Barrier Certificate | *PyTorch, MuJoCo, Optimization* June 2022 – Sep 2024
- Unified RL with formal verification via a bilevel, end-to-end differentiable framework that co-learns controllers and certificates (Barrier/Lyapunov) to enforce hard safety and stability in CPS with partially-unknown dynamics.
- Introduced generative model based soft barrier functions to encode hard reachability constraints in unknown stochastic environments by jointly learning dynamics and policy with probabilistic safety guarantee.
- Formulated an end-to-end architecture coupling visual world modeling with probabilistic barrier-certificate learning to achieve safety-aware policy optimization in high-dimensional state spaces.

Delay-Robust Reinforcement Learning | *JAX, Isaac Sim, Optimization* — Nov 2023 – Present
- Boosted RL under long/strong delays by introducing an auxiliary short-delay value-learning scheme that bootstraps to long delays, reducing sample complexity and improving sample efficiency.
- Reformulated delayed-observation RL as a variational inference problem and proposed a two-step procedure that achieves consistent delay-robust performance with strong sample-efficiency gains.
- Bridged offline training and online deployment with delays via a transformer-based belief policy with constraint handling that learns from delay-free logs yet acts delay-robustly at deployment.

Multi-layer Formal Safety Evaluation for Embodied Agents | *LLM, Ai2Thor, OmniGibison* March 2025 – Present
- Implemented formal safety rules using temporal logics (LTL, CTL) to enable formal evaluations.
- Designed a unified framework for multi-level safety evaluation (semantic, plan, trajectory) of embodied agents.
- Extended `VirtualHome` and `ALFRED` tasks with safety constraints to test LLM agents under multi-layer framework.

Technical Skills

Programming: Python, C/C++, CUDA, Java, LEAN 4, R, MATLAB, Julia, SQL
ML/AI Frameworks: PyTorch, JAX, TensorFlow, Hugging Face, OpenAI Gym, Scikit-learn
Optimization & Tools: Gurobi, CVX, CasADi, Linux, AWS, Docker, Git, Unity3D, Simulink
Research Methods: Reinforcement Learning, Formal Methods, LLM Post-train, Optimization, Statistical Modeling