Yixuan Jia

Ann Arbor, Michigan, USA | jiayx@umich.edu | +1 (734)-846-2853 | Homepage | Google Scholar

Research Interests

Generative Models, Agentic AI and GenAI for Science, with recent focus on **Video Generation** and **World Models**, which share foundational structure with my work on generative priors and diffusion-based inference.

Education

University of Michigan, PhD candidate in Electrical and Computer Engineering — Jan 2023 – Now

- Advisor: Jeffrey Fessler, Qing Qu
- Awards: Riethmiller Fellowship, 2026

University of Michigan, M.S. in Electrical and Computer Engineering — Sept 2020 – Dec 2022

- GPA: 4.0/4.0
- Coursework: Matrix Methods for SIPML, Optimization Methods for SIPML, DL for Computer Vision, Large Language Models

Tsinghua University, B.S. in Instrument Science and Technology (Primary) — Sept 2014 – Jul 2018

- Core Coursework GPA: 3.8/4.0
- Awards: Scholarship for Future Scholars, 2018, Tsinghua University (Top 3%)

Tsinghua University, B.B.A. (Secondary) — Sept 2015 – Jul 2018

- Core Coursework GPA: 3.8/4.0

Work Experience

ByteDance (Seed), Research Scientist Intern, Agentic AI for Science – San Jose, CA, USA — May 2026 – Aug 2026

Supervisor: Yilai Li

- Developed a domain-specific adaptation of the EvoMaster agent harness framework for exchange-correlation density functional discovery, including a population management protocol tailored to the search process.
- Achieved performance comparable to SOTA, demonstrating the effectiveness of the designed agent harness on a challenging scientific discovery benchmark.

Woobo Inc., Algorithm & Software Development Engineer Intern – Beijing, China — Sept 2018 – Jun 2019

Supervisor: Feng Tan

- Implemented a speech recognition system using Kaldi to enhance command recognition accuracy.
- Developed a speech synthesis module based on HTS (HMM-based Text-to-Speech) for natural human-robot voice interaction.
- Built and assembled a 3D-printed prototype using SolidWorks for visualization.

Research Experience

I. Diffusion Models & Video Generation

- Proposed **ICR (ICML 2026)**: the Invariant Contamination Ratio, a label-free metric based on Fisher-style invariance–residual decomposition that identifies optimal feature-extraction noise levels in diffusion models and serves as an early signal of memorization under limited data.
- Co-developed **MCLR (NeurIPS 2026)**: a principled alignment objective that maximizes inter-class likelihood-ratios during training, achieving classifier-free-guidance-quality samples under standard sampling, and formally established the equivalence between CFG and alignment-based training.
- Co-developed **Directional Phase Transitions (Under Review)**: introduced a directional expansion rate revealing a contraction–expansion–contraction phase structure in reward-guided flow sampling, and an adjoint-based control within the expansion window that improves reward alignment on data assimilation, PDE solving, and text-to-image generation.
- Co-developed **Raster or Random? (Under Review)**: a unified causal-attention framework that isolates generation order as the only variable, showing autoregressive order wins on language while random order wins on images, explained by training-time order augmentation and inference-time shift accumulation.
- Proposed **ForcingDAS (ICMLW 2026 Spotlight)**: repurposed diffusion forcing from video generation to learn a single joint-trajectory (video) prior with per-frame noise schedules, unifying filtering and smoothing at inference time without retraining.
- Co-developed **Data-Forcing Distillation (DFD, ICMLW 2026)** with NVIDIA Research: a distillation method that restores both diversity and fidelity in few-step video generation, enabling efficient sampling without sacrificing generation quality.
- Co-developed **DeCache (Under Review)** with Kuaishou: a training-free streaming video super-resolution framework that decou-

ples observation-conditioned rendering from KV-cache memory writing, preventing degraded frames from contaminating temporal memory and achieving state-of-the-art perceptual quality.

II. AI for Science

- *Agentic AI for Science:* Co-developed **Imaging-101 (ICCP 2026 Oral)** with He Sun's group at Peking University: a benchmark of 57 expert-verified, paper-grounded computational imaging tasks across six scientific domains (from astronomy to medicine), each canonicalized into a four-stage pipeline (preprocessing, forward physics, inverse solver, visualization) and evaluated on planning, function-level, and end-to-end reconstruction tracks. Evaluating seven frontier LLM coding agents showed that the dominant failures are scientific-reasoning gaps rather than coding bugs, e.g., selecting physically inappropriate inverse solvers and missing tacit unit conventions and normalizations, motivating skill-augmented, domain-specialized imaging copilots.
- *Data Assimilation & PDEs:* Proposed **FlowDAS (NeurIPS 2025)**: the first stochastic-interpolant framework that jointly learns observation-conditioned state-transition dynamics and generative priors for unknown stochastic systems, achieving state-of-the-art on Navier-Stokes and SEVIR weather nowcasting; extended by **ForcingDAS** to 2D Navier-Stokes vorticity, SEVIR precipitation nowcasting, and global atmospheric state estimation.
- Co-developed **DAWN (Under Review)**: a training-data-free blind deconvolution framework alternating Wiener-guided input injection with deep-image-prior refinement, outperforming the state of the art by up to 4.5 dB under heavy noise.
- Co-developed **FunBCS (NeurIPSW 2026)**: a function-space backward-consistent diffusion sampler that optimizes the denoiser input for physics-consistent reconstruction from sparse observations, reducing error by 27–64% and running 1.4–2.1$\times$ faster than the state of the art on four PDE inverse problems.
- *Computational & Biomedical Imaging:* Led 2 journal papers (**SpeRF**, **Y90 SPECT**) and contributed to 2 SNMMI conference abstracts (**At-211 SPECT**, **SAMS**) on deep-learning methods for clinical SPECT imaging, in collaboration with the UMich Nuclear Medicine Department.
- Highlights: **SpeRF (EJNMMI Physics 2025)** achieved up to 4$\times$ reduction in clinical Lu-177 SPECT acquisition time via NeRF-style self-supervised projection synthesis (phantom + 17 patient studies); **Y90 SPECT (EJNMMI Physics 2023)** achieved 66% lower NMAE than the Monte-Carlo gold standard via a unified 3-stage CNN for scatter estimation, reconstruction, and dosimetry.

Entrepreneurial Experience

H2OS (h2oswater.com), Co-founder & Lead AI Researcher – Ann Arbor, MI, USA Jan 2026 – Present

Co-founders: Yuhan Li (CEO), Yiting (Sophia) Li (CTO)

What is H2OS? *H2OS is an AI-powered aquaculture startup developing dissolved-oxygen sensing and forecasting systems to help fish farms prevent hypoxia and optimize aeration, feeding, and water-management decisions.*

- Led the design of H2OS's core dissolved-oxygen forecasting model in aquaculture ponds: an LSTM-based time-series model trained via physics-guided transfer learning, using a data-rich estuary dataset to improve forecasting in a data-scarce fish farm setting.
- Incorporated two domain-specific physical constraints into LSTM training: Henry's law (temperature-dependent DO solubility) and the monotonic nighttime DO depletion trend, improving physical consistency and reducing negative transfer across environments.
- Using only the first four nighttime measurements to recursively forecast DO until dawn, the proposed method achieves $> 30\%$ lower RMSE than a standard LSTM, demonstrating the value of combining transfer learning with physics-based regularization.

Publications

* Equal contribution † Corresponding author

First-Author Publications

[6] S. Chen*, J. Ying*, ***Y. Jia****, Y. Gu*, E. Ye, W. Bai, Z. Zeng, S. Ren, B. Gao, Y. Li, T. Zhang, H. Sun†. Imaging-101: Benchmarking LLM Agents for Scientific Computational Imaging. *ICCP 2026* (Oral).

[5] ***Y. Jia***†, S. Chen, Y. Pan, X. Li, L. Shi, C. Jung, H. Yuan, I. Alkhouri, Y. Wu, S. Ravishankar, J. Fessler, Q. Qu. ForcingDAS: Unified and Robust Data Assimilation via Diffusion Forcing. *ICMLW 2026* (Spotlight).

[4] X. Li*, ***Y. Jia****, Z. Zhang, X. Li, L. Shi, J. Zhou, Z. Zhu, L. Shen, Q. Qu†. Evaluating the Representation Space of Diffusion Models via Self-Supervised Principles. *ICML 2026* (Poster).

[3] S. Chen*, ***Y. Jia****, Q. Qu, H. Sun†, J. Fessler. FlowDAS: A Stochastic Interpolant-Based Framework for Data Assimilation. *NeurIPS 2025* (Poster).

[2] Z. Li*, ***Y. Jia****†, X. Xu, J. Hu, Y. Dewaraja, J. Fessler. Shorter SPECT Scans using Self-Supervised Coordinate Learning to Synthesize Skipped Projection Views. *EJNMMI Physics* | *IMSI Computational Imaging 2024 Workshop* (Oral).

[1] ***Y. Jia***†, Z. Li, A. Akhavanallaf, J. Fessler, Y. Dewaraja. ^{90}Y SPECT Scatter Estimation and Voxel Dosimetry Using a Unified Deep Learning Framework. *EJNMMI Physics* | *SNMMI 2023* (Oral).

Other Publications

[6] Y. Pan, M. H. Ashiq, C. Jung, ***Y. Jia***, J. M. Miller, Q. Qu, I. Alkhouri. Backward-Consistent Diffusion Sampling for Sparsely Observed PDE Inverse Problems. *NeurIPSW 2026* (Poster).

[5] S. Chen, S. Liu, ***Y. Jia***, Z. Wang, H. Ling, Q. Qu, J. Gao†. Data-Forcing Distillation: Restoring Diversity and Fidelity in Few-Step Video Generation. *ICMLW 2026* (Poster).

[4] F. Hussain, ***Y. Jia***, Z. Li, Z. Lu, J. Fessler, Y. Dewaraja†. Deep Residual Learning Framework for Scatter Estimation in SPECT Imaging of Alpha Emitters: Application in ^{211}At SPECT. *SNMMI 2026* (Poster).

[3] X. Li†, ***Y. Jia***, X. Li, J. Fessler, R. Wang, Q. Qu. MCLR: Improving Conditional Modeling in Visual Generative Models via Inter-Class Likelihood-Ratio Maximization. *NeurIPS 2026* (Poster) | *ICMLW 2026* (Oral).

[2] Z. Lu, Z. Li, ***Y. Jia***, G. Chen, M. Roseland, G. Mok, Y. Dewaraja†. Segment Anything Model for SPECT (SAMS): Novel Implementation in SPECT Imaging for Tumor Segmentation. *JNM Supplementary* | *SNMMI 2024* (Oral).

[1] Y. Gou, ***Y. Jia***, P. Wang†, C. Sun. Progress of Inertial Microfluidics in Principle and Application. *Sensors*.

Under Review

[4] Y. Pan, ***Y. Jia***, C. Huang, Q. Qu, I. Alkhouri. DAWN: Robust Neural Blind Deconvolution via Alternating Wiener Guidance. *CVPR 2027 Submission*.

[3] R. Zhu, W. Bai, ***Y. Jia***, K. Zhao, H. Sun. DeCache: Decoupled and Damped Memory Purification for Robust Streaming Video Enhancement. *ICLR 2027 Submission*.

[2] C. Jung, ***Y. Jia***, Y. Pan, I. Alkhouri, W. H. Ali, L. Shen, Q. Qu. Directional Phase Transitions in Reward Guidance for Flow Models. *ICLR 2027 Submission*.

[1] L. Shi, G. Li, H. Zhang, ***Y. Jia***, Q. Qu. Raster or Random? Let the Data Decide. *ICLR 2027 Submission*.

Skills

Research Areas: Diffusion Models, Flow Matching, Generative AI, Foundation Models, Representation Learning, Self-Supervised Learning, Data Assimilation, Inverse Problems, Computational Imaging, Video Generation, World Models

Models & Techniques: Stochastic Interpolants, Score Matching, Diffusion Forcing, Diffusion Transformer (DiT), Classifier-Free Guidance (CFG), Contrastive Learning, Model Distillation, LoRA / Fine-Tuning, Neural Radiance Fields (NeRF), Variational Inference, Bayesian Filtering / Smoothing

ML Frameworks & Libraries: PyTorch, JAX, PyTorch Lightning, Hugging Face Diffusers / Transformers, Weights & Biases

Distributed Training & Infrastructure: Multi-GPU / Multi-Node Training (DDP, FSDP), Docker, Git, Linux, Slurm, HPC Clusters

Programming Languages: Python, C++, C, MATLAB, Julia

Math Foundation: Optimization, Probability & Statistics, Linear Algebra

AI-Assisted Development: Cursor, Claude Code, GitHub Copilot

Teaching

Graduate Student Instructor, University of Michigan — Fall 2022 – Spring 2025

- EECS 559 Optimization Methods for SIPML (Wn23, Wn25)
- EECS 551 Matrix Methods for SIPML (Fa24)
- EECS 453 Principles of Machine Learning (Fa22)
- Biomedical AI (Fa23)
- AI Magic Summer School — K-12 outreach (Su24)

Service

Conference & Journal Reviewer: NeurIPS, ICLR, ICML, CPAL, EJNMMI Physics, QIMS

Organizer, The 2025 Michigan Student Symposium for Interdisciplinary Statistical Sciences (*MSSISS 2025*) — Oct 2024 – Mar 2025