

Xuyang Li, Ph.D.

Postdoctoral Researcher, Pennsylvania State University

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Education

Dual Ph.D. in Civil Engineering & Computer Science, Michigan State University	Sept 2019 - Sept 2024
M.S. in Civil Engineering, Michigan State University	Sept 2017 - Aug 2019
B.S. in Civil Engineering, Wuhan University of Technology, China	Sept 2013 - Aug 2017

Professional Highlights

- Published in high-impact journals (*Nature Communications*) and top machine learning conferences, Best Paper Award at SMASIS 2022 (ASME).
- Interdisciplinary research expertise in both Engineering Mechanics and Machine Learning, which led to the development of:
 - (1) Novel physics-based models and ML parameter estimation applied to structural identification and other scientific problems (thermal runaway, porous media flow, cardiac electrophysiology, etc.)
 - (2) Unique diagnostic and monitoring methods for damage detection in civil and mechanical structures (NSF-funded in support of future resilient infrastructure systems).
 - (3) Advanced machine learning algorithms to deliver high quality, fast, and cost-effective solutions for response analysis and assessment of infrastructure assets (i.e., roads, bridges) under highly disruptive loading conditions (i.e., hurricanes, earthquakes, flooding, etc.).
- Advised and co-advised many undergraduate students and M.Sc. students in their research projects.
- Member of ASCE Committee on Data Sensing and Analytics & reviewer for professional journals.

Research Interests

- Scientific Machine Learning (SciML), Physics-Informed Machine Learning, Reinforcement Learning.
- Structural Health Monitoring, System Identification.
- Parameter Estimation & Inverse Problems.
- Numerical Methods, Finite Element Analysis & Reduced Order Modeling.

Publications ([Google Scholar](#))

1. *Li, Xuyang*, Bolandi, H., Masmoudi, M., Salem, T., Lajnef, N., Boddeti, V. "Mechanics-Informed Autoencoder Enables Automated Detection and Localization of Unforeseen Structural Damage." *Nature Communications* 2024. [[GitHub](#)] [[Link](#)]
2. *Li, Xuyang*, Masmoudi, M., Bolandi, H., Lajnef, N., Boddeti, V. "Building Bespoke Physical Models from Scarce Observations." under review by *Nature*.

3. Li, Xuyang, Masmoudi, M., Lajnef, N., Boddeti, V. "Estimating Field Parameters in Multiphysics Governing Equations from Scarce Observations." **ICLR 2024 Workshop on AI4DifferentialEquations in Science 2024**. [\[Link\]](#)
4. Masmoudi, M., Li, Xuyang, Lajnef, N., Boddeti, V. "ParaFIND: Parameter Field Inference on Non-uniform Domains using Neural Network." **NeurIPS 2024 Workshop on Data-driven and Differentiable Simulations, Surrogates, and Solvers**.
5. Li, Xuyang, Bolandi, H., Salem, T., Lajnef, N., Boddeti, V. "NeuralSI: Structural Parameter Identification in Nonlinear Dynamical Systems." **European Conference on Computer Vision–ECCV 2022 Workshops**, (2023). [\[GitHub\]](#) [\[Link\]](#)
6. Li, Xuyang, Salem, T., Bolandi, H., Boddeti, V., Lajnef, N. "Methods for the Rapid Detection of Boundary Condition Variations in Structural Systems." **Smart Materials, Adaptive Structures and Intelligent Systems**. Vol. 86274. American Society of Mechanical Engineers (2022). **Best Paper Award in SMASIS 2022**. [\[Award\]](#) [\[Link\]](#)
7. Li, Xuyang, Masmoudi, M., Bolandi, H., Lajnef, N., Boddeti, V. "Structural Parameter Field Identification in Nonlinear Dynamic Systems." under review.
8. Li, Xuyang, Jin, W., Klinger, J., Saha, N., Lajnef, N. "Data-driven Mechanical Behavior Modeling of Granular Biomass Materials." under review by **Computers and Geotechnics**.
9. Bolandi, H., Li, Xuyang, Salem, T., Boddeti, V., Lajnef, N. "Bridging Finite Element and Deep Learning: High-Resolution Stress Distribution Prediction in Structural Components." **Frontiers of Structural and Civil Engineering** (2022). [\[Link\]](#)
10. Bolandi, H., Li, Xuyang, Salem, T., Boddeti, V., Lajnef, N. "Deep learning paradigm for prediction of stress distribution in damaged structural components with stress concentrations." **Advances in Engineering Software** 173 (2022): 103240. [\[Link\]](#)
11. Bolandi, H., Sreekumar, G., Li, Xuyang, Lajnef, N., Boddeti, V. "Neuro-DynaStress: Predicting Dynamic Stress Distributions in Structural Components." **arXiv preprint arXiv:2301.02580** (2022). [\[Link\]](#)
12. Bolandi, H., Sreekumar, G., Li, Xuyang, Lajnef, N., Boddeti, V. "Physics Informed Neural Network for Dynamic Stress Prediction." **Applied Intelligence** 53.22 (2023): 26313-26328. [\[Link\]](#)
13. Salem, T., Jiao, P., Zaabar, I., Li, Xuyang, Zhu, R., Lajnef, N. "Functionally graded materials beams subjected to bilateral constraints: Structural instability and material topology." **International Journal of Mechanical Sciences** 194 (2021): 106218. [\[Link\]](#)
14. Salem, T., Lajnef, N., Jiao, P., Li, Xuyang, Zaabar, I. "Postbuckling of multi-direction anisotropic constrained functionally graded material beams." **Behavior and Mechanics of Multifunctional Materials XV**. Vol. 11589. SPIE, (2021). [\[Link\]](#)

Professional Experience

Postdoctoral Researcher, Pennsylvania State University

Oct 2024 - present

Advisor: Prof. [Romit Maulik](#)

- Exploring scientific reinforcement learning (RL) on interpretability and physics-informed methods.
- Applying RL to nuclear fusion dynamics to mitigate runaway electron effects.

Research Assistant, Michigan State University

Sept 2019 - Sept 2024

Advisors: Prof. [Nizar Lajnef](#) & Prof. [Vishnu Boddeti](#)

- Developed parameter estimation and optimization methods for Multiphysics modeling in composite materials, flow problems, EV batteries thermal runaways, and cardiac electrophysiology.
- Designed novel framework for fast structural health monitoring & PINN-based dynamic predictions.
- Contributed to research proposals on Artificial Intelligence for Highway Transportation (2022) & RFID and wireless technologies in highway construction and asset management (2019).
- Published in Nature Communications ^[1] and in scientific machine learning tracks of top AI conferences in ICLR ^[3], NeurIPS ^[4], and ECCV ^[5], with a Best Paper Award ^[8]. Paper under review at Nature ^[2].

Teaching Assistant, Michigan State University

Sept 2020 - Aug 2024

- CE221: Statics (2020 - 2024).
- CE461: Computational Methods in Civil Engineering (Spring 2020, 2022, and 2024).

Research Intern, Idaho National Laboratory (INL)

Jul 2023 - Aug 2023

Advisor: Dr. [Wencheng Jin](#)

- Developed data-driven ML models to characterize nonlinear plastic behavior in granular biomass.
- Paper under review at Computers and Geotechnics ^[4].

Awards

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| • Dissertation Completion Fellowship, Michigan State University | 2024 |
| • Best Student Paper Award at Smart Materials, Adaptive Structures, and Intelligent Systems (SMASIS) Conference. Organized by ASME. [Link] | 2022 |
| • Graduate School Travel Fellowship, Michigan State University | 2022 & 2023 |
| • Engineering Recruitment Fellowship, Michigan State University | 2019 & 2020 |
| • Graduate Office Fellowship, Michigan State University | 2019 |

Contributed Funded Research Projects

- “Internet of Self-powered Sensors - Towards a Scalable Long-term Condition-based Monitoring and Maintenance of Civil Infrastructure”, National Science Foundation.
- “Monitoring of Runway and Taxiway Pavement Structures Instrumentation – procuring, and installing self-powered wireless sensors at NAPMRC”, Federal Aviation Administration.
- Smart Geogrids, Tensar International Co.
- Novel Data-Driven Condition-Based Maintenance Approaches for Bridges Monitoring, Targeted Support Grant for Technology Development.

Updated: Oct. 2024

Professional Service

- Member of the American Society of Civil Engineers (ASCE) Committee on Data Sensing and Analytics [\[Link\]](#).
- Reviewer for Journal of Fluid Mechanics.
- Reviewer for the ASCE Energy Engineering Journal.
- Reviewer for the ASCE International Conference on Transportation and Development (ICTD 2023).

Mentoring

- Mahdi Masmoudi (master student → Ph.D. student).
- Raheel Tariq (master student → Ph.D. student).
- Hanan Ahmed (master student → Ph.D. student).
- Rithvak Pulugu (master student).
- James Roulo (master student).
- James Morrison (undergrade student).

Membership

- American Society of Civil Engineering (ASCE).
- American Concrete Institute (ACI).
- American Institute of Steel Construction (AISC).
- National Society of Professional Engineers (NSPE).

Programming Languages

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| • Python (PyTorch, TensorFlow, NumPy, Pandas, Scikit-learn, CUDA). | • MATLAB (Image Processing Toolbox, Partial Differential Equation Toolbox). |
| • Julia (Flux, Lux, DiffEqFlux, DifferentialEquations). | • C++. |
| • Mathematica. | • LaTeX. |
| | • GitHub. |

Modeling Software

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| • ABAQUS. | • Autodesk Fusion 360. |
| • ANSYS. | • SAP200. |
| • AutoCAD. | • Pro E. |
| • LabVIEW. | |

References

Prof. Nizar Lajnef

Professor

Michigan State University

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Prof. Romit Maulik

Assistant Professor

Pennsylvania State University

rmaulik@psu.edu

Prof. Vishnu Boddeti

Associate Professor

Michigan State University

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Dr. Wencheng Jin

Staff Scientist

Idaho National Laboratory

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