University of Minnesota
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Geography, Environment & Society
College of Liberal Arts

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Education

Ph.D., ***Peking University.*** *Cartology and Geographic Information Science* 2020
Modelling and Analyzing Geospatial Distributions with Artificial Neural Networks

B.S., ***Peking University***. *Geographic Information Systems* 2014
An Incremental Map-Matching Method Based on Road Network Topology

B.Ec., ***Peking University***. *Economics* 2014

Positions/Employment

University of Minnesota, Twin Cities

Assistant Professor, Department of Geography, Environment and Society (GES) 2021 - Present
(Start date delayed from 2020 fall to 2021 fall due to the COVID-19 pandemic)

Faculty Member, *Minnesota Population Center* 2021 - Present

Affiliated Faculty, Data Science Initiative, College of Science and Engineering 2022 - Present

University College London

Visiting Lecturer, SpaceTimeLab, Civil Environmental & Geomatic Engineering 2018 - 2019

Peking University

Research Assistant, School of Earth and Space Sciences 2016 - 2020

Research Assistant, Geosoft Lab 2017 - 2018

Teaching Assistant, School of Earth and Space Sciences: 2015 - 2018

Data Visualization Technician, Geosoft Lab 2013 - 2013

RS, GIS & GPS Practice Intern, School of Earth and Space Sciences: 2012

Beijing GeekArt Technology Co. Ltd.

Chief Product Officer 2018- 2020

Beijing *LongRuan Technology Co. Ltd*

Software Engineer Intern 2015

RESEARCH, SCHOLARSHIP, AND CREATIVE WORK

Publications

Asterisk(*) - indicates corresponding author
Underline - indicates student/mentee author
Sharp(#) - indicates co-first author

Journal Articles (Under Review & In Progress)

Zhu, D.*, & Ma, Z. (2025). Gravity-informed deep flow inference for spatial evolution in panel data, *International Journal of Geographical Information Science* (2nd round review)

Zhu, D.*, Wang, S., & Luo, P. (2025). Deep spatial process heterogeneity: Explaining spatial regression graph convolutional neural networks. *International Journal of Geographical Information Science* (1st round review)

Luo, P., Xiong, M., Duarte, F., Santi, P., Ratti, C., & **Zhu, D.*** (2025). The spatial overlapping of communities explains urban mobility. *Nature Computational Science.* (1st round review)

Wang, S., & **Zhu, D.*** (2025). A context-enhanced graph neural network operator for edge-to-edge learning in human mobility networks, *Transactions in GIS.* (1st round review)

Xiong, M., & **Zhu, D.*** (2025). Lakeplace: Sensing interactions between lakes and human activities, *Environment and Planning B: Urban Analytics and City Science* (1st round review)

Guo, H., Wang, H., **Zhu, D**., Fotheringham, S., & Liu, Y. (2025). RegionGCN: Spatial heterogeneity aware graph convolutional networks, *Annals of the American Association of Geographers*. (2nd round review)

Luo, P., Song, C., Li, H., **Zhu, D.**, & Duarte, F. (2025). Modeling shared micro-mobility as a label propagation process for detecting overlapping communities. *Computers, Environment and Urban Systems.* (1st round review)

Cheng, X., Wang, T., **Zhu, D.**, Ma, J. (2025). Uncertainty explanation of artificial intelligence models by SHAP. *IEEE Transactions on Neural Networks and Learning Systems*. (1st round review)

Wang, Y., Wang, Z., Zhang, F., Tang, C., Kang, C., **Zhu, D.**, Ma, Z., Ruan, S., Zhang, W., Zheng, Y., Yu, P., Liu, Y. (2025). A Gravity-informed spatiotemporal transformer for human activity intensity prediction, *Transactions on Pattern Analysis and Machine Learning*. (1st round review)

Zhu, D.* (2025). Flow network of human mobility in cities. (in progress)

Wang, S., & **Zhu, D.*** (2025). A survey of learning geographical relationships in GeoAI. (in progress)

Li, Z., & **Zhu, D.** (2025). GeoShapley for graph-structured geospatial data. (in progress)

Zhu, D.*, & Li, Z., (2025). Deep spatial lag effects of structured observations in graph neural networks. (in progress)

Journal Articles (Accepted & Published)

Wang, S., & **Zhu, D.*** (2025). Inferring human movements after snowfall: Weather-informed graph learning model for flow redistribution in mobility networks, *International Journal of Geographical Information Science.* (Accepted, in press)

Xiong, M., **Zhu, D.***, & David Van Riper (2025). A visitor-enriched census in the U.S. cities using large-scale mobile positioning data, *Scientific Data.* (Accepted, in press)

Ma, Z., & **Zhu, D.*** (2025). Collective flow evolution patterns reveal the mesoscopic structure in

sequential spatial network snapshots. *International Journal of Geographical Information Science,* 39(1), 86-117.

Zeng, X., Song, Y., & **Zhu, D.*** (2025). Spatially explicit knowledge in geo-embeddings: Interpreting location representation derived from human movement trajectories. *Transactions in Urban Data, Science, and Technology*, 27541231251333348.

Xiong, M., & **Zhu, D.*** (2025). Lakeplace: Sensing interactions between lakes and human activities, *arXiv preprint: 2505.02289.*

Jiang, B., Cheng, T., Tsou, M. H., **Zhu, D.**, Ye, X. (2025). Advancing translational human dynamics research: bridging space, mind, and computational urban science in the era of GeoAI. *Computational Urban Science*, 5(1), 1-9.

Wang, S., Zhao, C., Jiang, Q., **Zhu, D.**, Ma, J., & Sun, Y. (2025). Application of Graph Convolutional Neural Networks and multi-sources data on urban functional zones identification, a case study of Changchun, China. *Sustainable Cities and Society*, 106116.

Wang, Y., & **Zhu, D.*** (2024). A hypergraph-based hybrid graph convolutional network for intracity human activity intensity prediction and geographic relationship interpretation. *Information Fusion*, 104, 102149.

Luo, P., & **Zhu, D**.* (2024). Uncover the nature of overlapping community in cities. *arXiv preprint: 2402.00222.*

Zhang, Y., Yu, W., & **Zhu, D.** (2024). Next Track Point Prediction Using a Flexible Strategy of Subgraph Learning on Road Networks. *International Journal of Geographical Information Science, 1-26*

Zhang, G., Gong, X., & **Zhu, D.** (2024). Geographic proximity and homophily effects drive social interactions within VGI communities: an example of iNaturalist. *International Journal of Digital Earth*, *17*(1), 2297948.

Liu, Y., Wang, K., Xing, X.,…, **Zhu, D**. (2023). On spatial effects in geographical analysis. *ACTA GEOGRAPHICA SINICA*, 78(3), 517-531.

Chen, T., **Zhu, D.**, Cheng, T., Gao, X., & Chen, H. (2023). Sensing dynamic human activity zones using geo-tagged big data in Greater London, UK during the COVID-19 pandemic. *PloS one*, *18*(1), e0277913.

Luo, P., Song, Y., **Zhu, D.**, Cheng, J., Meng, L. (2023). A Generalized Heterogeneity Model for Spatial Interpolation. *International Journal of Geographical Information Science*, 37(3), 634-659.

Zhu, D.*, Liu, Y., Yao, X., & Fischer, M. M. (2022). Spatial regression graph convolutional neural networks: A deep learning paradigm for spatial multivariate distributions. *GeoInformatica*, 26 (4), 645-676.

Chen, T., Bowers, K., **Zhu, D.***, Gao, X., Cheng, T. (2022). Spatio-temporal stratified associations between urban human activities and crime patterns: a case study in San Francisco around the COVID-19 stay-at-home mandate. *Computational Urban Science*, 2(1), 13.

Zhang, Y., Yu, W., & **Zhu, D.** (2022). Terrain feature-aware deep learning network for digital elevation model superresolution. *ISPRS Journal of Photogrammetry and Remote Sensing*, 189, 143-162.

Huang, X., **Zhu, D.**, Zhang, F., Liu, T., Li, X., & Zou, L. (2021). Sensing population distribution from satellite imagery via deep learning: Model selection, neighboring effects, and systematic biases. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing,*

14, 5137--5151.

Zhu, D.*, Ye, X., & Manson, S. (2021). Revealing the spatial shifting pattern of COVID-19 pandemic in the United States. *Scientific reports, 11*(1), 8396.

Xing, X., Huang, Z., Cheng, X., **Zhu, D.**, Kang, C., Zhang, F., & Liu, Y. (2020). Mapping human activity volumes through remote sensing imagery. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, 13*, 5652--5668.

Sari Aslam, N., **Zhu, D.**, Cheng, T., Ibrahim, M. R., & Zhang, Y. (2020). Semantic enrichment of secondary activities using smart card data and point of interests: A case study in London. *Annals of GIS, 27*(1), 29--41.

Zhu, D., Zhang, F., Wang, S., Wang, Y., Cheng, X., Huang, Z., & Liu, Y. (2020). Understanding place characteristics in geographic contexts through graph convolutional neural networks. *Annals of the American Association of Geographers, 110*(2), 408--420.

Yao, X., Gao, Y., **Zhu, D.**, Manley, E., Wang, J., & Liu, Y. (2020). Spatial origin-destination flow imputation using graph convolutional networks. *IEEE Transactions on Intelligent Transportation Systems, 22*(12), 7474--7484.

Wang, Y., **Zhu, D.**, Yin, G., Huang, Z., & Liu, Y. (2020). A unified spatial multigraph analysis for public transport performance. *Scientific Reports, 10*(1), 9573.

Wu, L., Cheng, X., Kang, C., **Zhu, D.**, Huang, Z., & Liu, Y. (2020). A framework for mixed-use decomposition based on temporal activity signatures extracted from big geo-data. *International Journal of Digital Earth, 13*(6), 708--726.

Zhang, F., Zu, J., Hu, M., **Zhu, D.**, Kang, Y., Gao, S., Zhang, Y., & Huang, Z. (2020). Uncovering inconspicuous places using social media check-ins and street view images. *Computers, Environment and Urban Systems, 81*, 101478.

Liu, Y., Yao, X., Gong, Y., Kang, C., Shi, X., Wang, F., ... **Zhu, D.**, & Zhu, X. (2020). Analytical methods and applications of spatial interactions in the era of big data. *Acta Geographica Sinica*, 75(7), 1523-1538.

Zhu, D., Cheng, X., Zhang, F., Yao, X., Gao, Y., & Liu, Y. (2019). Spatial interpolation using conditional generative adversarial neural networks. *International Journal of Geographical Information Science, 34*(4), 735-758.

Chen, L., Gao, Y., **Zhu, D.**, Yuan, Y., & Liu, Y. (2019). Quantifying the scale effect in geospatial big data using semi-variograms. *PloS one, 14*(11), e0225139.

Zhang, F., Wu, L., **Zhu, D.**, & Liu, Y. (2019). Social sensing from street-level imagery: A case study in learning spatio-temporal urban mobility patterns. *ISPRS Journal of Photogrammetry and Remote Sensing, 153*, 48--58.

Yao, X., Wu, L., **Zhu, D.**, Gao, Y., & Liu, Y. (2019). Visualizing spatial interaction characteristics with direction-based pattern maps. *Journal of Visualization*, 22, 555--569.

Zhang, S., **Zhu, D.*#**, Yao, X., Cheng, X., He, H., & Liu, Y. (2018). The scale effect on spatial interaction patterns: An empirical study using taxi OD data of Beijing and Shanghai. *IEEE Access, 6*, 51994--52003.

Zhu, D.*, & Liu, Y. (2018). Modelling irregular spatial patterns using graph convolutional neural networks. *arXiv preprint arXiv:1808.09802*.

Yao, X., **Zhu, D.**, Gao, Y., Wu, L., Zhang, P., & Liu, Y. (2018). A stepwise spatio-temporal flow clustering method for discovering mobility trends. *IEEE Access, 6*, 44666--44675.

Zhu, D., Huang, Z., Shi, L., Wu, L., & Liu, Y. (2018). Inferring spatial interaction patterns from

sequential snapshots of spatial distributions. *International Journal of Geographical Information Science, 32*(4), 783--805.

Liu, Y., Zhan, Z., **Zhu, D.**, Chai, Y., Ma, X., & Wu, L. (2018). Incorporating Multi-source Big Geo-data to Sense Spatial Heterogeneity Patterns in Urban Space. *GEOMATICS AND INFORMATION SCIENCE OF WUHAN UNIVERS, 43*(3), 327--335.

Zhu, D., Wang, N., Wu, L., & Liu, Y. (2017). Street as a big geo-data assembly and analysis unit in urban studies: A case study using Beijing taxi data. *Applied Geography, 86*, 152--164.

Zhu, D.*, & Liu, Y. (2017). An incremental map-matching method based on road network topology. *GEOMATICS AND INFORMATION SCIENCE OF WUHAN UNIVERS, 42*(1), 77--83.

Books and Book Chapters

Zhu, D.* & Ma, Z. (2025). Towards the Spatial Evolution between Distribution Snapshots: A Network Perspective Spatial Evolution. In *Urban Human Mobility - Practices, Analytics, and Strategies for Smart Cities,* edited by Xiao Huang, Xinyue Ye, Kathleen Stewart, and Subasish Das, 177 - 192

Zhu, D.*, & Cao, G. (2024). Intelligent Spatial Prediction and Interpolation Methods. In *Handbook of Geospatial Artificial Intelligence (GeoAI),* edited by Song Gao, Yingjie Hu, and Wenwen Li*,* 121-150.

Zhu, D. *, & Hu, Y. (2023). Artificial Intelligence. In *Concise Encyclopedia of Human Geography,* edited by Loretta Lees and David Demeritt, 32-36.

Conference Proceedings

Wang, S., & **Zhu, D.*** (2024). Edge Activating Module: Learning edge-to-edge features for mobility flow generation. In Proceedings of the 7th ACM SIGSPATIAL International Workshop on AI for Geographic Knowledge Discovery (pp. 11-14).

Xiong, M., & **Zhu, D.*** (2024). *From Lake to Lakeplace: A Case Study of Lake-related Human Activities in the Twin Cities***,** In Proceedings of the CaGIS+UCGIS Symposium, June 3-6, Ohio, Columbus (UCGIS 2024).

Zhu, D.*, Gao, S., Cao, G**.** (2022) Towards the Intelligent Era of Spatial Analysis and Modeling. In Proceedings of The 5th ACMSIGSPATIAL International Workshop on AI for Geographic Knowledge Discovery (GeoAI'22), Nov., Seattle, WA, United States.

Luo, P., & **Zhu, D.*** (2022). Sensing overlapping geospatial communities from human movements using graph affiliation generation models. In Proceedings of The 5th ACMSIGSPATIAL International Workshop on AI for Geographic Knowledge Discovery (GeoAI'22), Nov., Seattle, WA, United States.

Wang, Y., & **Zhu, D.*** (2022) SHGCN: A hypergraph-based deep learning model for spatiotemporal traffic flow prediction. In Proceedings of The 5th ACMSIGSPATIAL International Workshop on AI for Geographic Knowledge Discovery (GeoAI'22), Nov., Seattle, WA, United States.

Zhang, W., Ma, Y., **Zhu, D.**, Dong, L., & Liu, Y. (2022). *MetroGAN: Simulating Urban Morphology with Generative Adversarial Network.* In Proceedings of the 28th ACM SIGKDD Conference on Knowledge Discovery and Data Mining (KDD 2022), Aug., Washington DC, United States.

Chen, T., & **Zhu, D.*** (2021). *The Spatio-temporal stratified association between human activities*

and crime patterns during the COVID-19 stay-at-home mandate. In Proceedings of the 2021 ACM SIGSPATIAL China Annual Conference on Space Intelligence (SpatialDI 2021), Apr., Hangzhou, China *[Accepted.*:2021]

Chen, T., Cheng, T., & **Zhu, D.** (2021). *The exploration of human activity zones using geo-tagged big data during the COVID-19 first lockdown in London, UK*. In Proceedings of the 29th Conference on GIS Research UK, Apr. 13-16, 2021, Cardiff University, United Kingdom.

Soundararaj, B., & **Zhu, D.** (2019). *Estimating pedestrian flow from footfall counts using Geo-propagation*. (2019 Annual Conference on Complex Systems (CCS 2019), Sep. 30 - Oct. 4, Singapore. *[Accepted.*:2019]

Wang, Y., **Zhu, D.**, Yin, G., Huang, Z., & Liu, Y. (2019). *Investigating local travel speed with spatial network structures and properties*. In Proceedings of the 2nd International Conference on Urban Informatics, June 24-26, Hong Kong, China.

Zhu, D.*, Cheng, T., & Liu, Y. (2019). *Geo-propagation from Incomplete Spatial Distribution Data: A Case Study of House Price Estimation*. In Proceedings of the 27th Conference on GIS Research UK, Apr. 23-26, Newcastle upon Tyne, United Kingdom.

Zhu, D.*, & Liu, Y. (2018). *Modelling spatial patterns using graph convolutional networks*. In Proceedings of the 10th International Conference on Geographic Information Science (GIScience 2018), Aug. 28-31, Melbourne, Australia.

Conference Presentations

Zhu, D.* (2025). RegionGCN: Spatial-Heterogeneity-Aware Graph Convolutional Networks, Mar. 24 - 28, Detroit, MI, United States (AAG 2025).

Ma, Z., & **Zhu, D.*** (2025). Gravity-Informed Deep Flow Inference for Spatial Evolution in Panel Data, Mar. 24 - 28, Detroit, MI, United States (AAG 2025).

Harris, J., & **Zhu, D.*** (2025). Multi-City Urban Scaling: Insights from Human Mobility Data on Carbon Emissions Efficiency, Mar. 24 - 28, Detroit, MI, United States (AAG 2025).

Wang, S., & **Zhu, D.*** (2024). Edge Activating Module: Learning edge-to-edge features for mobility flow generation. Oct. 29-Nov.1, Atlanta, GA, United States (GeoAI'24).

Zhu, D.* (2024). A hypergraph-based hybrid graph convolutional network for human activity intensity prediction, Apr. 16-20, Hawaii, United States (AAG 2024)

Zhu, D.* (2024). *From Lake to Lakeplace: A Case Study of Lake-related Human Activities in the Twin Cities***,** June 3-6, Ohio, Columbus, United States (CaGIS+UCGIS Symposium 2024).

Xiong, M., & **Zhu, D.*** (2024). Lakeplace: sensing human-lake interactions with mobile phone data, Apr. 16-20, Hawaii, United States (AAG 2024)

Ma, Z., & **Zhu, D.*** (2024). Bi-directional spatial evolution networks for flow inference, Apr. 16-20, Hawaii, United States (AAG 2024)

Wang, S., & **Zhu, D.*** (2024). Generating human mobility network under extreme snowfall: A case study in the winter of Twin Cities, Apr. 16-20, Hawaii, United States (AAG 2024)

Ma, Z., **Zhu, D.*** (2023). *Collective Flow Evolution as a Mesoscopic Structure of Spatial Network*, July. 20-22, London, United Kingdom (GeoInformatics 2023)

Zhu, D.* (2023). *Learning Spatial Heterogeneity via Explainable Deep Spatial Regression*. Mar. 23-27, Denver, United States (AAG 2023)

Ma, Z., **Zhu, D.*** (2023). *Collective Flow Evolution Pattern: A mesoscopic exploration of spatial network dynamics*, Mar. 23-27, Denver, United States (AAG 2023) [2nd place in AAG 2023

Robert Raskin Student Competition]

Hendrickson, R., **Zhu, D.*** (2023). *Exploring the Scaling Relationships between Human Mobility and Air Pollutants in the Twin Cities*, Mar. 23-27, Denver, United States (AAG 2023)

Zhu, D.*, Liu, Y., Yao, X., & Fischer, M.M. (2022). *Spatial Regression Graph Neural Networks*. (American Association of Geographers Annual Meeting 2022, Feb. 26, Virtual (AAG 2022)

Zhu, D.*, Zhang, F., Cheng, X., & Liu, Y. (2019). *Spatial interpolation based on conditional generative adversarial neural networks*. (American Association of Geographers Annual Meeting 2019, Apr. 3-7, Washington, DC, United States (AAG 2019)

Xing, X., **Zhu, D.**, Cheng, X., & Liu, Y. (2018). *Population mapping based on deep features of remote sensing imagery*. The 26th International Conference on Geoinformatics, June 28-30, Kunming, China. (GeoInformatics 2018)

Chen, L., **Zhu, D.**, & Liu, Y. (2018). *Quantify the scale effect in geospatial big data using semi-variograms*. The 26th International Conference on Geoinformatics, June 28-30, Kunming, China. (GeoInformatics 2018)

Zhu, D., Shi, L., Wang, Y., Cheng, X., & Liu, Y. (2017). *Infer spatial interaction patterns from spatial distributions*. The 25th International Conference on Geoinformatics, Aug. 2-4, Buffalo, United States (GeoInformatics 2017)

Zhu, D., Wang, N., & Liu, Y. (2016). *Street perspective: a novel spatial unit in urban social sensing*. The 17th International Symposium on Spatial Data Handling (SDH), Aug. 18-20, Beijing, China. (SDH 2016)

Zhu, D., & Liu, Y. (2016). *The distance effect in spatial interaction and spatial similarity: a big data view of Tobler's First Law*. The 33rd International Geographical Congress, Aug. 21-23, Beijing, China. (IGC 2016)

Invited Talks, Posters, and Exhibits

Keynote/Plenary Address/Panelist

Zhu, D. "When Human Dynamics meets GeoAI", Panelist, the 10th Symposium on Human Dynamics Research, AAG 2024, Hawaii, US. (Apr. 18, 2024). *Invited.*

Zhu, D. "Sensing the overlapping nature of mobility network using geospatial artificial intelligence", Panelist, Symposium on Replicable Spatiotemporal Data Science, Spatial Data Lab, Center for Geographic Analysis, Harvard University. (Jul 15-16, 2023). *Invited*.

Zhu, D. "Artificial Intelligence in Urban Science", Keynote Speaker, Opening webinar on Urban Science, Swarma Club. (Jul 1, 2023). *Invited*.

Zhu, D. "Intelligent spatial prediction: Rethinking geospatial modeling in the era of GeoAI", Keynote Speaker, Annual Conference of Geomatics and GIScience, Central South University, China. (Dec 26, 2020). *Invited*.

Guest Lecture

Zhu, D. "When GeoAI meets Human Environment", GEOG 8001: Problems in Geographic Thought, UMN. (Nov 14, 2024). *Invited*

Zhu, D. "Artificial Intelligence + Geospatial", GEOG 8001: Problems in Geographic Thought, UMN. (Nov 30, 2023). *Invited*

Zhu, D. "Inferring national migration flows from sequential population snapshots," Geospatial Seminar Department of Civil Environmental & Geomatic Engineering, UCL. (Feb 21, 2019).

Invited.

Zhu, D. "Intelligent Sensing of Urban Space in Street Perspective," Intelligent Transportation Systems Course, Institute of Remote Sensing and GIS, PKU. (Oct 17, 2017). *Invited*.

Invited Talk

Zhu, D., "Geospatial Data Intelligence for Spatial Prediction", Urban Informatics Series, Department of Urban Informatics, Shenzhen University. (May 16, 2024). *Invited*

Zhu, D., "Geospatial Data Intelligence for Human-Environment Systems ", Data Management Lab, Department of Computer Science and Engineering, University of Minnesota. (May 22, 2024). *Invited.*

Zhu, D., "Intelligent Spatial Prediction and Interpolation Methods ", GeoAI Solutions for Sustainable Development: The Handbook of Geospatial Artificial Intelligence (GeoAI)', AI for Good webinar, International Telecommunication Union (ITU), United Nations (Feb 23, 2024). *Invited*.

Zhu, D. "Geospatial Data Intelligence for Social Sensing", Coffee Hour Lecture Series, Department of Geography, Environment, and Society, University of Minnesota, Twin Cities. (Nov 9, 2023). *Invited.*

Zhu, D. "Geospatial Artificial Intelligence", Series webinar on Urban Science, Swarma Club. (Aug 5, 2023). *Invited*

Zhu, D. "The overlapping community structure and collective flow evolution pattern in urban mobility networks", Department of Intelligent Engineering, Sun Yat-Sen University. (Jul 4, 2023). *Invited*

Zhu, D. "The overlapping community structure and collective flow evolution pattern in urban mobility networks", Department of Geography, Northeast Normal University. (Jun 30, 2023). *Invited*

Zhu, D. "The overlapping community structure and collective flow evolution pattern in urban mobility networks", Department of Geography, Beijing Normal University. (Jun 28, 2023). *Invited*

Zhu, D. "The overlapping community structure and collective flow evolution pattern in urban mobility networks", School of Earth and Space Science, Peking University. (Jun 27, 2023). *Invited*

Zhu, D. "The overlapping community structure and collective flow evolution pattern in urban mobility networks", Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Science. (Jun 26, 2023). *Invited*

Zhu, D. "The overlapping community structure and collective flow evolution pattern in urban mobility networks", Department of Geoscience and Information Physics, Central South University. (Jun 25, 2023). *Invited*

Zhu, D. "How human movements drive complex and dynamic community structures within the Twin Cities Metro", Minnesota Compass, Amherst H. Wilder Foundation. (Apr 5, 2023). *Invited*.

Zhu, D. "Revealing the flow patterns underlying spatial distribution snapshots", Humanistic GIS Lab, Department of Geography, University of Washington, Seattle. (Oct 31, 2022). *Invited*.

Zhu, D. "Network-based GeoAI analytics," Research Seminar at the Chair of Cartography and Visual Analytics, School of Engineering and Design/Department of Aerospace and Geodesy, Technical University Munich. (Jul 21, 2022). *Invited*.

Zhu, D. "Intelligent spatial prediction in incomplete-data scenarios," GeoAI Research Seminar

Discussion Knowledge Computing Lab, Department of Computer Science & Engineering, University of Minnesota. (Dec 16, 2021). *Invited*.

Zhu, D. "Inferring spatial interaction pattern from spatial distribution snapshots," China Data Lab 2021 Workflow Webinar, Wuhan University & Harvard University. (Jun 18, 2021). *Invited*.

Zhu, D. "Intelligent spatial understanding: representation, modeling and prediction," CPGIS 2021 GeoAI Seminar Series, China University of Geosciences. (May 9, 2021). *Invited*.

Zhu, D. "Linkages between Spatial Regression and Graph Neural Networks," The 5th GIScience Symposium, Peking University, Beijing Normal University, and Chinese Academy of Science. (Apr 17, 2021). *Invited*.

Zhu, D. "About spatial heterogeneity patterns," Presentation in Academic Star Competition, School of Earth and Space Sciences, Peking University, Beijing, China. (Feb 26, 2017)

Zhu, D. "A map visualization of the air quality index in China," ChinaVis Data Challenge at the 3rd China Visualization and Visual Analytics Conference (ChinaVis 2016), Changsha, China (Jul 23, 2016)

Posters or Exhibitions

Xiong, M., **Zhu, D.***, Van Riper, D., "A visitor-enriched census in the U.S. cities using large-scale mobile positioning data", 2025 Research Computing Exhibition, Minnesota Supercomputing Institute, Minneapolis, University of Minnesota, US. (Apr 24, 2025)

Grants, Awards, Gifts, or Endowment Earnings

Awarded

Partnerships for Sustainable Communities (PSC) Course Grants
***PI*:** Institute on the Environment, University of Minnesota
Fall 2025

Quantifying Carbon Emission Efficiency through the Lens of Human Mobility
PI; DSI Medium/Large Seed Grant, Data Science Initiatives, University of Minnesota
April 1, 2024 - April 1, 2025

A GeoAI-based Model for Human Mobility Flow Generation
PI: Seed Grants for Social Sciences Research, OFAA, College of Liberal Arts
Mar 1, 2023 – June 1, 2024

Rural Mobility and Access: Leveraging Big Data Analytics and Context-Aware Computing
co-PI: CTS Scholars Seed Research, Center for Transportation Studies, University of Minnesota
July 1, 2024 - June 30, 2025

Sensing Geospatial Communities in Mobility Networks: How Human Movements Drive Dynamic Community Structures within the Twin Cities Metro Area
PI: Faculty Interactive Research Program, Center for Urban & Regional Affairs (CURA)
July 1, 2022 – July 1, 2023

Intelligent Spatial Models and Analytical Methods
PI: Faculty Set-Up Fund**;** College of Liberal Arts, University of Minnesota
September 1, 2021 –

Modeling spatial heterogeneity and spatial interactions from the big geo-data perspective: 201806010077
PI: China Scholarship Council (CSC) Funding
October 1, 2018 - October 1, 2019

Geo-spatial models and analytical methods
RA: National Natural Science Fund for Distinguished Young Scholars
January 2017 - July 2020

Multi-sensing of urban locations with big geo-data
RA: National Key Research and Development Program of China
July 2017 - July 2020

Theoretical and analytical methods of spatial interaction networks in geospatial big data
RA: The Major Program of the National Natural Science Foundation of China
January 2019 - January 2021

Investigating human mobility pattern based on massive spatio-temporal data
***RA*;** National Natural Science Foundation of China
January 2013 - December 2016

Applied - under review, or not funded

Mapping Demand-Supply Mismatches of Artificial Light at Night with Human Digital Footprints: Towards Lighting Conservation and Energy Justice (Final Round - Pitch Presentation)
PI: IonE Impact Goals 2025, Institute on the Environment, University of Minnesota
FY 25-27

Uncovering Evolution Mechanisms in Spatiotemporal Dynamic Systems (Pending review)
PI: Google Unrestricted Fund 2025, Google Research
FY 25-26

Human Movements after Snowfall: A Weather-Informed GeoAI Model to Infer Mobility Flow Redistribution (Not Funded)
PI: Grant-in-aid of Research, Artistry, and Scholarship program (GIA), University of Minnesota
July 1, 2025- Dec 31, 2026

Lakeplace: Profiling lake-related human activities in the Twin Cities (Not Funded)
PI, Spark Grant 2024, Minnesota Population Center, University of Minnesota
FY25-26

Mapping Demand-Supply Mismatch of Artificial Light at Night in Twin Cities with Human Digital Footprints (Not Funded)
***PI*:** Sustainable GeoCommunities Seed Grants, RIO, University of Minnesota
FY25-27

Estimating the Community-Level Carbon Emission in Twin Cities with Human Mobilities and Graph-Based AI (Not Funded)
***PI*:** Minneapolis Climate Action and Racial Equity Fund, Minneapolis Foundation
FY 25-26

Honors and Scholarships

Dean's First-Year Research & Creative Scholars (DFRACS), *College of Liberal Arts, University of Minnesota* 2025
Waldo Tobler Award, *Geographic Information Science & Systems Specialty Group, AAG 2025* (2nd place; Student Awardee: Zhongfu Ma) 2025
Minnesota GIS/LIS Student Scholar Award, *MN GIS/LIS Consortium* (Student Awardee: Meicheng Xiong) 2024
Robert Raskin Award, *Cyberinfrastructure Specialty Group AAG 2023* (2nd place; Student Awardee: Zhongfu Ma) 2023
Top 20 2022 Global Young Scientist Award, *World Geospatial Developers Conference* 2022
Distinction of Doctoral Thesis, *Peking University* 2020
Excellent Graduates, *Peking University* 2020
China National Scholarship, *Ministry of Education, P. R. China* 2019
Early Career Scholarship, *GIS Research United Kingdom (GISRUK)* 2019
AAG Travel Award, *Applied Geography Speciality Group* 2019
Presidential Fellowship, *Peking University* 2018
Rising Star Award, *College GIS Forum (CGF), China* 2018
Tang Lixin Scholarship, *Peking University* 2017
Founder Scholarship, *Peking University* 2012
54 Scholarship, *Peking University* 2011

TEACHING AND CURRICULUM DEVELOPMENT

Activities for Teaching Enhancement:

Early Career Teaching and Learning Program, University of Minnesota 2024-2025

University of Minnesota

GEOG 5533 Advanced Spatial Analysis 2024 - Present
Chief Instructor
GIS 5555 Applied Spatial Analysis and Modeling 2023 - Present
Chief Instructor
GEOG 3531/5531 Numerical Spatial Analysis 2021 - Present
Chief Instructor
GEOG 8980 Seminar in Geospatial Artificial Intelligence 2022 - Present
Chief Instructor
GIS 8990 Research Problems in GIS 2022 - Present
Chief Instructor

Peking University

04831410: Introduction to Computation 2016 - 2018
Teaching Assistant
01213660: Intelligent Transportation Systems 2017
Guest Lecturer
01213610: GIS Algorithms and Applications 2016 - 2017

Teaching Assistant
01235080: Geo-mathematical Models 2015
Teaching Assistant

University College London
CEGE 0097: Spatial Analysis and Geocomputation 2019
Guest Lecturer, Tutor

ADVISING AND MENTORING

Graduate Student Activities

Jacob Harris, Geography MA	Advisor	2024 - Present
Meicheng Xiong, Geography PhD	Advisor	2023 - Present
Sheng Wang, Geography PhD	Advisor	2023 - Present
Zhongfu Ma, Geography PhD	Advisor	2022 - Present
Rob Hendrickson, Master, GIS	Advisor	Graduated 2023
Gene (Ziying) Cheng, Master, GIS	Advisor	Graduated 2022
Nithya Murikinati, Master, Data Science	Committee member	2025
Mohamed Hemdan, Computer Science PhD	Committee member	2025
Tianyi Li, Civil, Environmental, and Geo-Engineering PhD	Committee member	2024
Xiaohuan Zeng, Geography MA	Committee member	2022 - 2023
Zekun Li, Computer Science PhD	Committee member	2021 - 2023
Mohsen Ahmadkhani, Geography PhD	Committee member	2021 - 2024

Undergraduate Student Activities

Mathias Kreuziger, Geography Major	DFRACS mentor	2024 - 2025
Sumeiya Mohamed, Computer Science Major	DFRACS mentor	2024 - 2025

SERVICE AND PUBLIC OUTREACH

Service to the Discipline/Profession/Interdisciplinary Area(s)

Editorship/Guest Editorship

Editorial Board Member	Computational Urban Science	2023 - Present
Guest Editor	Computational Urban Science	2024 - 2025
Guest Editor	Frontiers in Environmental Science	2022
Guest Editor	Remote Sensing	2022

Reviewer

Spatial Statistics	2016 - Present
Acta Geodaetica et Cartographica Sinica	2017 - Present
Computers, Environment, and Urban Systems	2017 - Present
Applied Geography	2018 - Present
IEEE ACCESS	2018 - Present
IEEE Transactions on Industrial Informatics	2018 - Present
International Journal of Geographical Information Science	2018 - Present

PLOS ONE	2018 - Present
Annals of the American Association of Geographers	2020 - Present
Cities	2020 - Present
Computational Urban Science	2020 - Present
Geo-spatial Information Science	2020 - Present
Nature Scientific Reports	2020 - Present
Transactions on Spatial Algorithms and Systems	2020 - Present
Cartography and Geographic Information Science	2021 - Present
CRC Press - Taylor & Francis Group	2021 - Present
Geomatics and Information Science at Wuhan University	2021 - Present
Humanities and Social Sciences Communications	2021 - Present
International Journal of Applied Earth Observation and Geoinformation	2021 - Present
International Journal of Digital Earth	2021 - Present
ISPRS International Journal of Geo-Information	2021 - Present
Journal of Planning Education and Research	2021 - Present
Stochastic Environmental Research and Risk Assessment	2021 - Present
Artificial Intelligence in Geosciences	2022 - Present
IEEE Geoscience and Remote Sensing Letters	2022 - Present
ISPRS Journal of Photogrammetry and Remote Sensing	2022 - Present
Journal of Transport and Land Use	2022 - Present
Transactions in GIS	2022 - Present
Environment and Planning B: Urban Analytics and City Science	2023 - Present
Geographical Analysis	2023 - Present
Scientific Data	2024 - Present
Sustainable Cities and Society	2024 - Present

Review panels for external funding agencies, foundations, etc

National Science Foundation, Computer and Information Science and Engineering (CISE), Information & Intelligent Systems (IIS)	Panel Reviewer	2023
National Science Foundation, Methodology, Measurement, and Statistics (MMS)	Reviewer	2025
National Science Foundation, Human-Environment and Geographical Sciences (HEGS)	Reviewer	2023
National Science Foundation, Environmental Sustainability (ES)	Reviewer	2023

Organization of Conferences, Workshops, Panels, Symposia

33rd ACM SIGSPATIAL International Conference on Advances in Geographic Information Systems	Local chair	2025
AAG 2025 Symposium on GeoAI and Deep Learning	Session Chair	2025
Geo for AI vs. AI for Geo: When GeoAI Meets Spatiotemporal Analysis and Modeling, International Symposium on Spatiotemporal Data Science: GeoAI for Social Sciences (ISSDS 2024)	Panel Chair	2024
I-GUIDE (Institute for Geospatial Understanding through an Integrative Discovery Environment) Forum 2024	Program Committee Member	2024
The 7th International Workshop on AI for Geographic	Program Chair	2024

Knowledge Discovery (GeoAI'24)		
AAG 2024 Symposium on GeoAI and Deep Learning	Session Chair	2024
International Symposium of Spatiotemporal Data Science 2024	Program Committee Member	2024
The 30th International Conference on GeoInformatics (GeoInformatics'23)	Program Committee Member	2023
The 2nd International Workshop on Geospatial Knowledge Graphs and GeoAI: Methods, Models, and Resources (GeoKG & GeoAI 2023)	Program Committee Member	2023
I-GUIDE (Institute for Geospatial Understanding through an Integrative Discovery Environment) Forum 2023	Program Committee Member	2023
AAG 2022 Symposium on Data-Intensive Geospatial Understanding: the Era of AI and CyberGIS, GeoAI - Intelligent Geospatial Analytics	Session Chair	2022
The 28th Geographical Information Science Research UK Conference (GISRUK'20)	Session Chair	2020
The 5th International Workshop on AI for Geographic Knowledge Discovery (GeoAI'22)	Program Committee Member	2022
The 4th International Workshop on AI for Geographic Knowledge Discovery (GeoAI'21)	Program Committee Member	2021
The 3rd International Workshop on AI for Geographic Knowledge Discovery (GeoAI'19)	Program Committee Member	2019

Service to the University/College/Department

Department

Member, Admissions Committee, Department of GES, UMN	2022 - 2024
Member, Awards Committee, Department of GES, UMN	2022 - 2024
Member, Graduate Education Policy Committee, Department of GES, UMN	2022 - 2023
Member, Coffee Hour Committee, Department of GES, UMN	2022 - 2023
Member, Undergraduate Education Policy Committee, Department of GES, UMN	2021 - 2022

University

Member, Executive Committee, Master of GIS (MGIS) Program, UMN	2022 - Present

Service to the Professional Organizations

Member, International Association of Chinese Professionals in Geographic Information Sciences (CPGIS)	2017 - Present
Member, Association of American Geographers (AAG)	2019 - Present
Member, ACM Special Interest Group on Spatial Information (SIGSPATIAL)	2022 - Present
Member, Career Development Committee, International Association of Chinese Professionals in Geographic Information Sciences (CPGIS)	2022 - Present
BOD Member, International Association of Chinese Professionals in Geographic Information Sciences (CPGIS)	2023 - Present
Member, Site Selection Committee, International Association of Chinese Professionals in Geographic Information Sciences (CPGIS)	2024 - 2025

Member, Election Committee, International Association of Chinese Professionals in Geographic Information Sciences (CPGIS)	2024 - 2025
Member, University Consortium for Geographic Information Science (UCGIS)	2024 - Present
Judge, John Odland Student Competition of Spatial Analysis & Modeling (SAM) Specialty Group at AAG 2025	2025
Judge, 2025 MinneMudac Student Data Science Competition, Minne Analytics, Data Science Initiatives, University of Minnesota	2025