Yadi Cao

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Contents

Research Focus

Scientific machine learning, plasma simulation, computational mechanics, computational fluid dynamics

Bio

Yadi Cao is a postdoctoral researcher in CSE at UCSD, within Rose Yu's STL lab. He completed his Ph.D. in 2024 from the Multiples lab at UCLA, co-advised by Professors Chenfanfu Jiang and Demetri Terzopoulos. His work has been recognized by prestigious awards and mentions, including Best Paper Award at the DLDE workshop at NeurIPS 2023, Spotlight at NeurIPS 2022, and Editor's Pick in Physics of Fluids 2018.
Yadi is seeking tenure-track positions and is open to mentoring and collaboration opportunities.

Education

University of California, Los Angeles (UCLA) Los Angeles, CA
Ph.D. in Computer Science *2021–2024*

- Thesis: Advancing physics-based simulations: Integrating conventional and machine learning approaches for enhanced computational efficiency
- Advisors: Chenfanfu Jiang (Applied Math) and Demetri Terzopoulos (Computer Science)

University of British Columbia (UBC) Kelowna, BC, Canada
MASc in Mechanical Engineering *2016–2018*

- Thesis: Analytical and numerical study of plug flow inside round/concentric microchannels
- Advisor: Sunny Ri Li (Mechanical Engineering)

University of Science and Technology of China (USTC) Hefei, Anhui, China
BEng *2012–2016*

Publications [Google Scholar]

Preprints

- Yang, J, Bhat, M, Hu, B, **Cao, Y**, Dehmamy, N, Walters, R, Yu, R. Discovering Symbolic Differential Equations with Symmetry Invariants. Arxiv 2505.12083.
- Yue, L, Somasekharan, N, **Cao, Y**, Pan, S. Foam-Agent: Towards Automated Intelligent CFD Workflows. Arxiv 2505.04997.
- **Cao, Y***, Liu, Y* (equal contribution), Yang, L, Yu, R, Schaeffer, H, Osher, S. VICON: Vision In-Context Operator Networks for Multi-Physics Fluid Dynamics Prediction. Arxiv 2411.16063.
- Wang, H, **Cao, Y**, Huang, Z, Liu, Y, Hu, P, Luo, X, Song, Z, Zhao, W, Liu, J, Sun, J, Zhang, S. Recent Advances on Machine Learning for Computational Fluid Dynamics: a Survey. Arxiv 2408.12171.

Journal Articles in Submission

- **Cao, Y***, Zhang, F*, Liu, W* (equal contribution), Neiser, T, Meneghini, O, Smith, S, Nazikian, R, Sammuli, B, Yu, R. TGLF-SINN: Deep Learning Surrogate Model for Accelerating Turbulent Transport Modeling in Fusion. In submission to Nuclear Fusion.

- Ding, Y, Wu, K, **Cao, Y**, Magdon-Ismail, M, Gao, J. Computing Equilibria in Complex Systems with Billions of Interactions. In submission to PNAS NEXUS.

Conference Proceedings

- Lyu, B*, **Cao, Y*** (equal contribution), Watson-Parris, D, Bergen, L, Berg-Kirkpatrick, T, Yu, R. Adapting While Learning: Grounding LLMs for Scientific Problems with Intelligent Tool Usage Adaptation. ICML 2025.
- Maheshwari, S, Mohanty, A, **Cao, Y**, Razu, S, McCulloch, A, Yu, R. BIGE: Biomechanics-informed GenAI for Exercise Science. L4DC 2025.
- Huang, Z, Zhao, W, Gao, J, Hu, Z, Luo, X, **Cao, Y**, Chen, Y, Sun, Y, Wang, W. Physics-Informed Regularization for Domain-Agnostic Dynamical System Modeling. NeurIPS 2024. **Best Paper Award**, NeurIPS DLDE workshop 2023.
- **Cao, Y**, Chai, M, Li, M, Jiang, C. Efficient Learning of Mesh-Based Physical Simulation with Bi-Stride Multi-Scale Graph Neural Network. ICML 2023.
- Li, X, **Cao, Y**, Li, M, Yang, Y, Zhang, X, Schroeder, C, Jiang, C. PlasticityNet: Learning to Simulate Metal, Sand, and Snow for Optimization Time Integration. **Spotlight**, NeurIPS 2022.

Journal Articles

- **Cao, Y**, Zhao, Y, Li, M, Yang, Y, Choo, J, Terzopoulos, D, Jiang, C. Unstructured moving least squares material point methods: a stable kernel approach with continuous gradient reconstruction on general unstructured tessellations. Computational Mechanics, 2024.
- Fang, Y, Li, M, **Cao, Y**, Li, X, Wolper, J, Yang, Y, Jiang, C. Augmented Incremental Potential Contact for Sticky Interactions. IEEE TVCG 2023.
- **Cao, Y**, Chen, Y, Li, M, Yang, Y, Zhang, X, Aanjaneya, M, Jiang, C. An Efficient B-Spline Lagrangian/Eulerian Method for Compressible Flow, Shock Waves, and Fracturing Solids. ACM TOG (SIGGRAPH) 2022.
- **Cao, Y**, Gao, X, Li, R. A Liquid Plug Moving in an Annular Pipe: Heat Transfer Analysis. International Journal of Heat and Mass Transfer, 2019.
- **Cao, Y**, Li, R. A Liquid Plug Moving in an Annular Pipe: Flow Analysis. Physics of Fluids, 2018. **Editor's Pick**.

Academic and Technical Talks

Efficient Learning of Multi-Physics Simulation by Vision In-Context Operator Learning
Algorithms For Multiphysics Models In The Post-Moore's Law Era, LANL (Host: Brian Oshea) *Jun, 2025*

TGLF-SiNN: A Spectra-informed Deep Learning Surrogate for Accelerating Fusion
UCSD MAE+CER Winter 2025 Energy Seminar, UCSD (Host: George Tynan) *Feb, 2025*

A Data-Efficient, Energy Spectrum-Informed Surrogate Modeling for Fusion Simulations
National Artificial Intelligence Research Resource Virtual Session Panelists (Host: Nitin Sukhija) *Oct, 2024*

Advancing Physics-based Simulation with Unstructured Discretization and Machine Learning
UCLA Level Set Lab Reading Group (Host: Stanley Osher) *Feb, 2024*
UCSD Rose STL Lab Reading Group (Host: Rose Yu) *Jan, 2024*
Yale Lu Group Reading Group (Host: Lu Lu) *Jan, 2024*
Caltech Anima AI + Science Lab Reading Group (Host: Anima Anandkumar) *Jan, 2024*

Research Community Service

Program Committee

- AAAI (2025)
- IJCAI (2024)

Reviewer (excluding committee services listed above)

- NeurIPS (2023, 2025)
- ACM SIGGRAPH (2024, 2025)
- ICML (2024, 2025)
- ICLR (2024, 2025)
- TMLR (Transactions on Machine Learning Research) (2025)
- IEEE Transactions on Visualization and Computer Graphics (2025)
- ICLR Workshop: Tackling Climate Change with Machine Learning (2025)
- Pacific Graphics (2022, 2024)
- Physics of Fluids (2018–2024)

Mentoring

Current Mentees

- **Undergraduate Students:**
  - Wesley Liu (UCSD; next stop: master student at USC)
  - Lucas Hlaing (UCSD)
  - Zach Lawrence (UCSD)
  - Leo Lai (UCSD)
  - Chloe Huang (University of Michigan; next stop: PhD student at Rose Lab)
  - Yang Zhang (Peking University)

Alumni

- **Master Students:**
  - Futian Zhang (UCSD; next stop: Software Engineer at ServiceNow)
  - Shubh Maheshwari (UCSD)
  - Howard Tsai (UCSD)
- **Undergraduate Students:**
  - Bohan Lyu (Tsinghua University; next stop: visiting student at Princeton University)
  - Darin Djapri (UCSD; next stop: continuing study at UCSD)
  - Yuwei Ren (UCSD; next stop: continuing study at UCSD)

Programs

Gear Up2Research (GEAR) 2025
UCSD *San Diego, CA*

Early Research Scholars Program (ERSP) 2024–2025
UCSD *San Diego, CA*

Summer Training Academy for Research Success (STARS) 2024
UCSD *San Diego, CA*

Teaching

Teaching Fellow at University of California Los Angeles
Operating Systems Principles (CS 111) (Instructors: Paul Eggert, Peter Reiher) *6 Quarters, 2022–2024*
Introduction to Algorithms and Complexity (CS 180) (Instructor: Matthew Ferland) *Summer 2023*

Teaching Assistant at University of British Columbia
Heat Transfer Applications (ENGR385) (Instructor: Ri Li) *Spring 2018*
Measurement Principles in Thermal Fluids (ENGR479) (Instructor: Ri Li) *Winter 2018*
Matter and Energy (APSC182) (Instructors: Shelir Ebrahimi, John Brereton) *2 Semesters, 2016–2017*

Industry Experience

Student Researcher 2023–2024
AR Perception, Google *Los Angeles, CA*
Researcher Intern 2022
Creative Vision, Snap *Los Angeles, CA*
SDE Intern 2021
Taichi Graphics *Beijing, China*
CAE/FEM Software Research Developer 2019–2020
shonCloud Tech/shonDynamics *Suzhou, Jiangsu, China*

Awards and Honors

UCLA Non-residential Tuition Grant 2022–2024
UCLA Graduate Fellowship 2021
UBC Graduate Fellowship 2017–2018
NSERC Funding for Exchange Research 2017
USTC Alumni Fellowship of B.C. Canada 2017
Bronze Prize, Zhongwei-cup Energy & Environment Protection Contest 2015
Silver Prize, National Outstanding Undergraduate Scholarship 2013–2014