Hao Li

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Research Interests

- Graph-based modeling and representation learning for social networks.

- Topological data analysis, with a focus on persistent homology in dynamic systems.

- Large language models for social reasoning, simulation, and prediction.

Education

Wuhan University, Hubei, China   2019 – Present

PhD student in Communication and Information Systems, Supervisor: Prof. Hao Jiang, expected June 2026, Combined Master's and PhD Program

Wuhan University, Hubei, China   2015 – 2019

B.S. in Communication Engineering

Experience

Research Center for Computational Analysis of Internet Communication, Wuhan University, Hubei, China   2019 – Present

Research Assistant

- Initiated and led a focused study group on persistent homology and the application of large language models to social science, facilitating collaboration across research teams.

- Served as a core member in two national research projects, leading graduate students to complete key tasks.

- Authored a technical guide on topological learning and LLM-based simulations, and mentored eight graduate students on thesis design and academic writing.

Selected Publications

- **Li, H.**, Chen H, Gong R, et al. Agentmandering: A Game-Theoretic Framework for Fair Redistricting via Large Language Model Agents[C]//Proceedings of the AAAI Conference on Artificial Intelligence. 2026

- **Li, H.**, Wan H, Chen Y, et al. TMetaNet: Topological Meta-Learning Framework for Dynamic Link Prediction[C]//International Conference on Machine Learning. PMLR, 2025

- **Li, H.**, Jiang H, Zheng Y, et al. UniGO: A Unified Graph Neural Network for Modeling Opinion Dynamics on Graphs[C]//Proceedings of the ACM on Web Conference 2025. 2025: 530-540. *Oral Presentation*

- **Li, H.**, Gong R, Jiang H. Political actor agent: Simulating legislative system for roll call votes prediction with large language models[C]//Proceedings of the AAAI Conference on Artificial Intelligence. 2025, 39(1): 388-396. *Oral Presentation*

- **Li, H.**, Jiang, H., Jiajun, F., Ye, D., & Du, L. (2024, August). Dynamic Neural Dowker Network: Approximating Persistent Homology in Dynamic Directed Graphs. In Proceedings of the 30th ACM SIGKDD Conference on Knowledge Discovery and Data Mining (pp. 1554-1564). *Oral Presentation*

- **Li, H.**, Jiang H, Ye D, et al. DHGAT: Hyperbolic representation learning on dynamic graphs via attention networks[J]. Neurocomputing, 2024, 568: 127038.

- **Li, H.**, Jiang H, Xian H, et al. Federated Learning for Privacy-Preserving Prediction of Occupational Group Mobility Using Multi-Source Mobile Data[C]//2023 IEEE International Conference on Data Mining (ICDM). IEEE, 2023: 249-258.

SELECTED PROJECTS

Political Behavior Simulation with Large Language Model Agents

2024 – Present

- Led a group of seven graduate students to explore political behavior modeling using large language model (LLM)–based agents.

- Proposed a multi-agent decision simulation framework that constructs political actor agents from multi-source data, achieving state-of-the-art performance on roll call vote prediction.

- Designed a redistricting algorithm based on game-theoretic interactions between partisan LLM agents, yielding fairer district maps with reduced gerrymandering potential.

Topological Analysis of Social Graph Structure and Link Evolution via Persistent Homology

2023 – Present

- Led a group of five graduate students to analyze structural patterns in information propagation networks on platforms such as Weibo and X.

- Proposed a Dowker Zigzag Persistence approach and designed a neural architecture for link prediction in dynamic directed graphs, achieving state-of-the-art performance.

- Designed a dynamic line graph neural network to approximate Dowker persistence diagrams, achieving a 15× speedup over standard methods.

Opinion Propagation Modeling in Social Networks with Opinion Dynamics

2022 – 2024

- Collected and cleaned large-scale social media data from multiple platforms, organizing them by topic for opinion modeling tasks.

- Designed an opinion prediction framework that combines synthetic datasets based on opinion dynamics and specialized graph neural networks.

- Achieved 3× acceleration in future opinion estimation while reaching state-of-the-art performance on benchmark datasets.

SKILLS SUMMARY

- **Programming:** Python, Bash, Matlab
- **Frameworks & Libraries:** PyTorch, PyG, DGL, Transformers, Scikit-learn, NetworkX
- **Tools:** Git, VS Code, Overleaf, Jupyter Notebook, Docker
- **Visualization & Editing:** Adobe Premiere, Illustrator, Manim

HONORS AND AWARDS

Wuhan University Graduate Academic Innovation Scholarship   2024
Second Prize of the Science and Technology Award of the Chinese Institute of Communications (first-ranked student)   2025