Dr. Rui Zhu

Address : 1 CREATE Way, 09-02 CREATE Tower, Singapore 138602
Tel : +65-6601-1548 ; Mobile : +65-8360-5708
Website : https://felix-rz.github.io
Email : rui.zhu@smart.mit.edu

Working Experience

2018-2020 **Singapore-MIT Alliance for Research and Technology, Singapore**
Post-doctoral Associate
MIT Senseable City Laboratory
Future Urban Mobility IRG
Joint Researcher at MIT Senseable City Laboratory, MIT, USA
Websites : https://smart.mit.edu/ & http://senseable.mit.edu/

Education

2014-2017 **The Hong Kong Polytechnic University, Hong Kong SAR**
Ph.D. in Geo-Informatics
Department of Land Surveying and Geo-Informatics
Faculty of Construction and Environment
Dissertation : Spatiotemporal data modeling for the analysis of dynamic behaviors of urban heat island (HKIS – Dissertation Awards for Postgraduate Students, 2 winners in 2019)

2015-2016 **Université Laval, Canada**
(6 months) Ph.D. Exchange Study
Department of Geomatics
Faculty of Forestry, Geography and Geomatics

2010-2013 **KTH - Ryoal Institute of Technology, Sweden**
M.Sc. in Geodesy and Geo-Informatics
Department of Urban Planning and Environment
School of Architecture and the Built Environment
Dissertation : Moving object trajectory based intelligent traffic information hub

2006-2010 **Nanjing Normal University, China**
B.Sc. Geographic Information System
Department of Geographical Information System
School of Geography Science (National "Double-First Class" Initiative)
Dissertation : Virtual-Reality based Railway Visualization with VC++ and OpenGL

Journal Publications

2020

[22] **Zhu, R.**, Zhang, X., Mazzarello, M., Santi, P., Ratti, C. (2020). Planning of photovoltic modules in three-dimensional cities for real-time electric demand : A case study in Bologna, Italy. Ongoing project

[21] **Zhu, R.**, Kondor, D., Zhang, X., Santi, P., Ratti, C. (2020). Solar charging improve operational efficiency of shared electric scooters. Ongoing project

[20] **Zhu, R.**, Zhang, X., Kondor, D., Santi, P., Ratti, C. (2020). Understanding spatiotemporal heterogeneity of bike-share and scooter-share mobility. *Computers, Environment and Urban Systems*. Major revision completed

[19] Kwok, C. Y. T., Wong, W. S., Hui, K. K. W., Kan, Z., Li, H., **Zhu, R.**, Ko, F. W. Y., Shiu, H. Y. K. (2020). Detection of Structural Defects of Urban Trees Using Thermal Infrared Imaging Technique. *Remote Sensing*. In peer review

Journal Publications

2020

[18] Wang, M., Wong, M. S., **Zhu. R.** (2020). Identification of healthy and unhealthy tree crowns from remote sensing images using convolutional neural networks. *Sustainability*. In peer review

[17] Yang, Z., Hui, K. W., Abbas, S., **Zhu, R.**, Kwok, C. Y. T., Heo, J., Ju, S., Wong, W. S. (2020). A Review of Monitoring Methods on Tree Sway, Tilt and Root-plate Movement. *Urban Forestry & Urban Greening*. In peer review

[16] **Zhu, R.**, Wong, W. S., You, L., Santi, P., Nichol, J., Ho, H. C., Lu, L., Ratti, C. (2020). The effect of urban morphology on the solar capacity of three-dimensional cities. *Renewable Energy*. Accepted. (Singapore TV Channel 8 ; Portfolio Magazine ; Video)

[15] **Zhu, R.**, Guilbert, E., Wong, W. S. (2020). Object-oriented tracking of spatial and thematic dynamic behaviors of urban heat islands. *Transactions in GIS*, 24, 85–103.

[14] Kan, Z., Wong, W. S., **Zhu, R.** (2020). Understanding space-time patterns of vehicular emission flows in urban areas using geospatial technique. *Computers, Environment and Urban Systems*, 79, 101399.

2019

[13] **Zhu, R.**, You, L., Santi, P., Wong, W. S., Ratti, C. (2019). Transformation of solar accessibility in reforming urban areas : A case study in Kowloon East, Hong Kong. *Sustainable Cities and Society*, 51, 101738.

[12] You, L., Tuncer, B., **Zhu, R.**, Xing, H., Yuen, C. (2019). A Synergetic Orchestration of Objects, Data and Services to Enable Smart Cities. *IEEE Internet of Things Journal*, 6(6), 10496–10507.

[11] Ho, H. C., Wong, W. S., Abbas, S., **Zhu, R.** (2019). Development of the Adjusted Wind Chill Equivalent Temperature (AWCET) for cold mortality assessment across a subtropical city : validation and comparison with a spatially-controlled time-stratified approach. *BMC Public Health*, 19, 1290.

[10] Lu, M., An, K., Hsu, S. C., **Zhu, R.** (2019). Considering user behavior in free-floating bike sharing system design : A data-informed spatial agent-based model. *Sustainable Cities and Society*, 49, 101567.

[9] Ho, H. C., Abbs, S., Yang, J., **Zhu, R.**, Wong, W. S. (2019). Spatiotemporal prediction of increasing winter perceived temperature for climate change mitigation : A sustainable planning guideline for a sub-tropical city. *International Journal of Environment Research and Public Health*, 16, 497.

2018

[8] **Zhu, R.**, Guilbert, E., Wong, W. S. (2018). Object-core oriented data modelling for tracking of behaviors of urban heat islands. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, 42(4), 763–770.

[7] Na, J., Yang, X., Dai, W., Li, M., Xiong, L., **Zhu, R.**, Tang, G. (2018). Bidirectional DEM relief shading method for extraction of gully shoulder-line in loess tableland area. *Physical Geography*, 39(4), 368-386.

2017

[6] **Zhu, R.**, Wong, W. S., Guilbert, E., Chan, P. W. (2017). Understanding heat patterns produced by vehicular flows in urban areas. *Scientific Reports*, 7, 16309.

[5] **Zhu, R.**, Guilbert, E., Wong, W. S. (2017). Object-oriented tracking of the dynamic behavior of urban heat islands. *International Journal of Geographical Information Science*, 31(2), 405–424.

2016

[4] **Zhu, R.**, Guilbert, E., Wong, W. S. (2016). Tracking the spatial evolution of urban heat islands. *ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, 3(2), 3–8.

Journal Publications

2016 [3] Wong, W. S., **Zhu, R.**, Liu, Z., Lu, L., Peng, J., Tang, Z., Lo, C. H., Chan, W. K. (2016). Estimation of Hong Kong's solar energy potential using GIS and remote sensing technologies. *Renewable Energy*, 99, 325–335.

[2] Li, F., Tang, G., Wang, C., Cui, L., **Zhu, R.** (2016). Slope Spectrum Variation in a Simulated Loess Watershed. *Frontiers of Earth Science*, 10(2), 328–339.

2013 [1] Yang, Y., Tang, G., Cao, M., **Zhu, R.** (2013). An intelligent method to discover transition rules for cellular automata using bee colony optimization. *International Journal of Geographical Information Science*, 27 (10), 1849–1864.

Conference Publications

2016 **Zhu, R.**, Guilbert, E., Wong, W. S. (2016). Tracking the spatial evolution of urban heat islands, Commission II, WG II/1. *In Proceeding of the XXIII ISPRS Congress*. Prague, Czech Public, 12-19 July 2016.

2015 **Zhu, R.**, Guilbert, E., Wong, W. S. (2015). Event-based tracking of the dynamic behavior of urban heat islands. *In Proceeding of the 2nd International Conference on Sustainable Urbanization*, 239. Hong Kong, China, 7-9 January 2015.

2013 **Zhu, R.**, Gidófalvi, G. (2013). GPS-based crowd sourced intelligent traffic information hub. *In Proceeding of the 26th International Cartographic Conference*, 669–670. Dresden, Germany, 25-30 August 2013.

2011 **Zhu, R.**, Alizadeh, A., Wu, W. (2011). A GIS based potential risk assessment for water body, *In Proceeding of the 1st Higher Technical Institution in Russia*, 168–171. St. Petersburg, Russia, 20-23 April 2011.

2009 Yang Tao, Guoan Tang, Shanshan Ge, Shijie Zhu, Xiangxi Dai, **Zhu, R.**, 2009. Assessment of urban building layout based on spatial pattern analysis methods, *IEEE 2009 17th International Conference on Geoinformatics*, 1-5. Fairfax, VA, USA, 12-14 August 2009.

Presentations

2019 **Zhu, R.** The effect of urban morphology on the solar capacity of three-dimensional solar cities. CREATE Symposium 2019. SMART, Singapore, 06 December 2019. (Invited)

Zhu, R. The effect of urban morphology on the solar capacity of three-dimensional solar cities. The Second International Conference on Urban Informatics. HK PolyU, Hong Kong SAR, 24-26 June 2019.

Zhu, R. The effect of urban morphology on the solar capacity of three-dimensional solar cities. Applied Energy "A+B" Symposium. MIT, USA, 22-24 May 2019.

Zhu, R. Strong effect of urban geomorphology to solar capacity of three-dimensional cities (poster presentation). Future Urban Mobility Symposium 2019. Singapore, 28-29 January 2019.

2018 **Zhu, R.** The development of senseable cities. Urban Planning, Land & Resources Commission of Shenzhen Municipality. Shenzhen, China, 09 November 2018. (Invited)

Zhu, R. Mapping of three-dimensional solar cities. SMART FM Seminar. Singapore, 23 October 2018.

Zhu, R. Challenges of Drive-By IoT Sensing for Smart Cities : City Scanner Case Study. PURBA 2018, The 7th International Workshop on Pervasive Urban Applications. Singapore, 12 October 2018.

Presentations

2018

Zhu, R. Vibour AR glasses - A prototype. SMART-REMix Event. Singapore, 25 July 2018.

Zhu, R. Modelling of urban mobility for sustainable cities. Workshops of Future Urban Mobility Summer Research. Singapore, 6 & 9 July 2018.

Zhu, R. Modelling of urban mobility to solve environmental and transportation problems. Location : SMART at CREATE Tower. Singapore, 15 May 2018.

2017

Zhu, R. My studying experience during the past ten years. Location : Nanjing Normal University. Nanjing, China, 24 November 2017.

Zhu, R. Understanding heat patterns produced by vehicular flows in urban areas. The 38th Research Salon of HK PolyU. Hong Kong, China, 17 February 2017.

2016

Zhu, R. Understanding spatiotemporal heat patterns of vehicular flows in urban areas. Conference of the 2016 Cartographic Visualization of Big Data for Early Warning and Disaster/Crisis Management (EW&CM)-Methodology, Techniques and Applications. Nanjing, China, 27-29 November 2016.

Zhu, R. Going abroad to see the world. Location : Nanjing Normal University. Nanjing, China, 26 October 2016.

Zhu, R. Object-oriented tracking of dynamic behaviors of urban heat islands. The 7th Nationwide PhD-students Forum in Geo-Information, China. Nanjing, China, 26-28 November 2016.

2015

Zhu, R. Tracking thematic and spatiotemporal dynamic behaviors of urban heat islands. Location : Laval University. Quebec City, Canada, 30 November 2015. (Invited)

Lectures and supervisions

2013

KTH - Course of Spatial Database (Course code : AG2425).
Teaching Assistant. Created the tutorial, gave lectures, and marked homework. It contained spatial database development, geometry definition, spatial queries and spatial indices with PostgreSQL and PostGIS. (Link ; Tutorial)

2012

KTH - Course of Web and Mobile GIS (Course code : AG2417).
Teaching Assistant. Created the tutorial, gave lectures, and marked homework. It contained GIS computer solutions, such as web maps based on GeoServer, ArcGIS Server, and ArcGIS API for JavaScript, mobile maps based on OpenStreetMap, Google Map, and ArcGIS SDK for Android. (Link ; Tutorial)

2011

KTH - MapReduce-based Spatial Data Mining with Eclipse and Hadoop.
Research Assistant. Developed a spatial-data generator to create billions of points with x-dimensional attributions in normal spatial distribution patterns, and discovered frequent item sets in MapReduce and Hadoop.

05/2017

Detection of tree health with multispectral remote sensing data.
Co-Supervisor for bachelor's final-year project. Student : Christy Lui ; HK PolyU.

05/2017

Electricity Usage of Different Land Use in Hong Kong.
Co-Supervisor for bachelor's final-year project. Students : Chan Wai Yan, Ngan Hui Yee, and Yim Cheuk Yuet ; HK PolyU.

04/2016

Advance solar photovoltaic system on building facets for supporting individual households.
Co-Supervisor for bachelor's final-year project. Student : Chan Wai Ki ; HK PolyU.

Lectures and supervisions

04/2016 Estimation of land surface temperature from satellite images.
Co-Supervisor for bachelor's final-year project. Student : Kong Cheuk Lam ; HK PolyU.

05/2015 Impacts of the anthropogenic heat flux to the urban heat islands.
Co-Supervisor for master's dissertation. Student : Xiaoyuan Zhi ; HK PolyU.

05/2015 Map matching for smartphone-based vehicle's navigation.
Co-Supervisor for master's dissertation. Student : Zhefu Li ; HK PolyU.

Projects

09/2019–08/2022 Solar energy potential on 3D urban envelops.
Co-PI for the project entitled with "*Development of an integrated model for estimating 3D solar energy potential using GIS, Remote Sensing and Deep learning techniques*", Funded by Hong Kong GRF, HKD 1,210,980, 36 months.

01/2015–05/2015 Thermal images analysis for detecting trees' health.
Based on the thermal images of trees taken by UAVs, a new method/algorithm is designed to detect decayed parts of tress effectively.

03/2012–05/2013 Moving Object Trajectory Based Intelligent Traffic Information Hub.
The system enables mobile users to locate and send real-time tracking information to a dynamic website for the trajectory analysis. The system can detect spatio-temporal distribution of traffic congestion, and send real-time warnings to the relevant vehicles. Notification accuracy and scaling performance of the system tare systematically tested.

10/2011–12/2011 National Economic Analysis of a Flooding of Lake Mälaren, Sweden.
Group project on flooding area prediction and urban planning based on spatial analysis by ArcGIS with the support of a Swedish company of Sweco.

01/2010–12/2010 Software Development for Essential GIS Algorithms with Eclipse.
Individually developed GIS software, which imports ArcGIS-supported raster data, provides spatial analysis functions such as slope, aspect, focal sum, zonal minimum, etc., and visualize each of the operation results.

01/2010–06/2010 Virtual-Reality based Railway Roads with VC++ and OpenGL.
Developed a prototype for DEMs reading, rendering and visualizing remote sensing images in 3D environment.

09/2008–01/2009 Digital Image Processing in Remote Sensing with Visual C#.
Individually developed software for digital image processing, which reads optional seven bands of digital images, draws the images in RGB, and provides functions of image smoothing, image stretching, and ISH color transformation, etc.

05/2008–09/2009 Criminal Spatio-temporal Distribution Patterns Prediction.
The project did the research on criminal spatio-temporal distribution analysis with the cooperation of one local police office. I was the project manager, and physically participated in the research. The project got two awards and one paper published. (PI, Funded by Nanjing Normal University.)

Selected awards

04/2019 The Hong Kong Institute of Surveyors – Dissertation Awards for Postgraduate Students (2 winners in 2019 in Hong Kong)

10/2016 The best oral representation and conference paper for the 7th Nationwide PhD-students Forum in Geo-Information, China (5% Selection)

05/2015 Innovation and Seed Fund for Augmented Reality-based Vehicle's Navigation Development, HK PolyU

Selected awards

04/2014	PhD Scholarship of General Research Fund provided by University Grants Committee of Hong Kong
04/2011	Diploma for participating in the International Forum-Competition of Young Researchers, Russia
05/2010	Outstanding Graduate in School of Geographic Science, Nanjing Normal University
12/2009	First Prize for Comprehensive Ability Scholarship (5% Selection)
03/2009	Second Prize of Outstanding Academic Report Spatio-temporal Distribution Pattern Prediction of Motor Stolen Cases in Urban Areas
05/2007	Leadership award in May the fourth Recognition
06/2006	Outstanding University Student Union Member

Member and reviewer

Member of The International Society for Photogrammetry and Remote Sensing (ISPRS)
Member of The International Association of Chinese Professionals in Geographic Information Sciences (CPGIS)
Editorial board member in the Journal of Geospatial Engineering
ISPRS Scientific Committee 1-5 October 2018, Delft, The Netherlands
Guest Editor for Climate – Understanding and Mitigating Urban Heat Island-Remote Sensing and GIS Technologies
Guest Editor for Climate – The Interaction of Climate Change with Landscape and Environment
Reviewer for *Scientific Reports*
Reviewer for *International Journal of Geographical Information Science*
Reviewer for *Transactions in GIS*
Reviewer for *IEEE Transactions on Cognitive and Developmental Systems*
Reviewer for *Remote Sensing (Reviewer Board)*
Reviewer for *Climate*
Reviewer for *Atmosphere*
Reviewer for *Urban Climate*
Reviewer for *Remote Sensing Applications : Society and Environment*
Reviewer for *the 19th COTA ICTP 6-8 July 2019, Nanjing, China*

Computer skills

8 years	PostgreSQL, PostGIS, and pgRouting Java in Eclipse (J2EE), ArcMap, and Quantum GIS
3 years	Web GIS (JSP + Servlet + JavaBeans, GeoServer, OpenLayers, WMS and WFS) Mobile GIS (GPS + OpenStreetMap SDK / Google Map SDK + Android) ArcGIS solutions (ArcMap, ArcGIS Server)
2 years	Visual C#, Visual C++ (MFC), OpenGL, Oracle, MATLAB Apache Spark, HTML, JavaScript, CSS

Referee

Carlo Ratti.
Professor of the Practice
Department of Urban Studies and Planning
Massachusetts Institute of Technology
77 Massachusetts Avenue 9-209, Cambridge, MA 02139 USA
T +1-617-2537926 ; F +1-617-2588081 ; W http://senseable.mit.edu

Director, MIT Senseable City Laboratory
Director, MIT Italy Program
Visiting Scholar, Cornell Tech, NYC
Visiting Professor, Universitá di Roma Tor Vergata, Rome
Visiting Professor, IAAC, Barcelona