Zhewei (Jacky) LIU
哲维 刘

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EDUCATION

2021 **Ph.D in Geographical Information Science, The Hong Kong Polytechnic University, Hong Kong SAR, China**

Dissertation: Semantic, Spatial and Temporal Modelling of Geotagged Social Media Data for Desirable Region and Event Detection

Committee: Prof. Zhizhao Liu (chair), Prof. Wenzhong Shi (supervisor), Prof. Geoffery Shen (Co-supervisor), Prof. Yu Liu (Peking Unv), Prof. Yang Yue (Shenzhen Unv)

2015 **B.S. in Remote Sensing and Geographical Information Science, Wuhan University, China**

GPA 3.65/4.0, Average Score 89.5/100, Ranking: **1**/70

PROFESSIONAL APPOINTMENTS AND EXPERIENCES

2022-2023 Texas A&M University, College Station, TX
Postdoctoral Researcher, advised by Dr. Ali Mostafavi

2021-2022 The Hong Kong Polytechnic University
Research Assistant

RESEARCH INTEREST

GeoAI, spatial data science, environmental justice, urban resilience, human mobility

PUBLICATIONS

1) **Liu, Z.**, Liu, C., & Mostafavi, A. (2023). Beyond Residence: A Mobility-based Approach for Improved Evaluation of Human Exposure to Environmental Hazards. *Environmental Science & Technology*. https://doi.org/10.1021/acs.est.3c04691

2) **Liu, Z.**, Liu, J., Hu, R., Yang, B., Huang, X., & Yang, L. (2023). Calendar events' influence on the relationship between metro ridership and the built environment: A heterogeneous effect analysis in Shenzhen, China. *Tunnelling and Underground Space Technology*, 141, 105388. https://doi.org/10.1016/j.tust.2023.105388

3) Yu, Y., Yao, Y., **Liu, Z.***, An, Z., Chen, B., Chen, L., & Chen, R. (2023). A Bi-LSTM approach for modelling movement uncertainty of crowdsourced human trajectories under complex urban environments. International Journal of Applied Earth Observation and Geoinformation, 122, 103412. (**corresponding author**) https://doi.org/10.1016/j.jag.2023.103412

4) **Liu, Z.**, Liu, J., Huang, X., Zhang, E., & Chen, B. (2022). Measuring Chinese cities' economic development with mobile application usage. *Journal of Geographical Sciences*, 32(12), 2415-2429. https://doi.org/10.1007/s11442-022-2054-x

5) **Liu Z**, Shi W*, et al.. (2022) A LSTM-based approach for modelling the movement uncertainty of indoor trajectories with mobile sensing data. *International Journal of Applied Earth Observation and Geoinformation*, 108 https://doi.org/10.1016/j.jag.2022.102758

6) **Liu Z**, Wang A*, Chan Ed, et al. (2022) Categorisation of cultural tourism attractions by tourist preference using location-based social network data: The case of Central, Hong Kong. *Tourism Management*, 90. https://doi.org/10.1016/j.tourman.2022.104488

7) **Liu, Z**., Shi, W., & Zhang, A. (2021). Detecting home countries of social media users with machine-learned ranking approach: A case study in Hong Kong. *Applied Geography*, 134, 102532. https://doi.org/10.1016/j.apgeog.2021.102532

8) **Liu, Z.**, Zhang, A., Yao, Y., Shi, W., Huang, X., & Shen, X. (2021). Analysis of the performance and robustness of methods to detect base locations of individuals with geo-tagged social media data. *International Journal of Geographical Information Science*, 35(3), 609-627. https://doi.org/10.1080/13658816.2020.1847288

9) Shi, W., **Liu, Z***, An, Z., & Chen, P. (2021). RegNet: a neural network model for predicting regional desirability with VGI data. *International Journal of Geographical Information Science*, 35(1), 175-192. (**corresponding author**, with supervisor being first author). https://doi.org/10.1080/13658816.2020.1768261

10) **Liu, Z.**, Zhou, X., Shi, W., & Zhang, A. (2019). Recommending attractive thematic regions by semantic community detection with multi-sourced VGI data. *International Journal of Geographical Information Science*, 33(8), 1520-1544. https://doi.org/10.1080/13658816.2018.1563298

11) **Liu, Z.**, Zhou, X., Shi, W., & Zhang, A. (2018). Towards detecting social events by mining geographical patterns with VGI data. *ISPRS International Journal of Geo-Information*, 7(12), 481. https://doi.org/10.3390/ijgi7120481

12) Shi, W., Yu, Y., **Liu, Z.**, Chen, R., & Chen, L. (2022). A deep-learning approach for modelling pedestrian movement uncertainty in large-scale indoor areas. *International*

Journal of Applied Earth Observation and Geoinformation, 114, 103065. https://doi.org/10.1016/j.jag.2022.103065

13) Huang, X., Wang, S., Zhang, M., Hu, T., Hohl, A., She, B., ... & **Li, Z.** (2022). Social media mining under the COVID-19 context: Progress, challenges, and opportunities. *International Journal of Applied Earth Observation and Geoinformation*, 113, 102967. https://doi.org/10.1016/j.jag.2022.102967

14) Fu, W., Shao, P., Dong, T., & **Liu, Z.** (2022). Novel Higher-Order Clique Conditional Random Field to Unsupervised Change Detection for Remote Sensing Images. *Remote Sensing*, 14(15), 3651. https://doi.org/10.3390/rs14153651

15) Shen, X., Shi, W., **Liu, Z**., Zhang, A., Wang, L., & Zeng, F. (2022). Extracting Human Activity Areas from Large-Scale Spatial Data with Varying Densities. *ISPRS International Journal of Geo-Information*, 11(7), 397. https://doi.org/10.3390/ijgi11070397

16) Shi, W. Z., Zeng, F., Zhang, A., Tong, C., Shen, X., **Liu, Z.**, & Shi, Z. (2022). Online public opinion during the first epidemic wave of COVID-19 in China based on Weibo data. *Humanities and Social Sciences Communications*, 9(1), 1-10. https://www.nature.com/articles/s41599-022-01181-w

17) Zhang, A., Shi, W., Tong, C., Zhu, X., Liu, Y., **Liu, Z.**, ... & Shi, Z. (2022). The fine-scale associations between socioeconomic status, density, functionality, and spread of COVID-19 within a high-density city. *BMC Infectious Diseases*, 22(1), 1-22. https://link.springer.com/article/10.1186/s12879-022-07274-w

18) Shen, X., Shi, W., Chen, P., **Liu, Z.**, Wang, L. (2022) Novel model for predicting individuals' movements in dynamic regions of interest. *GIScience & Remote Sensing* https://doi.org/10.1080/15481603.2022.2026637

19) Zhan, Z., Shi, W., Zhang, M., **Liu, Z.**, Peng, L., Yu, Y., & Sun, Y. (2022). Landslide Trail Extraction Using Fire Extinguishing Model. *Remote Sensing*, 14(2), 308. https://doi.org/10.3390/rs14020308

20) Shao, P., Yi, Y., **Liu, Z.**, Dong, T., Ren, D. (2022). Novel Multiscale Decision Fusion Approach to Unsupervised Change Detection for High-Resolution Images. *IEEE Geoscience and Remote Sensing Letters* https://doi.org/10.1109/LGRS.2022.3140307

21) Shao, P., Shi, W., **Liu, Z.**, & Dong, T. (2021). Unsupervised Change Detection Using Fuzzy Topology-Based Majority Voting. *Remote Sensing*, 13(16), 3171 https://doi.org/10.3390/rs13163171

22) Yao, Y., Shi, W., Zhang, A., **Liu, Z.**, & Luo, S. (2021). Examining the diffusion of coronavirus disease 2019 cases in a metropolis: a space syntax approach. *International Journal of Health Geographics*, 20(1), 1-14 https://doi.org/10.1186/s12942-021-00270-4

23) Huang, X., Lu, J., Gao, S., Wang, S., **Liu, Z.**, & Wei, H. (2021). Staying at Home Is a Privilege: Evidence from Fine-Grained Mobile Phone Location Data in the United States during the COVID-19 Pandemic. *Annals of the American Association of Geographers*, 1-20. https://doi.org/10.1080/24694452.2021.1904819

24) Wang, A., Zhang, A., Chan, E. H., Shi, W., Zhou, X., & **Liu, Z**. (2021). A review of human mobility research based on big data and its implication for smart city development. *ISPRS International Journal of Geo-Information*, 10(1), 13. https://doi.org/10.3390/ijgi10010013

25) Chen, P., Shi, W., Zhou, X., **Liu, Z.**, & Fu, X. (2019). STLP-GSM: a method to predict future locations of individuals based on geotagged social media data. *International Journal of Geographical Information Science*, 33(12), 2337-2362 https://doi.org/10.1080/13658816.2019.1630630

PAPERS UNDER REVIEW

1) **Liu, Z.**, Huang, L., Fan, C., & Mostafavi, A. FairMobi-Net: A Fairness-aware Deep Learning Model for Urban Mobility Flow Generation. *Nature Communications*.

2) Rajput, A., Liu, C., **Liu, Z.**, & Mostafavi, A. (2023). From Places to People: Human-centric Characterization of Life Activity Flood Exposure for Intra-and Inter-city Analysis. *Nature Cities* (corresponding author)

3) Hsu, C., Liu, C., **Liu, Z.***, Mostafavi, A. Unraveling Weather Impacts on Air Transportation and Passenger Delays using Location-based Data. *Journal of Air Transport Management* (corresponding author)

4) Ho, Y., **Liu, Z.***, Mostafavi, A. MLFEJ: Decoding the Role of Urban Features in Shaping Environmental Injustice Using Interpretable Machine Learning. *Sustainable Cities and Society* (corresponding author)

5) **Liu, Z.,** Mostafavi A. Collision of Environmental Injustice and Sea Level Rise: Assessment of Risk Inequality in Flood-induced Pollutant Dispersion from Toxic Sites in Texas. *Environmental Research*

6) **Liu, Z.,** Mostafavi A. Interpretable machine learning for predicting urban flash flood hotspots using intertwined land and built-environment features. *Computers, Environment and Urban Systems* (major revision)

7) **Liu, Z.**, Gu, H., Zhou, L., et al. The impact of COVID-19 lockdowns on ride-hailing: a drivers' income inequality perspective. *Travel Behaviour and Society* (major revision)

8) Liu, J., **Liu, Z.***. Rethinking Landscape Ecological Risk Assessment and its Applicability: Counterintuitive Findings from Coastal Areas. *Land Degradation & Development* (minor revision)

9) Liu, J., **Liu, Z.*** From parts to wholes: holistic insights into ecological risk induced by land use change –a case study of Xiapu County, China. *Land Use Policy*. (corresponding author)

10) Yu, Y., **Liu, Z.***, Chen, R. Towards Wide-area Indoor Positioning: An Enhanced Wi-Fi/BLE/QR/MEMS Sensors Integration Approach. *IEEE Transactions on Instrumentation & Measurement* (major revision) (corresponding author)

CONFERENCE PROCEEDINGS

Yu Y, Shi W, **Liu Z.** LSTM-MLP Based Uncertainty Modelling Approach for Complex Human Indoor Trajectory, ISPRS Geospatial Week, Sept 2023. (**ISPRS GSW2023 Best Workshop Paper Award**)

PATENTS

Shi W, **Liu Z**. Regional attraction assessment method and device. ZL 201910436416.0

Shi W, **Liu Z**. Method for predicting target area based on social media sign-in, terminal and storage medium. ZL 202011358914.7

Shi W, Wang M, **Liu Z**. Camera internal reference and camera relative laser radar external reference calibration method and electronic equipment. ZL 202110023285.0

Shi W, **Liu Z**. Regional attraction evaluation method and device. ZL 201910715730.2

Shi W, **Liu Z**. A LSTM-based model for uncertainty modelling of indoor trajectory. ZL 2021 1 0752788.1

GRANTS&FUNDINGS

External

2023-2024 Place attractiveness prediction using geographical and social context with deep learning, Open Research Fund, Guangdong–Hong Kong-Macau Joint Laboratory for Smart Cities, RMB 20,000, **PI**.

2023- Harnessing Big Data and Al to Augment Disaster Situational Awareness, Emergency Management Use Case, Texas Division of Emergency Management, USD 15,000, **Co-I**

2022- Home country detection of social media users based on machine-learned ranking, Open Research Funding, LIESMARS, China, RMB 50,000, **PI**.

2024- Convolutional Network Frameworks for Spatial Regression, General Research Funding, University Grants Committee, Hong Kong, HKD 1,083,600, **Co-I and leading writer** (*under review*)

Internal

2022 Postdoc Matching Fund (to support excellent Postdoc researcher with special University funding), The Hong Kong Polytechnic University, Hong Kong, China, HKD 364,054, **Funding Receiver**.

AWARDS & HONORS

2023	First Price of 2022 Smart City Research and Innovation Scheme (SCRIS)
2023	Shanghai Leading Talent (Oversea Young Scholar Program), Shanghai Municipal People's Government, China
2015	Outstanding Graduates of Wuhan University, 2015 (10%)
2012/13/14	Annual Outstanding Students of Wuhan University, three times (10%)
2013/14	Second Honor Scholarship of Wuhan University, twice (10%)
2012	Xijie Special Scholarship
2012	First Honor Scholarship of Wuhan University (5%)

INVITED TALKS&PRESENTATIONS

2022	**Liu Z**. Research Innovation on Human Mobility Modelling, Clemson University, Nov Online
2022	**Liu Z**. Human Mobility and Research Experience Sharing, Northwestern Polytechnical University, Nov Online
2022	**Liu Z**. Market Segmentation and Chinese Economy Forecasting with Spatial Big Data, Guangzhou University, May Online
2022	**Liu Z**. Attractive Region Detection and Recommendation with Geotagged Social Media Data, Wuhan University of Technology, April Online
2022	**Liu Z.** Artificial Intelligence on Geospatial Big Data Analytics, International Young Scholar Research Forum, Tongji University, March, Online

2021 **Liu Z.** Spatial Big Data Analytics and Human Mobility Modelling, Hohai University, September, Online

2021 **Liu Z.** Location Recommendation and Event Detection with Large-scale Human Mobility Data, China University of Geosciences (Wuhan), May, Online

2021 **Liu Z.** Semantic, Spatial and Temporal Modelling with Multi-sourced Spatial Big Data, East China Normal University, April, Online

RESEARCH PROJECT

2020 **Three-dimensional perception of urban agglomerations and data governance technology, National Key R&D Program funded by Ministry of Science and Technology, P.R. China**

Core researcher and developer

- Model the patterns of human mobility and evaluate the results' uncertainty using multi-sourced flow data, using Python libraries Scikit-learn, Numpy, Pandas.
- Data governance strategies are proposed to maintain the consistence and interoperability of heterogeneous data sources.

2018-2020 **Collaborative computation for multi-source geographic big flow data, funded by Ministry of Science and Technology, P.R. China**

Core researcher and developer

- Develop a series of novel indicators to quantify the irregular human movement, with Python and ArcGIS
- Detect events by investigating the irregular patterns of the tracked human mobility using the Extreme Studentized deviate (ESD) statistical test.

2016-2018 **Urban big data analytics for spatiotemporal human activity modeling and prediction, funded by the Hong Kong Polytechnic University**

Core researcher and developer

- A novel indicator is proposed to quantify the attractiveness of the urban regions with human mobility (location-based social network)
- A novel deep learning framework RegNet is proposed, using Python library Tensorflow, Keras, for predicting the attractiveness of the urban regions.

2014-2015 **Monitoring of the Evolution of Urbanization of Dongguan, funded by Department of Land and Resources of Guangdong Province, P.R. China**

Core researcher and developer

- Evaluate urbanization of Dongguan city and develop a comprehensive software by leveraging C#, ArcObjects, and Oracle, for urbanization monitoring with geospatial features.

TEACHING EXPERIENCE

Teaching Assistant/Lecturer, Texas A&M University

2023 Urban Computing (18 master students enrolled)

This course provides students with the latest background, knowledge and technology about urban computing. By leveraging advanced geospatial analytics and artificial intelligence techniques, the course explores how to model, predict, and optimize urban movement in a data-driven manner, enabling to address various urban challenges, including transportation, urban planning, and public safety. The pressing issue of environmental justice is also discussed, which aims to ensure equitable distribution of environmental benefits and burdens among different socioeconomic groups. This session highlights the role of data-driven methodologies in identifying and addressing disparities in access to resources, exposure to pollution, and vulnerability to climate change. By examining these two interrelated topics, the lectures provide valuable insights into the potential of urban computing in creating smarter, more sustainable, and equitable cities.

Teaching Assistant, The Hong Kong Polytechnic University

2022 Urban Informatics (LSGI545, 3 credits, 128 master students enrolled)

This course provides a hands-on introduction to the tools, technologies, and practical approaches used to organize and analyze urban data. It enables students to apply the theories and concepts of urban science to a variety of practical issues in urban planning and Smart City development; utilize their knowledge of the theories, methods, and tools of urban science and informatics better understand cities and inform Smart City planning and development. The Teaching Assistant are responsible for conducting tutorial, introducing the latest advancements of smart cities, and teaching the usage of agent-based-model software NetLogo

2021 Principles of GIS (LSGI521, 3 credits, 107 master students enrolled)

This subject is to provide students with an understanding of the theory embodied in spatial information systems in terms of spatial data modeling; spatial data structures; data analysis techniques; visualization and presentation, and an understanding of the flow of data and its various transformations from raw data collection to result presentation. The Teaching Assistants are responsible for conducting lecture and lab tutorial, introducing components of GIS, spatial data models, data management, spatial analysis, GIS applications, and hands-on experience on ArcGIS Pro.

2019 Research Frontiers in Construction and Environment (CE603, 3 credits, 105 doctoral students enrolled)

This subject is intended to provide students with: a good understanding of the research foci and achievements of the Faculty and its constituent departments; a broad perspective of key research issues in the broad field of construction and environment; general knowledge of the current status and future challenges of key research areas of FCE and their relationship with the student's own research. The Teaching Assistants are responsible for conducting lecture and lab tutorial, introducing geographic data capturing, management, visualization, processing and applications.

2016 Hydrographic Surveying (LSGI3350A, 3 credits, 87 undergraduates enrolled)

This subject introduces the technology of Hydrographic Surveying to students. Its purpose is to provide the necessary knowledge and practical instrument operational and data processing skills needed for them to confidently accomplish a bathymetric survey in the real world (at water area near Sai Kung, Hong Kong) during field camp at the conclusion of the course. This subject also aims to develop students' critical and creative thinking, as well as cooperative attitudes & behavior of working with others. The Teaching Assistants are responsible for conducting lab tutorial and field camp, teaching the use of total station, and CAD software.

SERVICE

2017-2022	**Co-founder/Coordinator** of Taibai Reading Club, the Hong Kong Polytechnic University
2019	The 2nd International Conference on Urban Informatics
2022	Geoinformatics 2022 (CPGIS 30th Anniversary) International Conference

Journal Reviewer:

- IEEE Transactions on Image Processing
- International Journal of Geographical Information Science
- Frontiers in Public Health
- Environment and Planning B: Urban Analytics and City Science
- Computational Social Science
- Environment, Development and Sustainability
- Trends in Computer Science and Information Technology
- Forests
- Tropical Medicine and Infectious Disease
- Sustainability
- Applied System Innovation
- International Journal of Environmental Research and Public Health
- Electronics
- Urban Informatics
- Sensors
- Future Transportation
- Behavioral Sciences
- ISPRS International Journal of Geo-Information
- Applied Network Science

UNDERGRADUATE SUPERVISING

2023 **Vuvraj Gupta**, UrbanFlow Pulse: Harnessing Mobility and Internet Connectivity in Post-Disaster Resilience Analysis
Lipai Huang, Fairness-based human flow prediction

2022 **Garrett Mccoy**, Mobility-based hazard exposure exacerbate environmental injustice
Andrew Zheng, Country-scale life expectancy, mortality, and disease forecasting using mobility-based hazard exposure index

Tyler Felton, Predicting urban fast flood risk with environmental Features, using boosted decision tree

LANGUAGES

Mandarin: Native
English: Professional Proficiency, **GRE**: 329/340
Cantonese: Elementary Proficiency

COMPUTER SKILLS

Programming Languages: Python, SQL, Matlab, C/C++, C#, Javascript
Code Library: Pytorch, Keras, Scikit-learn, Numpy, Pandas, OpenCV, ArcObjects
Skills: machine learning, large-scale database, complex network analysis, Git