Jixian Li, Ph.D.

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Biography

As a postdoctoral research associate at the Scientific Computing and Imaging (SCI) Institute under Dr. Chris Johnson, my work focuses on developing innovative visualization methods for scientific data, such as ensembles of computational fluid dynamics, medical imaging, biomedical simulations.
I received my Ph.D. from the University of Arizona, advised by Dr. Joshua Levine, where my dissertation studied deep learning approaches for exploring collections of visual features of scalar fields.
My research interests include visualization, uncertainty analysis, machine learning, and computational topology related to scientific data analysis. My broader goal is to help scientists to compute, analyze, and communicate their findings.

Education

Ph.D. Computer Science	University of Arizona	2022
M.S. Computer Science	University of Arizona	2017
B.S. Computer Science & Mathematics	University of Arizona	2015

Employment

Postdoctoral Research Associate	SCI Institute, University of Utah	2022-Present
Summer Intern	Lawrence Livermore National Laboratory	2019
Research Assistant	Dept. Computer Science, University of Arizona	2017-2022
Teaching Assistant	Dept. Computer Science, University of Arizona	2015-2017

Publications Under Review

1. Timbwaoga A. J. Ouermi**, Jixian Li**, Chris R. Johnson. “A Fast Iterative Robust Principal Component Analysis Method,” submitted to Technometrics. https://www.arxiv.org/abs/2506.16013

2. Joseph Hart, Bart van Bloemen Waanders, **Jixian Li**, Timbwaoga A. J. Ouermi, Chris R. Johnson, “Hyper-differential sensitivity analysis with respect to model discrepancy: Prior Distributions,” submitted to International Journal for Uncertainty Quantification. https://arxiv.org/abs/2504.19812

Publications

Peer-Reviewed Journal Publication:

1. Matthew Berger, **Jixian Li**, and Joshua A. Levine. “A Generative Model for Volume Rendering,” in IEEE Transactions on Visualization and Computer Graphics, 2018.

Peer-Reviewed Conference Publications:

2. Sangwon Jeong, **Jixian Li**, Shusen Liu, Chris R. Johnson, and Matthew Berger. “Text-based Transfer Function Design for Semantic Volume Rendering,” in IEEE Visualization and Visual Analytics (VIS), 2024.
3. MengJiao Han, **Jixian Li**, Sudhanshu Sane, Shubhan Gupta, Bei Wang, Steve Petruzza, and Chris R. Johnson. “Interactive Visualization of Time-Varying Flow Fields Using Particle Tracing Neural Networks,” in 2024 IEEE 17th Pacific Visualization Conference (PacificVis), 2024.
4. Zhe Wang, Dylan Cashman, Mingwei Li, **Jixian Li**, Matthew Berger, Joshua A. Levine, Remco Chang, and Carlos Scheidegger. “NeuralCubes: Deep Representations for Visual Data Exploration,” in 2021 IEEE International Conference on Big Data (IEEE BigData), 2021

Peer-Reviewed Workshop Publications:

5. **Jixian Li**, Timbwaoga A. J. Ouermi, Chris R. Johnson. “Uncertainty Tube Visualization of Particle Trajectories”, in IEEE Workshop on Uncertainty Visualization: Applications, Techniques, Software, and Decision Frameworks, 2025.
6. **Jixian Li**, Timbwaoga A. J. Ouermi, and Chris R. Johnson. “Visualizing Uncertainties in Ensemble Wildfire Forecast Simulations,” in IEEE Workshop on Uncertainty Visualization: Applications, Techniques, Software, and Decision Frameworks, 2024.
7. Timbwaoga A. J. Ouermi, **Jixian Li**, Zachary Morrow, Bart van Bloemen Waanders, and Chris R. Johnson. “Glyph-Based Uncertainty Visualization and Analysis of Time-Varying Vector Fields,” in IEEE Workshop on Uncertainty Visualization: Applications, Techniques, Software, and Decision Frameworks, 2024
8. Timbwaoga A. J. Ouermi, **Jixian Li**, Tushar M. Athawale, and Chris R. Johnson. “Estimation and Visualization of Isosurface Uncertainty from Linear and High-Order Interpolation Methods,” in IEEE Workshop on Uncertainty Visualization: Applications, Techniques, Software, and Decision Frameworks, 2024
9. Mengjiao Han, Tushar M. Athawale, **Jixian Li**, and Chris R. Johnson. “Accelerated Depth Computation for Surface Boxplots with Deep Learning,” in IEEE Workshop on Uncertainty Visualization: Applications, Techniques, Software, and Decision Frameworks, 2024
10. **Jixian Li**, Danielle Van Boxel, and Joshua A. Levine. “Autoencoder-Aided Visualization of Collections of Morse Complexes.” In IEEE Workshop on Topological Data Analysis and Visualization (TopoInVis), 2022.

Posters

P-1 Joseph Hart, Bart van Bloemen Waanders, **Jixian Li**, Timbwaoga A. J. Ouermi, and Chris Johnson, “ASCR AIVIS: Visualization Insight for Hyper-Differential Sensitivity Analysis,” SCI X, 2025 (Also presented in ASCR PI meeting in Texas, 2025)

P-2 **Jixian Li**, Timbwaoga A. J. Ouermi, and Chris R. Johnson. “Visualizing Uncertainties in Ensemble Wildfire Simulations,” SCI30, 2024

P-3 MengJiao Han, **Jixian Li**, Sudhanshu Sane, Shubhan Gupta, Bei Wang, Steve Petruzza, and Chris R. Johnson. “Interactive Visualization of Time-Varying Flow Fields Using Particle Tracing Neural Networks,” SCI30, 2024

P-4 Timbwaoga A. J. Ouermi, **Jixian Li**, Tushar M. Athawale, and Chris R. Johnson. “Approximation and Visualization of Surface Uncertainty,” SCI30, 2024

P-5 **Jixian Li**, Peer-Timo Bremer, Matthew Larsen, Cyrus Harrison, and Joshua A. Levine. “Integration between BabelFlow and Ascent for In-situ Data Analysis,” LLNL student poster symposium, 2019

Public Presentations

T-1. **Jixian Li**, Timbwaoga A. J. Ouermi, and Chris R. Johnson. “Visualizing Uncertainties in Ensemble Wildfire Forecast Simulations,” IEEE Workshop on Uncertainty Visualization: Applications, Techniques, Software, and Decision Frameworks, 2024

T-2. Invited: **Jixian Li**, “Visualizing Collection of Data,” University of Utah, 2023

T-3. **Jixian Li**, Danielle Van Boxel, and Joshua A. Levine, “Autoencoder-Aided Visualization of Collections of Morse Complex,” IEEE Workshop on Topological Data Analysis and Visualization (TopoInVis), 2022

T-4. Invited: **Jixian Li**, “Deep Learning Approaches for Exploring Collections of Visual Features of Scalar Fields,” SCI Institute, University of Utah, 2022

Thesis

Jixian Li, “Deep Learning Approaches for Exploring Collections of Visual Features of Scalar Fields,” Department of Computer Science, University of Arizona, 2022

Teaching & Mentoring

Ph.D. Students Co-Mentored (official advisor):
Mengjiao Han (Chris R. Johnson)
Sayed Fahim Ahmed (Bei Wang)
M.S. Student Co-Mentored (official advisor):
Jordan Washington (Chris R. Johnson)

Teaching Assistant, Department of Computer Science, University of Arizona:

CSC 436	Software engineering	2015-2017
CSC 445	Algorithms	2016
CSC 433/533	Computer Graphics	2017

Awards

2019 Galileo Circle Scholarship, College of Science, University of Arizona
2017 Teaching Award for Computer Science Department, College of Science, University of Arizona
2017 Outstanding Graduate Teacher, Department of Computer Science, University of Arizona

Recent Research Project Highlights:

Visualizing Uncertainties in Wildfire Forecasts

- Built a web-based interactive visualization system for visualizing uncertainties of fire front locations of wildfire simulations on desktop and mobile devices.
- Implemented GPU and process-based parallel computing of order statistics of fire front contours, reducing 30 minutes of computation to under 1 minute.
- Designed an approximated algorithm for the order statistics, reducing the computation time to milliseconds.
- Collaborated with wildfire experts to iteratively refine the visualization system based on the users' needs.
- Built surrogate models using implicit neural representations (INR) to overview fire front locations of varying simulation conditions.
- Applied uncertainty visualization to summarize simulation parameter sensitivities and INR models' epistemic uncertainties.

Vision-Language Model Guided Transfer Function Design

- Combined CLIP with a differentiable volume renderer to automate the transfer function design for volume rendering.
- Implemented Three.js volume renderer to produce high-resolution publication-ready images [2].
- Improved the optimization with stochastic gradient Langevin dynamics (SGLD), significantly increasing the probability of finding a valid opacity transfer function.
- Added shading to the differentiable volume renderer, helping the CLIP model to match images of natural objects and prompts.

Interactive Visualization of Time-Varying Flow Fields

- Built a web-based interactive visualization system for exploring flow fields and producing publication-ready images [3].
- Designed a responsive interface, helping users adjust the layout to accommodate different display purposes and constraints.
- Implemented customized shaders for pathline rendering and volume rendering of FTLE fields to improve interactivity.
- Implemented Deep Ensemble, MC Dropout, and SWAG based uncertainty quantification method and designed *uncertainty tube* for visualize and communicate uncertainty of the model.

Skills

Programming Languages: C, C++, Python, JavaScript, MATLAB
Visualization: VTK, ParaView, OpenGL, WebGL, Three.js, matplotlib
Parallel Computing: OpenMP, TBB, MPI, CUDA
Machine Learning: PyTorch, scikit-learn
Topological Data Analysis: TTK, Ripser, GUDHI, Mapper Interactive