Haonan Chen

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RESEARCH INTEREST

My research interests focus on **World Models** for **Embodied AI**, **VLA/VLM Systems**, **Multimodal Foundation Models**, and **Robotic Manipulation**. My current work centers on world modeling and robot manipulation, with a particular interest in modeling object state changes from images, language, 3D structure, and action data, and translating model predictions into executable robot behaviors. This line of work involves object-centric world models, 3D representations, VLA/VLM systems, real/sim data construction, model training and evaluation, and real-world robot deployment.
Looking ahead, I hope to work toward physical world-action foundation models that serve as predictive and decision-making backbones for embodied agents. I am particularly interested in 3D/4D representations that model how objects, robots, and scenes evolve under possible actions. More broadly, I hope to explore unified physical interfaces, large-scale real/sim and human-video data, and generative world models for action evaluation, test-time planning, and closed-loop robotic execution.

TIME AVAILABILITY

I am planning an early graduation around mid-2027, with some flexibility in the timeline. I am open to both research internships and full-time opportunities. Internship start dates and durations are flexible and can be coordinated based on the team's needs.

EDUCATION

National University of Singapore — Singapore
Ph.D. candidate in Computer Science, advised by Prof. Lin Shao — Aug. 2024 - Jul. 2027 [Expected]

Nanjing University — Nanjing, China
B.S. in Computer Science (Elite Class*) — Sept. 2020 - Jun. 2024

- GPA 4.514/5.000, Ranking 5/20, (Department) 21/256.

*: The Elite Class selects 20 students from the entire grade for scientific research-oriented training and independent ranking.

INTERNSHIP EXPERIENCE

RoboScience — Shenzhen, China
Embodied AI Research Intern / World Model Project Lead — Dec. 2025 – Sep. 2026

- Co-led the company's main World Model project from the ground up and led the research-side exploration; proposed a 3D full-object flow representation for robotic manipulation, enabling the model to predict the future motion of complete object geometry from image-language observations.
- Drove the research-side technical development, including problem formulation, representation design, data annotation pipelines, large-scale real/sim data construction, model design and training, evaluation and analysis, and robotic system deployment, forming an end-to-end pipeline from data and modeling to downstream execution.

RESEARCH EXPERIENCE

ObjectWorld: Scaling Object-Centric World Model and Datasets — NUS, Roboscience
Project Lead / First Author — 2025.11 - Present

- Led an object-centric world model project from the ground up, including problem formulation, research direction design, representation design, data/model pipeline, evaluation protocol, and robotic deployment.
- Proposed a 3D full-object flow representation for object-centric world modeling, enabling models to predict complete object flow from image-language multimodal observations for downstream robot manipulation.
- Built a scalable real data engine and automated annotation pipeline, covering video curation and segmentation, object segmentation, 3D/4D reconstruction, pose/mesh tracking, quality filtering, dataset organization, and benchmark construction.
- Designed, trained, and evaluated predictive models for 3D object dynamics; conducted ablation studies and error analysis; integrated predicted object flows with downstream robot execution systems.

Goal-VLA: Image-Generative VLMs as Object-Centric World Models NUS
Project Lead / First Author 2025.04 - 2025.09

- Led the project and developed a zero-shot robotic manipulation framework that uses image-generative VLMs as object-centric world models to predict desired goal states from visual observations and language instructions.
- Designed the full pipeline from goal-state generation to robot execution, including LLM/VLM agent collaboration, visual goal synthesis, reflection-based refinement, object pose estimation, spatial transformation recovery, and low-level manipulation planning.
- Built and evaluated the system across simulated and real-world manipulation tasks, demonstrating zero-shot generalization across diverse objects, scenes, and task instructions without task-specific robot demonstrations.

MetaFold: Language-Guided Multi-Category Garment Folding NUS
Project Lead / First Author 2024.08 - 2025.03

- Led the project and developed a language-guided framework for multi-category garment folding by disentangling high-level task planning from low-level action prediction for deformable object manipulation.
- Generated data with differentiable simulation and trained dense point-cloud trajectory generation models (Dynamic Model / World Model) to predict folding trajectories across diverse garment categories and language instructions.
- Integrated model training, trajectory prediction, action prediction, real-world perception, ablation studies, and robotic execution for real-robot deformable manipulation experiments.

SELECTED PUBLICATIONS

ObjectWorld: Scaling Object-Centric World Models with A Large-Scale 3D Full-Object Flow Dataset
Haonan Chen, Haitian Li, Sicheng Lu, Hexiang Wei, Jiajin Wu, Jiawei Zhang, Chenrui Tie, Jiongxu Chen, Zhuoman Liu, Yiwen Hou, Xin Fei, Chongkai Gao, Sheng Wang, Lin Shao
In Submission [Preprint]
TL;DR: Developed a large-scale 3D full-object flow dataset and an object-centric world model that converts image-language observations into 3D full-object flow for downstream robot manipulation.

MA-FPPO: Multi-Agent Flow-Pretrained Policy Optimization
Guowei Zou*, Haonan Chen*, Haitao Wang, Beiwen Zhang, Na Yan, Hejun Wu
In Submission [Preprint]
TL;DR: MA-FPPO combines flow-matching pretraining with online policy optimization, using shared team advantages to improve multi-agent adaptation and coordination.

ElasticWAM: Adaptive Spatiotemporal Imagination for Efficient Robot Control
Haitian Li, Tianfu Li, Xuxi Zhao, Zizheng Liu, Yangcheng Yu, Yiwen Hou, Xiao-Zeyu, Mutian Xu, Ziqian Yang, Haonan Chen, Lin Shao
In Submission [Preprint]
TL;DR: ElasticWAM uses action-guided supervision to decide where to refine imagined futures, how far to denoise, and when to stop, improving control efficiency through selective updates and cache reuse.

Goal-VLA: Image-Generative VLMs as Object-Centric World Models Empowering Zero-shot Robot Manipulation
Haonan Chen*, Jingxiang Guo*, Bangjun Wang, Tianrui Zhang, Xuchuan Huang Boren Zheng, Yiwen Hou, Chenrui Tie, Jiajun Deng, Lin Shao
IEEE International Conference on Robotics & Automation (ICRA) 2026 [Preprint]
TL;DR: Developed an object-centric world model using image-generative VLMs to predict goal states and translate them into robot actions, enabling zero-shot manipulation across objects and scenes.

MetaFold: Language-Guided Multi-Category Garment Folding Framework via Trajectory Generation and Foundation Model
Haonan Chen*, Junxiao Li*, Ruihai Wu*, Yiwei Liu, Yiwen Hou, Zhixuan Xu, Jingxiang Guo, Chongkai Gao, Zhenyu Wei, Shensi Xu, Jiaqi Huang, Lin Shao
IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) 2025 [Oral] [Preprint]

TL;DR: Proposed a language-guided garment folding framework that predicts dense trajectories for diverse garments, enabling multi-step deformable manipulation with foundation-model guidance.

TECHNICAL SKILLS

- **Research Areas:** World Models, VLA/VLM Systems, Multimodal Models, Robotic Manipulation
- **Modeling:** PyTorch, Transformer-based Models, Predictive Models, Generative Models, Multimodal Learning, Model Training and Evaluation.
- **3D & Robotics** 3D Vision, Point Clouds, Pose Estimation, Robot Manipulation, Simulation, Motion Planning, Real-World Robot Deployment.
- **Data & Systems** Dataset Construction, Automated Annotation, Benchmarking, Error Analysis.
- **Programming Language:** Python, C++.

AWARDS

- Research Scholarship, National University of Singapore 2024
- Nanjing University Outstanding Graduate, Nanjing University 2024
- Outstanding student leader of Nanjing University ($< 1\%$), Nanjing University 2022
- Special Scholarship for Undergraduates in Basic Science, Nanjing University 2021, 2022
- The people's scholarship in China, Nanjing University 2021, 2022