SHUAIXING CHEN

shxinchn@gmail.com shxingch.github.io shxingch

EDUCATION

Shanghai Jiao Tong University (SJTU), Shanghai, China Sep. 2021 – June 2025
B.E. in Electrical Engineering

PUBLICATIONS AND PREPRINTS

- Lingfeng Zhou*, **Shuaixing Chen***, Jin Gao, Dequan Wang: "LLM-Raft: Enhancing Urban Traffic Efficiency and Safety through Decentralized Coordination of Autonomous Vehicles" *NeurIPS 2025 Workshop on UrbanAI.*
- Ruolin Ye*, **Shuaixing Chen***, Yunting Yan*, Joyce Yang, Christina Ge, Dr. Jose A. Barreiros, Kate Tsui, Tom Silver, Tapomayukh Bhattacharjee: "CART-MPC: Coordinating Assistive Devices for Robot-Assisted Transferring with Multi-Agent MPC" *HRI 2025.*
- **Shuaixing Chen**, Ruolin Ye, Saurabh Dingwani, Pooyan Fazli, Hasti Seifi, Tapomayukh Bhattacharjee: "RCareGen: An Interface for Scene and Task Generation in Robotics Simulation" *HRI 2025 Late-Breaking Reports.*
- Ruolin Ye, Tom Silver, **Shuaixing Chen**, Justin Guo, Martin Lerou, Tapomayukh Bhattacharjee: "PhyRC: Physical Robotic Caregiving Challenge" *ICRA 2025 Competition.*

* Equal Contribution

RESEARCH EXPERIENCE

Shanghai Qi Zhi Institute | Advisor: Macheng Shen Feb 2025 – Present
Research Assistant – World Models & Representation Learning

- **Information-Theoretic Adaptive Tokenizer (Variable-Length Vision Generation)**
  - Proposed a variable-rate image tokenization framework grounded in Rate-Distortion Theory to optimize the trade-off between representation fidelity and code length.
  - Designed a Token-Gate Aware Attention mechanism with a learnable gate loss to dynamically prune redundant tokens based on information density.
  - Formulated a dual-stream Transformer objective that aligns the image-conditioned posterior with the unconditional prior via Cross-Entropy minimization, stabilizing the autoregressive generation.
  - Achieved single-digit token counts on MNIST and significant efficiency gains on ImageNet with stable convergence.
- **Action-Conditioned V-JEPA 2 & Self-Improving Closed-Loop MPC**
  - Engineered Action-Conditioned V-JEPA 2, a multi-modal pre-training pipeline that synchronously ingests video latents and action vectors to learn Action-Dependent State Transitions, significantly enhancing temporal stability for robotics.
  - Developed a latent model-based planning framework utilizing V-JEPA 2 for MPC Rollouts, enabling the agent to "dream" potential futures and optimize trajectories in the latent space.
  - Implemented an iterative Data Aggregation loop where trajectories generated by the MPC controller are fed back into the training set; this closed-loop mechanism fine-tunes the dynamics model to progressively align the pre-trained representation with physical control tasks.

Cornell University | Advisor: Tapomayukh Bhattacharjee July 2024 – Dec. 2024
Research Intern – EmPRISE Lab (Robotics & Caregiving)

- **CART-MPC (Multi-Agent Deformable Object Manipulation)**
  - Formulated a Turn-Taking Multi-Agent MPC framework to coordinate a heterogeneous system (Kinova Gen3 Arm & Actuated Hoyer Sling) for manipulating deformable linear objects (DLOs).

- Designed a topological cost function based on the Gauss Linking Number from Knot Theory; developed a Neural Amortization scheme using an LSTM network to regress this metric from visual history, enabling 30Hz real-time closed-loop control.
- Implemented a physics-aware perception pipeline using GroundedSAM2 and optical flow for keypoint tracking; trained an MLP dynamics model on synthetic RCareWorld data to robustly predict non-linear DLO deformations.
- Achieved Few-Shot Sim-to-Real Transfer on physical hardware (Rovi X3 Wheelchair), demonstrating a 62% success rate in single-strap tying tasks. (Accepted to **HRI 2025**)

- **RCareGen (Generative AI for Simulation)**
  - Developed an LLM-powered simulation interface integrating Gradio UI with RCareWorld/Unity backend to democratize scene generation.
  - Engineered a prompt-engineering pipeline that translates natural language user commands directly into executable Python simulation logic, automating the instantiation of complex caregiving environments. (Accepted to **HRI 2025 Late-Breaking Reports**)
- **Physical Robotic Caregiving Challenge (PhyRC) - ICRA 2025 Competition**
  - **Lead Simulation Developer:** Architected the official competition platform, building a high-fidelity Digital Twin environment in Unity/Obi to simulate contact-rich tasks (Assisted Dressing & Bathing).
  - **System Scale & Impact:** Optimized the physics engine to support diverse control policies from 56 international teams across 17 countries, ensuring backend stability under adversarial inputs.
  - **Evaluation Infrastructure:** Established an automated assessment pipeline via EvalAI, creating robust scoring metrics aligned with task objectives to benchmark participant submissions.

Shanghai Jiao Tong University | Advisor: Dequan Wang 2023 – 2024
Research Assistant – LLM-Powered Multi-Agent Systems

- **LLM-Raft: Decentralized Multi-Agent Consensus for Autonomous Driving**
  - Engineered a decentralized coordination architecture adapting the Raft Consensus Algorithm for LLM-based agents; implemented a dynamic grouping mechanism where vehicles autonomously form clusters to elect leaders and synchronize high-level semantic intentions (e.g., merging) under latency constraints.
  - Architected a scalable Multi-Agent Traffic Simulation treating vehicles as independent distributed nodes with separate inference threads; designed a Message Pool Retrieval System based on consensus algorithm to manage asynchronous inter-agent communication and ensure state consistency.
  - Conducted extensive ablation studies across varying traffic densities. Improved coordination efficiency and safety compared to greedy baselines; work accepted to **NeurIPS 2025 Workshop on UrbanAI**.

SKILLS

Languages	Python, C++, MATLAB, SQL, LaTeX
Frameworks	PyTorch, TensorFlow, ROS/ROS2, Docker, HuggingFace
Simulation	Unity, RCareWorld, Isaac Gym, MuJoCo, PyBullet
Hardware	Kinova Gen3 Arms, Aloha, RealSense Cameras, Mobile Bases (Powered Wheelchair)
Concepts	Model Predictive Control (MPC), Self-Supervised Learning (SSL), World Models

SERVICE

Reviewer: HRI 2024, HRI 2025
Competition Organization: Lead Simulation Developer, ICRA 2025 PhyRC Competition