

Che Liu

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Research Interest: My research focuses on multimodal learning, integrating diverse modalities such as 2D and 3D visual data, video, audio, natural language, and time-series signals. I am particularly interested in multimodal understanding and the development of unified models that support both perception and generation. My work combines large-scale pretraining with reinforcement learning to enable structured cross-modal reasoning, aiming to build scalable and generalizable systems for complex real-world tasks.

Education

Feb 2022 – 2026 (expected)

■ **Ph.D. Imperial College London**

Research Topic: Multimodal Learning.

Supervisors: Dr Rossella Arcucci, Dr Wenjia Bai

Apr 2024 – Jun 2024

■ **Visiting PhD. Technical University of Munich**

Research Topic: Multimodal Learning.

Supervisor: Prof. Dr. Daniel Rückert

Sep 2019 – Sep 2021

■ **M.Sc. with Distinction, Swansea University.**

Major in Computational Mechanics.

(Formerly Erasmus Mundus Program)

Sep 2016 – Jul 2018

■ **B.Sc. Shanghai University of Engineering and Science**

Major in Automotive Engineering.

Experience

April 2025 – Present

■ **Visiting Researcher – Embodied VLM, X-humanoid, Remote.**

- Leading the VLM post-training team, leveraging SFT and self-evolving RL across 3B to 72B parameter models on large-scale video datasets (30k+ hours) to advance reasoning capabilities for natural and embodied tasks.

May 2025 – Present

■ **Visiting Researcher – OmniLLM, StepFun, Remote.**

- Advancing OmniLLM post-training via joint audio-visual-language SFT and RL, developing specialized data curation pipelines and omni-capability benchmarks to drive state-of-the-art Omni reasoning.

Nov 2024 – Apr 2025

■ **Research Intern – Unified Multimodal Vision Pretraining,**

DAMO Academy, Beijing, China.

- Developed a unified vision pretraining framework using a single framework capable of processing 2D images, 3D volumetric data, and video across modalities.

Jul 2024 – Sep 2024

■ **Research Intern – Vision-Language Models, AstraZeneca, Cambridge, UK.**

- Investigated multimodal learning using purely synthetic data (image-text pairs) generated by diffusion models and large language models.
- Demonstrated that synthetic pretraining outperforms state-of-the-art models trained on real-world data.

Selected Publications

- Pelican-VL 1.0: A Foundation Brain Model for Embodied Intelligence
C. Liu, X-Humanoid, Technical Report
- Nexus-O: An Omni-Perceptive And -Interactive Model for Language, Audio, And Vision
C. Liu, *et al.* ACM Multimedia 2025
- Unified Visual Self-Supervised Pre-training Across Video, 2D, and 3D Vision
C. Liu, Alibaba Inc, DAMO Academy. Technical Report
- Step-Audio 2 Technical Report
StepFun Audio Team. Technical Report
- Beyond Distillation: Pushing the Limits of Medical LLM Reasoning with Minimalist Rule-Based RL
C. Liu, *et al.* Technical Report
- Investigating Vision-Language Model Architectures for 3D Volume Understanding
C. Liu, *et al.* ACL 2025 Findings
- Succeeding in Vision-Language Pretraining with Purely Synthetic Data
C. Liu, *et al.* ACL 2025 Findings
- Multimodal Time-Series Learning with Test-Time Enhancement
C. Liu, *et al.* ICML 2024
- Vision-Language Pretraining for Dense Visual Representation Learning
C. Liu, *et al.* NeurIPS 2024
- Learning Textual Hierarchies through Vision-Language Pretraining
C. Liu, *et al.* IEEE Transactions on Medical Imaging 2024

Collaboration and Supervision († - Equal contribution, ‡ - Supervision)

- Ariadne: A Controllable Framework for Probing and Extending VLM Reasoning Boundaries
Minghe Shen, Zhengzhong Tu, **Che Liu**‡, *et al.* Under Review
- Emergent Hierarchical Reasoning in LLMs through Reinforcement Learning
Haozhe Wang, **Che Liu**, Wenhui Chen, *et al.* Under Review
- SuPreME: A Supervised Pre-training Framework for Multimodal Representation Learning
Mingsheng Cai, **Che Liu**‡, *et al.* EMNLP 2025 Findings
- NOVA: Benchmark for Anomaly Localization and Clinical Reasoning
Cosmin I. Bercea, **Che Liu**, *et al.* NeurIPS Dataset and Benchmark Track 2025 (**Oral**)
- SRPO: Enhancing Multimodal LLM Reasoning via Reflection-Aware Reinforcement Learning
Zhongwei Wan, **Che Liu**, Shen Yan, *et al.* NeurIPS 2025
- Unifying Cross-Lingual Vision-Language Pre-Training by Diminishing Bias
Zhongwei Wan†, **Che Liu**†, *et al.* NeurIPS 2023

Invited Talks

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| 2025 | ■ Incentivizing Medical LLM Reasoning Without Distillation King's College London. |
| 2024 | ■ ECG Multimodal Learning Peking University. |
| | ■ Synthetic Data for Medical Multimodal Learning AstraZeneca, Cambridge. |
| | ■ Multimodal Medical AI Stanford MedAI. |
| 2023 | ■ Language Bias in Medical Vision-Language Pretraining Imperial College London. |
| | ■ Cross-lingual Medical Vision-Language Pretraining Peking University. |
| | ■ Latent Geometry Optimization in Medical Vision-Language Pretraining King's College London. |

Awards and Achievements

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| 2024 | ■ Top Reviewer Award (Top 10%) . NeurIPS 2024. |
| | ■ Turing Scheme Funding . Imperial College London. |
| 2022 | ■ Google Research Grant . Google Cloud Platform. |
| | ■ Engineering School Dean's Fund . Imperial College London. |