

Di Zhu

🌐 <https://dizhu-gis.github.io>

🏠 Room 511, Yaogan Building, Peking University, Beijing 100871, CN

✉ patrick.zhu@pku.edu.cn

☎ (+86) 15201471701

EDUCATION

- 2014 – 2020 • **Ph.D.** in Cartography and Geographic Information Science.
School of Earth and Space Sciences, Peking University (PKU)
Thesis: Understanding Spatial Patterns with GeoAI: Theories, Models and Applications
- 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 - Present)
- **Research Assistant**, Geosoft 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 - Present)
- **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

- 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
- 2018 • **State Scholarship Fund of China**, China Scholarship Council (£ 16,200 and travel stipend)
- **Presidential Fellowship**, Peking University (RMB 60,000 and tuition)

SCHOLARSHIPS, HONORS AND AWARDS (continued)






- **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

- Geospatial Modelling, Applied Artificial Intelligence, Big Geo-Data Analytics, Social Sensing, Spatial Statistics, Spatio-Temporal Data Modelling, Spatial Optimization, Spatial Network, Geovisualization, Generative Adversarial Neural Networks, Graph Theory, High Performance Computing, Human Mobility, Population, Social Media.

ACADEMIC EXPERIENCES

Peer-reviewed Journal Articles (including papers under review)

- 1 **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>
- 2 **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>
- 3 **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>
- 4 **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>
- 5 **Zhu, D.** & Liu, Y. (2018a). Modelling irregular spatial patterns using graph convolutional neural networks. *arXiv preprint*, arXiv:1808.09802.  <https://arxiv.org/abs/1808.09802>

- 6 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. (*: Co-first & corresponding author). 
<https://doi.org/10.1109/ACCESS.2018.2869378>
- 7 **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>
- 8 **Zhu, D.** & Liu, Y. (2017b). Urban dynamics from multi-source big geo-data. *E-Science Technology & Application*, 8(3), 7–17. 
<http://escj.cnec.cn/EN/10.11871/j.j.issn.1674-9480.2017.03.002>
- 9 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*, 1–13. 
<https://doi.org/10.1016/j.compenvurbsys.2020.101478>
- 10 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>
- 11 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>
- 12 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>
- 13 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>
- 14 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>
- 15 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>
- 16 **Zhu, D.**, Yao, X., Zhang, F., Zhang, Y. & Liu, Y. (2019). Predicting human activity distributions from urban facilities' configuration. *Scientific Reports*. (under review).
- 17 Wang, Y., **Zhu, D.**, Liu, Y., Yin, G. & Huang, Z. (2019). Understand public transport efficiency with spatial multigraph analysis. *Transportation Research Part B: Methodological*. (under review).
- 18 Aslam, N., **Zhu, D.** & Cheng, T. (2019). Semantic enrichment of secondary activities identification using smart card data and pois: London case study. *Annals of GIS*. (under review).
- 19 Yao, X., Gao, Y., **Zhu, D.**, Manley, E., Wang, J. & Liu, Y. (2019). Spatial origin-destination flow imputation using graph convolutional networks. *IEEE Transactions on Intelligent Transportation Systems*. (under review).

- 20 Zhang, F., Hu, M., Zu, J., **Zhu, D.**, Kang, Y., Gao, S. & Zhang, Y. (2019). Uncovering inconspicuous-nice places using mobile phone check-ins and street view images. *Computers, Environment and Urban Systems*. (under review).

Conferences and Presentations

- 1 **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.
- 2 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.
- 3 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.
- 4 **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.
- 5 **Zhu, D.** & Liu, Y. (2018b). 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.
- 6 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.
- 7 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.
- 8 **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.
- 9 **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.
- 10 **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.
- 11 **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.
- 12 **Zhu, D.** (2018). Spatial prediction using black-box models. *Invited talk at SpaceTimeLab, UCL*. Oct. 12, London, United Kingdom.
- 13 **Zhu, D.** (2017a). About spatial heterogeneity patterns. *Poster Presentation in Academic Star Competition, School of Earth and Space Sciences, PKU*. Feb. 26, Beijing, China.

- 14 **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.
- 15 **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-Present • **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-Present • **National Key Research and Development Program of China (no. 2017YFB0503602):** Muti-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.

PROJECTS EXPERIENCE (continued)

- 2018.06-Present • **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.
- 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)

TEACHING EXPERIENCE (continued)

- **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

- 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*
- 2020-: **Peer Reviewer** for *Cities*
- 2020-: **Peer Reviewer** for *Annals of the American Association of Geographers*
- 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*
- 2018 June: **Student Assistant** for the 35th Hongmen Dialogue of Peking University: Spatio-Temporal Big Data and Smart City (PKU).
- 2018 June: **Student Assistant** for the 2nd Youth Scholar Symposium of RS and GIS (PKU).
- 2017 Oct.: **Student Assistant** for the 2nd Symposium on GIScience (Beijing).

COMMUNITY SERVICES

- | | |
|-----------|--|
| 2019 June | <ul style="list-style-type: none">● Conference Volunteer for the Festival of AI and Emerging Technology (CogX 2019) (London, UK)<ul style="list-style-type: none">• Facilitating the awareness of transparent information exchange between academic scholars and the government. |
| 2012-2013 | <ul style="list-style-type: none">● Head of Propaganda Department for Student Union in School of Earth and Space Sciences, PKU. (Beijing, CN)<ul style="list-style-type: none">• 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 | <ul style="list-style-type: none">● Volunteer teaching of Geometry and Math for K-12 education during the Open Day of Tomorrow Advancing Life (TAL Education Group) (Beijing, CN) |

REFERENCES

Yu Liu

Professor

Peking University

✉ liuyu@urban.pku.edu.cn

Tao Cheng

Professor

University College London

✉ tao.cheng@ucl.ac.uk

Song Gao

Assistant Professor

University of Wisconsin-Madison

✉ song.gao@wisc.edu