Zonghan Zhang

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Mississippi State University, Department of Computer Science and Engineering

Education

Mississippi State University 2025
Ph.D. in Computer Science, Advisor: Dr. Zhiqian Chen
Dissertation: *Toward a unified network flow framework: from conservation principles to fluid dynamics models*
(An uncertainty-aware framework for intervention and decision-making in complex networked systems)

University of Pittsburgh, MS in Information Science 2019

Rutgers University, Master's in Human Resources Management 2014

Shanghai Jiao Tong University, Bachelor's in Human Resources Management 2010

Research Summary

I develop uncertainty-aware, interpretable machine learning frameworks to model and intervene in complex socio-technical systems. My research integrates probabilistic graph modeling, Bayesian optimization, structured decomposition, and sensitivity analysis to quantify decision-relevant uncertainty and expose higher-order interactions in networked systems. By combining statistical validation with mechanistic and structured representations, I aim to design reliable AI systems that support transparent, accountable, and policy-relevant decision-making under limited and observational data.

Research Interests

- Uncertainty-aware machine learning
- Interpretable and structured model representations
- Probabilistic graph learning and Bayesian optimization
- Sensitivity analysis and uncertainty quantification
- AI for socio-technical and decision-making systems

Selected Publications in Decision and Uncertainty Modeling

- **Z. Zhang**, Z. Chen, "Sobol's Total Indices for Accurate and Scalable Feature Exclusion in High-Dimensional Data," *IEEE BigData*, 2025.
- T. Rashme*, **Z. Zhang***, J. Weeks, M. Benbrahim, Z. Zhang, Z. Chen, N. Pillai, R. Ramkumar, and B. Nanduri, "Graph symbolic regression to interpret the spread of Vesicular Stomatitis Virus across the U.S. and Mexico," *ACM SIGSPATIAL*, 2025. (* denotes co-first authorship)
- **Z. Zhang**, Z. Zhang, Z. Chen, "Multiple-Source Localization from a Single-Snapshot Observation Using Graph Bayesian Optimization," *AAAI*, 2024.
- **Z. Zhang**, Z. Chen, "Understanding Influence Maximization via Higher-Order Decomposition," *SDM*, 2023.

Additional Refereed Publications

- **Z. Zhang**, R. Veerapaneni, M. Ayoola, A. Ram Das, Z. Chen, B. Nanduri, and M. Ramkumar, "Leveraging Graph Neural Networks for MIC Prediction in Antimicrobial Resistance Studies," *IEEE EMBC*, 2024.
- Z. Zhang, **Z. Zhang**, Z. Chen, "Neural Tangent Bayesian Optimization for Accurate and Efficient Influence Maximization," *ICTAI*, 2024.

Research Experience

Research Assistant, Mississippi State University 2020–2025
Advisor: Dr. Zhiqian Chen

- Contributed to the early development and conceptual framing of a research program on uncertainty-aware and interpretable machine learning for complex socio-technical systems, integrating probabilistic graph modeling, Bayesian optimization, and structured representations.
- Proposed and analyzed decision-support frameworks for evaluating interventions from observational and limited-feedback data, with applications in information diffusion and epidemic mitigation.
- Introduced interpretable sensitivity and higher-order interaction analysis methods to quantify structural and epistemic uncertainty in high-dimensional models.
- Contributed to NSF- and USDA-ARS-supported research projects, collaborating across computer science and public health to translate methodological advances into applied impact.

Teaching Experience

Guest Lecturer and Teaching Assistant, Mississippi State University 2023-2024
Course: Machine Learning, Artificial Intelligence, Graph Machine Learning

- Delivered guest lectures on probabilistic modeling and graph-based methods.
- Mentored students on research projects in graph learning, epidemic simulation, and interpretable modeling.

Ongoing Research Directions

- **Uncertainty-Aware Intervention Modeling in Socio-Technical Systems**. Developing probabilistic and interpretable frameworks to evaluate interventions in interconnected socio-technical systems. This work studies how uncertainty propagates across system layers and influences decision-making under limited experimentation.
- **Interpretable Multilayer Decision Systems**. Designing structured representations to model cross-layer dependencies in complex decision environments. The focus is on exposing higher-order interaction effects to enhance transparency and accountability in human–AI decision-making processes.
- **Probabilistic Modeling of Collective Dynamics and Policy Evaluation**. Developing stochastic and Bayesian methods to characterize uncertainty in large-scale systems. This work supports robust policy validation and reliable decision-making under limited data.

Professional Service

- Reviewer: NeurIPS, ICML, ICLR, AAAI, KDD, IJCAI, SIGIR, and SDM