

Yixuan Jia

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Research Interests

AI for Science, Generative Models, Data Assimilation, Inverse Problems, Computational Imaging

Education

- University of Michigan, PhD candidate in Electrical and Computer Engineering Jan 2023 – Now
- Advisor: [Jeffrey Fessler](#), [Qing Qu](#)
- Research Interest: Machine Learning, Generative Models, AI for Science, Computational Imaging
- University of Michigan, Master of Science 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, Bachelor of Science in Instrument Science and Technology (Primary) Sept 2014 – Jul 2018
- Core Coursework GPA: 3.8/4.0
- Coursework: Principles of Microcomputers, Embedded System Design and Practice
- Awards: Scholarship for Future Scholars, 2018, Tsinghua University (Top 3%)
- Tsinghua University, Bachelor of Business Administration (Secondary) Sept 2015 – Jul 2018
- Core Coursework GPA: 3.8/4.0
- Coursework: Principles of Economics, Principles of Management, Principles of Marketing

Publications

* Equal contribution † Corresponding author

First-Author Papers

- [3] FlowDAS: A Stochastic Interpolant-Based Framework for Data Assimilation
[ArXiv](#) | Presented at [NeurIPS 2025 \(Poster\)](#)
S. Chen*, **Y Jia***, Q. Qu, H. Sun[†], J. Fessler
- [2] Shorter SPECT Scans using Self-Supervised Coordinate Learning to Synthesize Skipped Projection Views
[EJNMMI Physics](#) | Presented at [IMSI Computational Imaging Workshop 2024 \(Oral & Poster\)](#)
Z. Li*, **Y Jia***[†], X. Xu, J. Hu, Y. Dewaraja, J. Fessler
- [1] Y^{90} SPECT Scatter Estimation and Voxel Dosimetry Using a Unified Deep Learning Framework
[EJNMMI Physics](#) | Presented at [SNMMI 2023 \(Oral\)](#)
Y Jia[†], Z. Li, A. Akhavanallaf, J. Fessler, Y. Dewaraja

Other Publications

- [3] MCLR: Improving Conditional Modeling in Visual Generative Models via Inter-Class Likelihood-Ratio Maximization
[ArXiv](#)
X. Li, **Y Jia**, X. Li, J. Fessler, R. Wang, Q. Qu
- [2] Segment Anything Model for SPECT (SAMS): Novel Implementation in SPECT Imaging for Tumor Segmentation
[JNM Supplementary](#) | Presented at [SNMMI 2024 \(Oral\)](#)
Z. Lu, Z. Li, **Y Jia**, G. Chen, M. Roseland, G. Mok, Y. Dewaraja[†]
- [1] Progress of Inertial Microfluidics in Principle and Application
[Sensors](#)
Y. Gou, **Y Jia**, P. Wang[†], C. Sun

Teaching

- [6] Optimization Methods in SIPML | UMich | Graduate Student Instructor Jan 2025 - May 2025
- [5] Matrix Methods for SIPML | UMich | Graduate Student Instructor Sep 2024 - Dec 2024
- [4] AI Magic Summer School | UMich | Graduate Student Instructor Jul 2024 - Aug 2024
- [3] Biomedical AI | UMich | Graduate Student Instructor Sep 2023 - Dec 2023
- [2] Optimization Methods in SIPML | UMich | Graduate Student Instructor Jan 2023 - Apr 2023

Working Experience

[1] Algorithm & Software Development Engineer, Intern at Woobo Inc. – 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) to enable natural voice responses in human-robot interactions.
- Built and assembled a 3D printed prototype using SolidWorks for visualization.

Leadership

[5] Organizer of The 2025 Michigan Student Symposium for Interdisciplinary Statistical Sciences ([MSSISS 2025](#))

Oct 2024 - Mar 2025

[4] Founder & Director, Private Educational Studio (Self-Owned), Beijing

Jun 2019 - Jun 2021

[3] Lead Counselor, Summer School of Science and Engineering, Tsinghua University

Jul 2017 - Aug 2017

[2] Chair of Sports, Student Union of Department, Tsinghua University

Sep 2016 - May 2017

[1] Head of Sports Department, Student Union of Department, Tsinghua University

Sep 2015 - May 2016

Projects

[10] **ForcingDAS: Unifying Filtering and Smoothing in Learned Data Assimilation**

Sep 2025 - Now

- Developing ForcingDAS, a unified data assimilation framework that bridges sequential filtering and variational smoothing through per-frame diffusion with a flexible scheduling matrix, enabling inference-time selection of assimilation strategies without retraining.
- Introducing causally-aligned training and noise-level-aware observation guidance; evaluating on Navier-Stokes and SEVIR radar nowcasting benchmarks. Targeting **NeurIPS 2026**.

[9] **ICR: Evaluating Diffusion Model Representations via Self-Supervised Principles**

Sep 2025 - Now

- Proposing the Invariant Contamination Ratio (ICR), a label-free metric based on Fisher-style invariance-residual decomposition to evaluate diffusion model feature quality across noise levels and training stages.
- Demonstrating that ICR identifies optimal noise levels for feature extraction and serves as an early signal of memorization under limited data, without requiring labels or generation. Submitted to **ICML 2026**, under review.

[8] **Inverse-101: Benchmarking LLMs for Scientific Inverse Problems**

Sep 2025 - Now

- Building Inverse-101, a comprehensive benchmark evaluating LLMs on scientific inverse problems across physics, chemistry, biology, and medical imaging, with automated subtask decomposition and unit-test verification.
- Revealing key LLM failure modes: domain-specific scientific knowledge gaps, “scientific debugging atrophy” (defaulting to trial-and-error over diagnostic reasoning), and lack of physics-grounded numerical intuition for units, scaling, and conditioning. Targeting **ICCP 2026**.

[7] **MCLR: Improving Conditional Modeling via Inter-Class Likelihood-Ratio Maximization**

Jun 2025 - Now

- Proposing MCLR, a principled alignment objective that maximizes inter-class likelihood-ratios during diffusion model training, achieving classifier-free guidance-like improvements under standard sampling without inference-time guidance.
- Establishing a formal equivalence between classifier-free guidance and alignment-based objectives. Submitted to **ICML 2026**, under review.

[6] **FlowDAS: A Stochastic Interpolant-Based Framework for Data Assimilation**

Jun 2024 - May 2025

- Proposed FlowDAS, a generative data assimilation framework leveraging stochastic interpolants to jointly learn observation-conditioned state transition dynamics and generative priors, enabling state estimation for stochastic dynamical systems without known physical models.
- Achieved state-of-the-art performance on multiple data assimilation benchmarks including Navier-Stokes and Kolmogorov flow systems. Paper accepted at **NeurIPS 2025**.

[5] **SpeRF: Shorter SPECT Scans with a NeRF-Based Method**

Oct 2023 - Jun 2024

- Addressed the challenge of extended SPECT imaging durations under low-count conditions, as in ¹⁷⁷Lu SPECT.
- Employed an unsupervised coordinate-based learning technique, adapting the neural radiance field (NeRF) concept in computer vision to synthesize under-sampled SPECT projection views.
- Enabled a significant reduction in acquisition time (by a factor of 2, 4, or 8) in clinical SPECT protocols by collecting fewer projections.

[4] **Data-Driven SPECT Respiratory Motion Correction**

May 2023 - Sep 2023

- Explored a surrogate respiratory signal extraction method using Maximum-likelihood Estimation (MLE) method.
- Applied translation to list-mode projections to perform motion-compensated SPECT reconstruction.
- Improved SPECT image quality by increasing Tumor-to-normal-liver ratio (TNR) and decreasing Lung Shunt Fraction (LSF) with the proposed method.

[3] **A Unified Deep-Learning Framework for Y^{90} SPECT Scatter Estimation and Voxel Dosimetry**

May 2022 - Mar 2023

- Designed a unified framework consisting of three stages: CNN based bremsstrahlung scatter estimation, SPECT reconstruction with scatter correction, and absorbed dose-rate map generation with a residual learning deep neural network.
- The framework mitigates the impact of poor SPECT image quality on dosimetry and accuracy-efficiency trade-off of Monte Carlo based scatter estimation and voxel dosimetry methods.

[2] **Image Inpainting Using cGAN**

Sep 2021 - Dec 2021

- Designed a deep neural network based on cGAN, and Partial Convolution, and Region Normalization methods for image inpainting.
- The network outperformed the network which adopts only Partial Convolution method after the same training iterations (using ℓ_1 error, PSNR and SSIM as numerical metrics).

[1] **cGAN for Cross-Modal Neuroimaging Rendering**

Jun 2019 - Sep 2019

- Validated and optimized a cGAN model with residual blocks and CNN discriminator to generate synthetic CTs from T1-weighted MRI.
- Trained a structure-constrained cycle-GAN (adding structure-consistency loss) for brain MR-to-CT synthesis using unpaired CT and MRI data and approximated to approximate the cycle-GAN trained with paired data.

Skills

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

ML Frameworks & Libraries: PyTorch, JAX, TensorFlow, Hugging Face, Weights & Biases

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

Infrastructure & Platforms: Docker, Git, Linux, Slurm, HPC Clusters