Yipeng Xu

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Last Updated: 10 July, 2026

Education

- **B.Eng. in Mechanical Engineering (Coursework Completed)** — *University of Nottingham Ningbo China*
  Advisors: *Dr. Ahmad Mousa*, *Dr. Xiaoyang Wei*, *Prof. Yong Ren* — 2021 – 2023 (Transferred to CS)
- **B.Sc. in Computer Science** — *University of Nottingham Ningbo China*
  First-Class Honours, Advisors: *Dr. Jianfeng Ren, Prof. Xiangjian He* — 2023 – 2026
- **MPhil in Data Intensive Science** — *University of Cambridge*
  Proposed Focus: Quantum Gravity, Computational Cosmology and Physics-Informed AI — 2026 – 2027 (Expected)

Research Interest

- *How can we trace the causal fabric of quantum spacetime within the macroscopic cosmic web?*

- Theoretical modeling of relational quantum causal processes and operator-algebraic spacetime.
- Testing foundational physics and causal structures via large-scale structure and weak lensing.
- Physics-informed AI and foundation models for faint physical signal extraction in massive surveys.
- Data-driven methodologies and high-performance computing for cosmological data mining.

SKILLS

- **Theoretical Physics**: Quantum Causal Models, Operator Algebras, Differential Geometry, General Relativity.
- **Cosmological Data Analysis**: Large-Scale Structure (LSS) analysis, Weak Lensing, Parameter Estimation.
- **Physics-Informed AI**: Physics-Informed Neural Networks (PINNs), Deep Generative Models, Context-Aware Vision.
- **Scientific Computing**: High-performance computing with Python (PyTorch), C/C++, MATLAB & Linux clusters.

Key Courses Taken

- Machine Learning, Optimization Method, Pattern Recognition, Discrete Mathematics, Fluid Dynamics

Selected Research Papers

1. **Yipeng Xu**, *Relational Quantum Causal Processes for Quantum Gravity: From Operator-Algebraic Facts to Causal Geometry, Vacuum-Response Sequestering, and Noncommutative Matter*, Published as a preprint on Zenodo, doi:10.5281/zenodo.20691997, 2026.
2. **Yipeng Xu**, *Neuro-symbolic discovery of interpretable subgrid-scale closures for large-eddy simulation via constrained Monte Carlo tree search*, intended for Journal of Fluid Mechanics (JFM).
3. **Yipeng Xu**, *Opinion: A Unified World Model is the cornerstone for integrating perception, reasoning, and decision-making in embodied AI*, accepted by Annual Conference on Neural Information Processing Systems (NeurIPS) 2025 Workshop: Embodied World Models for Decision Making.
4. **Yipeng Xu**[*], Mingxuan Chai[*], Jisheng Dang[*], Quan Wan, Bimei Wang, Hong Peng, Qiao Lin, Jianhuang Lai, Bin Hu, Tat-Seng Chua, *ActiveLook: Progressive Multi-Scale Active Perception for Long Video Reasoning*, Under Review at IEEE Transactions on Multimedia (TMM).
5. Yuzhe Wu[*], **Yipeng Xu**[*], Tianyu Xu, Jialu Zhang, Jianfeng Ren, Xudong Jiang, **Equal Contribution*, *GCA-SUNet: A Gated Context-Aware Swin-UNet for Exemplar-Free Counting*, arXiv:2409.12249 accepted by IEEE International Conference on Multimedia and Expo (ICME) 2025.
6. Xi Chen[*], **Yipeng Xu**[*], Yue Yuan, Qiao Lin, Xiaoyang Wei, Yuanyuan Shao, Jesse Zhu, Dongbing Li, *Data-driven machine learning for scale-up of bubbling and turbulent fluidized beds: Flow hydrodynamics and reactor performance*, accepted by Engineering Applications of Computational Fluid Mechanics (EACFM).
7. **Yipeng Xu**, Lijie Zhou, Alejandro Guerra-Manzanares, Kwadwo Dompreh, Siegfried Yeboah, Matthew Pike, *An Empirical Study of Turbidity Forecasting on Open Aquaponics Sensor Data*, accepted by IEEE Computer Society Signature Conference on Computers, Software, and Applications (COMPSAC), IEEE International Workshop on Trustworthy Agri-Data Management track 2026.
8. Jialu Zhang[*], Yuzhe Wu[*], **Yipeng Xu**[*], Yiran Li, Jianfeng Ren, Xudong Jiang, *LLaVA-SEGA: LLaVA-guided Semantic-Enhanced Group-Attended Framework for Class-Agnostic Counting*, under review at IEEE Transactions on Image Processing (TIP).
9. **Yipeng Xu**, Zehan Wang, Zixin Ding, Jing Xu, Qiao Lin, *Hybrid STGAT-MAPPO: Robust Multi-Agent Graph Reinforcement Learning for Scalable LEO Satellite Packet Routing*, Intended for IEEE Transactions on Network and Service Management (TNSM).

Selected Research Experience

- **Semi-Supervised Galaxy Morphology Classification** **[Key Contributor]** Jul. 2022 – Jun. 2023
  Advisor: *Minxiang Fu, Nan Li* @ National Astronomical Observatories, Chinese Academy of Sciences
  – Developed a semi-supervised framework for galaxy morphology classification using multi-scale structural contrastive loss to address noise, label sparsity, and class imbalance in astronomical imaging.
  – Designed an enhanced MoCo for unsupervised pre-training, integrated with adversarial training and robust regularization, significantly improving classification accuracy, AUC, and stability on multiple astronomical datasets, showing high potential for large-scale surveys.
- **Developing Global Correlations Between CPT Data and Vs in Sands** **[Key Contributor]** Dec. 2022 – July. 2023
  Advisor: *Abdulhalim Saeed, Ahmad Mousa* @ UNNC
  – Developed an ANN-based regression model to establish global correlations between Cone Penetration Test (CPT) data and shear wave velocity (Vs) in sands, focusing on liquefaction potential estimation.
  – The work addressed key challenges in geo-mechanical parameter estimation and was invited for presentation at the 3rd Symposium on Science and Engineering Education.
- **Physics-Inspired Machine Learning For the Scale-up of Fluidized Beds** **[Key Contributor]** Jun. 2023 – Apr. 2026
  Advisor: *Xiaoyang Wei* @ UNNC, *Jesse Zhu*, Fellow, Royal Society of Canada @ Western University
  – Developed a physics-inspired neural network for predicting flow hydrodynamics and reaction performance in fluidized beds, enhancing model generalizability and reducing computational cost for industrial scale-up. The corresponding paper is pending submission to AIChE Journal.
- **Interactive Automatic Image Labeling Platform Development** **[Group Leader]** Oct. 2024 – Aug. 2025
  Advisor: *Qing Xu, Xiangjian He*, Computer Vision and Intelligent Perception Laboratory @ UNNC
  – Led the development of a web platform for image data management and box prompt-based annotation, exploring the real-world deployment of advanced deep learning models.
  – The system integrates model ensembling, fine-tuning, and post-processing to automate labeling, addressing challenges in annotation efficiency, usability, and model trustworthiness.
- **State-of-the-art Deep Learning Model for Open-world Object Counting** **[Co-First Contributor]** May. 2024 – Now
  Advisor: *Jianfeng Ren*, Artificial Intelligence and Optimisation (AIOP) research group @ UNNC
  – Proposed GCA-SUNet, a Swin-UNet with a gated context-aware block for exemplar-free counting, achieving SOTA results by suppressing irrelevant features.
  – Developed LLaVA-SEGA, a cross-modal framework for few-shot counting that uses refined semantic features and candidate aggregation to count objects from visual exemplars alone, outperforming existing methods.
- **AI Foundation Model-based Management for NEV Power Batteries** **[Project Leader]** Jun. 2025 – Oct. 2025
  Advisor: *Yong Ren* @ UNNC, *Tao Wu*, Fellow of the British Royal Society of Chemistry @ UNNC
  – Led the development of an AI-driven framework for NEV battery SOH forecasting and thermal-runaway early warning. Acted as the project leader and applicant, coordinating a multidisciplinary team to participate in the 2025 "Challenge Cup" China Technology Innovation “Open bidding for selecting the best candidates” Competition.
  – SOH forecasting: A first-principles, MCU-deployable method comparing twin-condition charging segments to estimate capacity fade.
  – Thermal runaway early warning: A hierarchical system with a DLinear sentinel and an SE-TimesNet expert for robust, pack-level risk confirmation, optimized via ASHA for automated tuning.
  – Designed an edge-cloud architecture for on-board low-latency alerts and high-precision cloud verification.
- **Academic Services**: reviewer for IEEE International Conference on Multimedia & Expo (ICME) 2025, AAAI Conference on Artificial Intelligence (AAAI) 2026

Scholarships and Awards

- Zhejiang Provincial Outstanding Graduate 2026
- COMAP’s Mathematical Contest in Modeling (MCM), Finalist (Top 1%) 2026
- "Challenge Cup" China Technology Innovation Competition, National Grand Award 2025
- Chinese Astronomical Society undergraduate Astronomical Innovation Contest, A-Class Award (First Place) 2025
- Zhejiang Provincial Government Scholarship (2% among undergraduates) 2024
- Dream Scholarship - Science and Technology Category (2 out of 10,000 undergraduates and postgraduates) 2024
- Best Poster Award of FoSE Undergraduate Research Practice Showcase 2024
- COMAP’s Mathematical Contest in Modeling (MCM), Meritorious Winner & Honorable Mentions 2024
- Dream Scholarship - Science and Technology Category (4 out of 10,000 undergraduates and postgraduates) 2023
- COMAP’s Mathematical Contest in Modeling (MCM), Meritorious Winner 2023
- National Astronomical Observatories, Chinese Academy of Sciences Undergraduate Research Fellowship 2022
- COMAP’s Interdisciplinary Contest in Modeling (ICM), Meritorious Winner 2022
- Nottingham Outstanding Student Leader 2022