Lifan Zheng

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EDUCATION

Central South University — **Hunan, China**
Master's Degree in Sociology — *Sep 2021 – Jul 2024*

- **GPA:** 3.68/4.0
- **Scholarships:** First Class Scholarship, Second Class Scholarship
- **Honours:** Outstanding Student
- **Modules:** Qualitative Research Method, Social Survey and Statistics, Advanced Statistical Methods and Applications, Psychosocial and Behavioural Studies

Shanxi University — **Shanxi, China**
Bachelor's Degree in Labor and Social Security — *Sep 2017 – Jul 2021*

- **Average Score:** 87.5/100
- **Scholarships:** Outstanding Student Academic Scholarships
- **Honours:** Merit Student, Outstanding Graduate, Outstanding Graduation Thesis
- **Modules:** Social Policy, Social Welfare, Public Economics, Social Psychology, Statistics, Theory and Method of Social Survey

PAPERS & PUBLICATIONS

- Lu, P., Zhang, Z., Onyebuchi, C. H., & **Zheng, L**. (2024). Agent-based Modelling of High-Rise Building Fires Reveals Self-Rescue Behaviours and Better Fire Protection Designs. *Engineering Applications of Artificial Intelligence*, 127, 107401. https://doi.org/10.1016/j.engappai.2023.107401
- Can Professional Rescue Strategies Save More Lives? Agent-Based 3D Modelling of High-Rise Building Fire (Working Paper)
- Facing Crisis: Evacuation Path Optimisation Driven by Individual Experience and Social Learning Dynamics (Working Paper)

ACADEMIC PROJECTS

A Study on Simulation and Extrapolation of Collaborative Governance of Urban Communities under Complex Systems - Based on ABM Simulation and Modelling Approach — *2023 – 2024*
Graduate Research Provincial Innovation Project, Hunan Province
Co-Lead Researcher

- Project Description: This project aimed to investigate intelligent collaborative social governance's evolutionary mechanisms and operational systems. Through quantitative characterisation and modelling methods, it investigated goal decomposition in intelligent social governance, explored the evolutionary mechanisms of multidimensional interactions, constructed models for entity state transitions and behavioural learning, and simulated the dynamic equilibrium processes of network structures and social rules.
- Responsibilities:
  - Explored the evolution of intelligent social entity states and behaviours through autonomous learning driven by complex interactions and objectives.
  - Constructed and simulated dynamic mechanisms of complex structures in simulated intelligent societies' symbiotic information networks.
  - Investigated the computational framework for extrapolating intelligent societies, including constructing multi-level hierarchical optimisation models and investigating collaborative training methods.
- Methods:
  - Modelling and Simulation: Agent-Based Modelling (ABM), System Dynamics
  - Data Analysis: Evolutionary Game Theory, Complex Network Dynamics
- Papers:
  - Facing Crisis: Evacuation Path Optimisation Driven by Individual Experience and Social Learning Dynamics
    - This paper addresses the public safety threat from vehicle-ramming attacks and the necessity for effective evacuation strategies. It proposes a dual-driven method combining personal experience and social learning to optimise pathfinding. Using an agent-based model of the 2016 Berlin truck attack, the study finds that social learning reduces deaths and curtails evacuation time, but increases injuries compared to personal experience. In addition, the study explores the impacts of different social learning ratios on evacuation from both macro and micro perspectives.

Research on the Mechanisms Shaping Unified Civilizations Based on ABM Simulation — *2022 – 2023*
Graduate Autonomous Exploration and Innovation Project, Central South University
Co-Lead Researcher

- Project Description: The project explored the mechanisms shaping unified civilisations during the Spring and Autumn and Warring States periods using agent-based modelling (ABM). It simulated the impact of warfare, alliances, and betrayals on the formation of unified civilisations, revealing historical patterns in Chinese civilisation unification.
- Responsibilities:
  - Developed multi-agent models to simulate wars, alliances, and betrayals between states, using historical data, such as war frequency, alliance meetings, and changes in national power.
  - Conducted dynamic simulations to depict the probability, distribution, and processes of war, analysing aggression patterns and behavioural changes between states.
  - Performed counterfactual simulations to analyse the non-linear causal relationships between war and alliance behaviour under different historical conditions.

- Methods:
  - Modelling and Simulation: Agent-Based Modelling (ABM), System Dynamics, Warfare Dynamics
  - Data Analysis: Quantitative Analysis, Machine Learning

Prediction of Antisocial Behaviour Based on Big Data (No. 17ZWA21) *2017 – 2022*

Supported by the National Social Science Fund of China

Sub-Project Leader

- Project Description: The interdisciplinary project integrated computational social science and sociophysics, combining mathematical research, big data analysis, and theoretical studies. The main goal was to develop basic research and algorithms for predicting antisocial behaviour using big data.
- Responsibilities:
  - Led the sub-project focused on predicting sudden public safety incidents using agent-based modelling (ABM).
  - Researched various scenarios, including mass evacuations, terrorist attacks, and natural disasters (fires and floods).
  - Developed and applied big data algorithms to improve prediction accuracy and reliability.
- Papers:
  - Lu, P., Zhang, Z., Onyebuchi, C. H., & **Zheng, L**. (2024). Agent-based Modelling of High-Rise Building Fires Reveals Self-Rescue Behaviours and Better Fire Protection Designs. *Engineering Applications of Artificial Intelligence*, 127, 107401. https://doi.org/10.1016/j.engappai.2023.107401
    - This study modelled the 2017 Grenfell Tower fire using agent-based models based on percolation and social force theories. The model accurately predicted fire outcomes, revealing that self-rescue skills and central alarm systems significantly reduce casualties. This research offers valuable insights into high-rise building design and effective evacuation strategies, recommending fire-proof materials and routine self-rescue training for residents.
  - Can Professional Rescue Strategies Save More Lives? Agent-Based 3D Modelling of High-Rise Building Fire
    - This study uses agent-based 3D modelling to simulate the Grenfell Tower fire, accurately matching real case outcomes. It evaluates professional rescue strategies, revealing that a life-priority approach significantly reduces casualties compared to traditional methods. The study emphasises the critical timing and height of aerial ladders in rescue operations, suggesting that optimal strategies can save more lives.

ACADEMI EXPERIENCE

Computational Social Science Research Center **Zhejiang University, China**

Research Assistant *Dec 2024 – Now*

- Research Project Participation:
  - Contributed to the "Social Simulation Platform" research project
- Responsibilities:
  - Reviewed the relevant literature and followed the latest progress in the field of multi-intelligent body systems and social simulation to ensure that the project research is forward-looking.
  - Designed experiments to simulate real-world social interactions and analyzed data based on the results.
  - Evaluated the realism of the intelligent's behavioral responses and social interactions, made suggestions for further improvement, and wrote reports on the experimental results.

The 2nd CCF TCCC Workshop on Continuous Collaboration and Intelligence Leap (CCF TCCC TWCI 2022)

Organiser/Participant

- Theme: Collaborative Governance for Intelligent Society
- Presented the latest research on collaborative governance for intelligent society, highlighting contributions in governance infrastructure, human collective behaviour, social system modelling, complex system governance, online community governance, public health governance, social group intelligence, governance concepts, and frameworks
- Focused on theoretical construction, practices, and achievements in intelligent social governance, emphasising core theories, key technologies, and development trends of intelligent social collaborative governance

INTERNSHIP EXPERIENCE

Zhejiang Lab **Zhejiang, China**

Research Intern, Centre for Intelligent Social Governance Studies *Aug 2022 – Feb 2023*

- Research Project Participation:
  - Contributed to the "Intelligent Social Governance System Based on Social Simulation and Deduction" research project
- Project Management and Design:
  - Managed the "Comprehensive Security" section planning and design within the "AI Sociologist" project
  - Developed project implementation plans with meticulous attention to detail
  - Implemented project engineering code with precision and efficiency
  - Conducted rigorous simulation studies, concentrating on sudden public safety incidents like high-rise fires, urban flooding, and vehicular attacks

SKILLS & INTERESTS

- **Languages:** Chinese (native), English (IELTS 6.5)
- **Programming Language Skills:** NetLogo, Python, R
- **Miscellaneous:** SPSS, Stata, Linux, PS
- **Interests:** Basketball, Fitness