Di Zhu

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EDUCATION

2014 – 2020 • **Ph.D.** in Cartology and Geographic Information Science.
School of Earth and Space Sciences, Peking University (PKU)
Thesis: Modelling and Analyzing Geospatial Distributions with Artificial Neural Networks

2010 – 2014 • **B.S.** in Geographic Information Systems.
School of Earth and Space Sciences, Peking University
Thesis: An Incremental Map-Matching Method Based on Road Network Topology

2011 – 2014 • **B.A.** in Economics.
National School of Development, Peking University

EMPLOYMENT HISTORY

- **Assistant Professor**, Department of Geography, Environment and Society, University of Minnesota, Twin Cities (UMN) (2020 -)
- **Research Assistant**, Geosoft Lab & S3 Lab, PKU (2016 - 2020)
- **Visiting Lecturer**, SpaceTimeLab, University College London (UCL) (2018, 2019)
- **Tutor**, Department of Civil Environmental & Geomatic Engineering, UCL (2019)
- **Teaching Assistant**, School of Earth and Space Sciences, PKU (2016, 2017, 2018)
- **Teaching Assistant**, Institute of Remote Sensing and GIS, PKU (2015, 2016, 2017)
- **Co-Founder & Chief Product Officer** at Beijing Jikewenqing (GeekArt) Technology Co. Ltd. (2018 - 2020)
- **Software Engineer Intern** at Beijing LongRuan Technology Co. Ltd. (Summer 2015)
- **Data Visualization Intern** at Geosoft Lab, PKU (Summer 2013)
- **RS, GIS & GPS Practice Intern** at School of Earth and Space Sciences, PKU (Summer 2012)
- **Geology Field Trip Intern** at School of Earth and Space Sciences, PKU (Summer 2011)

SCHOLARSHIPS, HONORS AND AWARDS

2020 • **Distinction of Doctoral Thesis**, Peking University
• **Excellent Graduates**, Peking University

2019 • **China National Scholarship**, Ministry of Education, P. R. China (RMB 30,000)
• **Tang Lixin Scholarship**, Peking University (RMB 10,000)
• **Early Career Scholarship**, GIS Research UK (£ 220 and free conference registration)
• **Travel Award**, Annual Meeting of American Association of Geography, Applied Geography Speciality Group ($ 250)
• **Outstanding Student Award**, Peking University

SCHOLARSHIPS, HONORS AND AWARDS (continued)

2018
- **State Scholarship Fund of China**, China Scholarship Council (£ 16,200 and travel stipend)
- **Presidential Fellowship**, Peking University (RMB 60,000 and tuition)
- **Tang Lixin Scholarship**, Peking University (RMB 10,000)
- **Rising Star Award**, College GIS Forum (CGF), China
- **Outstanding Student Award**, Peking University

2017
- **Tang Lixin Scholarship**, Peking University (RMB 10,000)
- **Research Assistant Scholarship**, Peking University (RMB 45,000)

2016
- **First Class Postgraduate Scholarship**, Peking University (RMB 8,000)
- **Excellent in Academics Award**, Peking University

2015
- **First Class Postgraduate Scholarship**, Peking University (RMB 8,000)
- **Individual Scholarship for Outstanding Scientific Research**, Peking University

2014
- **First Class Postgraduate Scholarship**,Peking University (RMB 8,000)
- **Longruan Technology Award**, Beijing LongRuan Technology Co. Ltd. (RMB 5,000)

2012
- **Third Prize in P&G Challenge**, Beijing, China
- **Founder Scholarship**, Peking University (RMB 5,000)

2011
- **54 Scholarship**, Peking University (RMB 1,500)
- **Outstanding Student Award**, Peking University

RESEARCH INTERESTS

- GIScience, Geospatial Modelling, GeoAI, Big Geo-Data Analytics, Social Sensing, Spatial Statistics, Spatio-Temporal Data Mining, Urban Computing, Spatial Optimization, Spatial Network, Geovisualization, Generative Adversarial Neural Networks, Graph Theory, High Performance Computing, Human Mobility, Population.

ACADEMIC EXPERIENCES

Peer-reviewed Journal Articles (*: correspondence, △: co-first authorship)

1 **Zhu, D.***, Liu, Y. & Fischer, M. M. (2021). Spatial regression graph convolutional neural networks (srgcnns): A deep learning paradigm for spatial multivariate distributions. ***Computers, Environment and Urban Systems***. (under review).

2 **Zhu, D.***, Ye, X. & Manson, S. (2021). Revealing the spatial shifting pattern of covid-19 pandemic in the united states. ***Nature Scientific Reports***. (under review).

3 **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. https://doi.org/10.1080/24694452.2019.1694403

4 **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), 1–24. 735-758. https://doi.org/10.1080/13658816.2019.1599122

5 **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***, *4*(32), 783–805. https://doi.org/10.1080/13658816.2017.1413192

6 **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. https://doi.org/10.1016/j.apgeog.2017.07.001

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

8 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 o-d data of beijing and shanghai. ***IEEE Access***, *6*, 51994–52003. https://doi.org/10.1109/ACCESS.2018.2869378

9 **Zhu, D.** & Liu, Y. (2017a). An incremental map-matching method based on road network topology. ***GEOMATICS AND INFORMATION SCIENCE OF WUHAN UNIVERS***, *42*(1), 77–83. http://ch.whu.edu.cn/EN/10.13203/j.whugis20150016

10 **Zhu, D.** & Liu, Y. (2017b). Urban dynamics from multi-source big geo-data. ***E-Science Technology & Application***, *8*(3), 7–17. http://escj.cnic.cn/EN/10.11871/j.issn.1674-9480.2017.03.002

11 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 effect, and systematic biases. ***Journal of Selected Topics in Applied Earth Observations and Remote Sensing***. (under review).

12 Wang, Y., **Zhu, D**, Liu, Y., Yin, G. & Huang, Z. (2020). Understand public transport efficiency with spatial multigraph analysis. ***Nature Scientific Reports***, *10*, 9573. https://doi.org/10.1038/s41598-020-65175-x

13 Aslam, N., **Zhu, D.**, Cheng, T., Ibrahim, M. & Zhang, Y. (2020). Semantic enrichment of secondary activities using smart card data and point of interests: A case study in london. ***Annals of GIS***. https://doi.org/10.1080/19475683.2020.1783359

14 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***. https://doi.org/10.1109/TITS.2020.3003310

15 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. https://doi.org/10.1109/JSTARS.2020.3023730

16 Zhang, F., Zu, J., Hu, M., **Zhu, D.**, Kang, Y., Gao, S., … Huang, Z. (2020). Uncovering inconspicuous places using social media check-ins and street view images. ***Computers, Environment and Urban Systems***, *81*(101478), 1–13. https://doi.org/10.1016/j.compenvurbsys.2020.101478

17 Zhang, F., Wu, L., **Zhu, D.** & Liu, Y. (2019). Social sensing from street-level imagery: A case study in learning urban mobility patterns. ***ISPRS Journal of Photogrammetry and Remote Sensing***, *153*, 48–58. https://doi.org/10.1016/j.isprsjprs.2019.04.017

18 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–e0225139. https://doi.org/10.1371/journal.pone.0225139

19 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. https://doi.org/10.1109/ACCESS.2018.2864662

20 Yao, X., Wu, L., **Zhu, D.**, Gao, Y. & Liu, Y. (2018). Visualizing spatial interaction characteristics with direction-based pattern maps. ***Journal of Visualization***, 1–15. https://doi.org/10.1007/s12650-018-00543-4

21 Wu, L., Cheng, X., Kang, C., **Zhu, D.**, Huang, Z. & Liu, Y. (2018). A framework for mixed use decomposition based on temporal activity signatures extracted from big geo-data. ***International Journal of Digital Earth***. https://doi.org/10.1080/17538947.2018.1556353

22 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. http://ch.whu.edu.cn/EN/abstract/abstract5988.shtml

Conference Papers

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

2 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.

3 **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 (GISRUK 2019)*. Oral presentation, Apr. 23-26, Newcastle upon Tyne, United Kingdom.

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

5 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 (ICUI 2019)*. June 24-26, Hong Kong, China.

6 **Zhu, D.***, Cheng, X., Zhang, F., Gao, Y. & Liu, Y. (2019). Spatial interpolation based on conditional generative adversarial neural network. In *AAG annual meeting, GeoAI and Deep Learning Symposium: Deep Learning of Geospatial Patterns & Applications*. Oral Presentation, Apr. 5, Washington D.C., USA.

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

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

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

10 **Zhu, D.**, Shi, L., Wang, Y., Cheng, X. & Liu, Y. (2017). Infer spatial interaction patterns from spatial distributions. In *Proceedings of the 25th International Conference on Geoinformatics*. Oral Presentation, Aug. 2-4, Buffalo, USA.

11 **Zhu, D.**, Wang, N. & Liu, Y. (2016). Street perspective: A novel spatial unit in urban social sensing. In *Proceedings of the 17th international symposium on spatial data handling (SDH 2016)*. Oral presentation, Aug. 18-20, Beijing, China.

12 **Zhu, D.** & Liu, Y. (2016). The distance effect in spatial interaction and spatial similarity: A big data view of tobler's first law. In *Proceedings of the 33rd International Geographical Congress (IGC 2016)*. Oral presentation, Aug. 21-23, Beijing, China.

Invited Talks and Presentations

1 **Zhu, D.** (2020a). Intelligent spatial prediction: Rethinking geospatial modeling in the era of geoai. *Invited talk in the Annual Conference of Geomatics and GIScience@Central South University*. Dec. 26, Changsha, China.

2 **Zhu, D.** (2020b). Intelligent spatial prediction in incomplete-data scenarios. *Invited talk in CPGIS GeoAI Seminar Series@China University of Geosciences*. May 6, online livestream.

3 **Zhu, D.** (2019). Inferring national migration flows from sequential population snapshots. *Invited talk in Geospatial Seminar@UCL, Department of Civil Environmental & Geomatic Engineering, UCL*. Feb. 21, London, United Kingdom.

4 **Zhu, D.** (2018). Spatial prediction using black-box models. *Invited talk at SpaceTimeLab, UCL*. Oct. 12, London, United Kingdom.

5 **Zhu, D.** (2017a). About spatial heterogeneity patterns. *Poster Presentation in Academic Star Competition, School of Earth and Space Sciences, PKU*. Feb. 26, Beijing, China.

6 **Zhu, D.** (2017b). Intelligent sensing of urban space in street perspective. *Invited talk in Intelligent Transportation Systems Seminar, Institute of Remote Sensing and GIS, PKU*. Oct. 17, Beijing, China.

7 **Zhu, D.** (2017c). A map visualization of the air quality index in china. *Oral Presentation in ChinaVis Data Challenge at the 3rd China Visualization and Visual Analytics Conference (ChinaVis 2016)*. July 23, Changsha, China.

PROJECTS EXPERIENCE

2019.01-Present

- **The Major Program of the National Natural Science Foundation of China (no. 41830645)**: Theoretical and analytical methods of spatial interaction networks in geospatial big data. (**Research Assistant** at PKU Geosoft Lab)

  - Work with Dr. Yu Liu and Dr. Lun Wu
  - Investigate systematic methods for analyzing multi-modal spatial networks at different spatio-temporal scales. Develop a WebGIS platform and apply to: city (Shenzhen), megalopolis (Guangdong-Hong Kong- Macau Big Bay Area), and nation (China).

2017.01-2020.07

- **National Natural Science Fund for Distinguished Young Scholars (no. 41625003)**: Geo-spatial models and analytical methods. (**Research Assistant** at PKU Geosoft Lab)

  - Work with Dr. Yu Liu and Dr. Fan Zhang
  - Investigate human behavior characteristics from the perspective of the interaction between people and geographical environment with the support of big geo-data and deep learning methods using PyTorch on Linux.

2017.07-2020.07

- **National Key Research and Development Program of China (no. 2017YFB0503602)**: Multi-sensing of urban locations with big geo-data. (**Research Assistant** at PKU Geosoft Lab & Chinese Academy of Sciences)

  - Work with Dr. Yu Liu, Dr. Yong Gao and Dr. Tao Pei
  - Represent and model diverse geospatial semantics of locations and develop spatial prediction approaches incorporating locations' relatedness.

2018.10-2019.10

- **China Scholarship Council Funding (no. 201806010077)**: Modelling spatial heterogeneity and spatial interactions from the big geo-data perspective (**PI** at SpaceTimeLab, UCL).

  - Work with Dr. Tao Cheng and Dr. James Harworth
  - Develop a spatio-temporal Geo-propagation method for sparse geospatial data prediction with an application of the house price estimation in Beijing from 2011-2018.

2018.06-2020.12

- **A 2C location recommender and time planning Map App for offline meetup** (**Co-Founder & Chief Product Officer** at Beijing Jikewenqing Technology Co. Ltd.)

  - Work with Dr. Yaoli Wang, Dr. Xiang Ren and Miss Jiayin Feng
  - Integrate existing algorithms of location-related schedule planning and location recommendation in the context of clients' business scenarios: negotiate time according to every participant's schedule and activity preference.

PROJECTS EXPERIENCE (continued)

2018 Spring

- Inferred Migration Map in China: Tencent's Positioning data during 2016's Spring Festival. (**Main Developer** of PKU Geosoft Lab Team Work)
  - `https://dizhu-gis.github.io/pages/flow.html`
  - City-level migration flows inferred from two snapshots of population distributions that are captured before and during the Spring Festival, respectively.

2018 Summer

- Visualization of 2014's Weibo check-in data on Beijing Points on Interest (POIs). (**Main Developer** of PKU Geosoft Lab Team Work)
  - `https://dizhu-gis.github.io/pages/interactive_map_new.html`
  - Support the query of geographic places in Beijing urban areas and the corresponding POIs.

2015 Summer

- Visualization of taxi mobility patterns in Shanghai. (**Main Developer** of PKU Geosoft Lab Team Work)
  - Pick-ups and Drop-offs: `https://youtu.be/iCRaJlZc5b8`
  - Trajectories: `https://youtu.be/sb39SE52cFY`
  - Incorporate Shanghai taxi trajectories in June, 2009 to visually recognize human mobility patterns within the city scale.

2013.01-2016.12

- **National Natural Science Foundation of China (no. 41271386)**: Investigating human mobility pattern based on massive spatio-temporal data. (**Student Assistant** at PKU Geosoft Lab)
  - Work with Dr. Yu Liu and Dr. Lun Wu
  - Investigate the GPS-enabled taxis' origin and destination (OD) distributions, mobility patterns and relations with urban structure, street networks. Develop spatio-temporal data mining algorithms for processing large-scale geo-data using Python and PostgreSQL.

TEACHING EXPERIENCE

- **Tutor** for *CEGE 0097: Spatial Analysis and Geocomputation* (2019 at UCL)
- **Guest Lecturer** for *Geospatial Seminar of CEGE 0097: Spatial Analysis and Geocomputation* (Spring 2019 at UCL)
- **Teaching Assistant** for *04831410: Introduction to Computation* (2016, 2017, 2018 at PKU)
- **Guest Lecturer** for *01213660: Intelligent Transportation Systems* (Fall 2017 at PKU)
- **Teaching Assistant** for *01213610: GIS Algorithms and Applications* (2016, 2017 at PKU)
- **Teaching Assistant** for *01235080: Geo-mathematical Models* (2015 at PKU)
- **Teaching Assistant** for undergraduate/M.Sc dissertation designing and writing (2017 at SESS, PKU)

PROFESSIONAL SERVICES

- 2021 -: **Peer Reviewer** for *CRC Press - Taylor & Francis Group*
- 2021 -: **Peer Reviewer** for *Geomatics and Information Science of Wuhan University*
- 2020 -: **Peer Reviewer** for *Computational Urban Science*
- 2020 -: **Peer Reviewer** for *Transactions on Spatial Algorithms and Systems*
- 2020 -: **Peer Reviewer** for *Cities*
- 2020 -: **Peer Reviewer** for *Annals of the American Association of Geographers*
- 2020 -: **Peer Reviewer** for *Nature Scientific Reports*
- 2020 -: **Peer Reviewer** for *Geo-spatial Information Science*
- 2018 -: **Peer Reviewer** for *International Journal of Geographical Information Science*
- 2018 -: **Peer Reviewer** for *Applied Geography*
- 2018 -: **Peer Reviewer** for *PLOS ONE*
- 2018 -: **Peer Reviewer** for *IEEE Transactions on Industrial Informatics*
- 2018 -: **Peer Reviewer** for *IEEE ACCESS*
- 2017 -: **Peer Reviewer** for *Computers, Environment and Urban Systems*
- 2017 -: **Peer Reviewer** for *Acta Geodaetica et Cartographica Sinica*
- 2016 -: **Peer Reviewer** for *Spatial Statistics*
- 2020: **Session Chair** for the 28th Geographical Information Science Research UK Conference (GISRUK'20)
- 2019: **Program Committee Member** for the 3rd International Workshop on AI for Geographic Knowledge Discovery (GeoAI'19)
- 2019: **Student Board Member** for *American Association of Geographers Applied Geography Specialty Group*
- 2018: **Student Assistant** for the 35th Hongmen Dialogue of Peking University: Spatio-Temporal Big Data and Smart City (PKU).
- 2018: **Student Assistant** for the 2nd Youth Scholar Symposium of RS and GIS (PKU).
- 2017: **Student Assistant** for the 2nd Symposium on GIScience (Beijing).

COMMUNITY SERVICES

2019 June
- **Conference Volunteer** for the Festival of AI and Emerging Technology (CogX 2019) (London, UK)
  - Facilitating the transparent information exchange between academic scholars and the government.

2012-2013
- **Head of Propaganda Department** for Student Union in School of Earth and Space Sciences, PKU. (Beijing, CN)
  - Lead a team of more than 20 students to serve for over 600 Chinese students and scholars to give publicity of Earth/Environmental Science.

2015 June
- **Volunteer teaching** of Geometry and Math for K-12 education during the Open Day of Tomorrow Advancing Life (TAL Education Group) (Beijing, CN)